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ISMP

Acute Care ISMP Medication Safety Alert!®

Educating the Healthcare Community About Safe Medication Practices

Correct use of inhalers: Help patients breathe easier

Asthma and chronic obstructive pulmonary disease (COPD) are life-long, potentially life-threatening diseases that represent the leading chronic respiratory diseases in the world.[1] Inhalation of medications is an effective method for rapidly delivering short- or long-acting bronchodilators and corticosteroids to prevent, control, and treat respiratory symptoms that accompany these diseases. Inhalation of medications may also reduce the risk of adverse drug effects because the medications can often be provided in lower doses than an oral form of the drug.

Types of inhalers

Rescue inhalers that deliver short-acting bronchodilators to relieve sudden respiratory symptoms, and maintenance inhalers that deliver long-acting bronchodilators and corticosteroids to prevent and control respiratory symptoms, are the cornerstone of managing asthma and COPD. For a list of common rescue and maintenance inhalers used in the US, visit: www.ismp.org/sc?id=1764. Inhalation devices that deliver these medications are available in four basic types:

Pressurized metered-dose inhalers (MDIs), which have been around for decades, typically consist of a small canister of medication fitted into a plastic body with a mouthpiece. Each dose is delivered by pressing the canister into the plastic body while inhaling through the mouthpiece. Use of a spacer that connects to the MDI makes it easier to inhale the dose, which is first released into the spacer and then inhaled slowly.

Dry-powder, breath-activated inhalers are preloaded with the medication(s) inside the device. Prior to use, a single dose of the medication is loaded into the mouthpiece, often by turning or twisting the inhaler body until a "click" signals the dose is ready to be inhaled. Patients simply take a deep breath while their lips are sealed around the inhaler, and a single dose is delivered (breath-activated).

Dry-powder, capsule inhalers utilize capsules as the dose-holding system, which are inserted into the device by the manufacturer or by the patient prior to use, and punctured by the device before each dose is inhaled directly from the inhaler.

Soft mist inhalers are a propellant-free liquid inhaler that provides a slow-moving, soft aerosol cloud of medicine to help patients inhale the medication, even if they can't take a very deep breath.

Errors with inhalers

The correct use of an inhaler depends on its type; thus, each manufacturer provides detailed instructions for use, some with a *Medication Guide* for consumers and/or a short online video to help visualize the technique. Unfortunately, up to 94% of patients with asthma and COPD use their inhalers incorrectly.[2-4] Problems are not limited to one type of device,[3] nor are they limited to patients—even healthcare professionals have made errors.[2] Misuse leads to reduced efficacy and poor outcomes. For example, in a

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SAFETY briefs

HIGH-ALERT

U-500 syringe approved by FDA. Last week, the US Food and Drug Administration (FDA) approved a dedicated syringe manufactured by BD for the administration of regular insulin (concentrated) U-500 (**HUMULIN R U-500**) provided in vials. The volume of the new U-500 syringe is 0.5 mL

Figure 1. New U-500 insulin syringe from BD. Availability will be later this year.

(**Figure 1**). The scale measures from 25 units to 250 units in 5 unit increments. The syringe has a 31 gauge needle that is 6 mm in length. The syringes will be available later this year.

Once available, this means that U-100 syringes or tuberculin syringes should no longer be used when U-500 insulin is administered in hospitals or by patients at home. In the past, product labeling included a conversion table to facilitate use of a U-100 syringe (every unit on the U-100 scale was equivalent to 5 units of U-500 insulin). But this often led to confusion and medication errors when patients reported doses in terms of U-100 syringe units (e.g., 40 units when in reality they were taking 200 units). With tuberculin syringes, conversion to mL dosing was necessary, which also led to dosing errors. FDA has said that since conversions are no longer needed with this new U-500 insulin syringe, the Humu**LIN** R U-500 insulin vial's package insert will be updated to remove the dose conversion information for U-100 and tuberculin syringes. Humu**LIN** Regular U-500 is also available in a prefilled pen which measures the concentrated insulin in 5 unit increments.

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study published in 2015, Bonds et al. found that only 7% of patients who used MDIs demonstrated proper technique; 93% made at least one mistake, and of those, 63% missed 3 or more steps in the 11-step process.[2] While most of these errors typically result in diminished drug delivery rather than no delivery at all, other errors have resulted in omitted doses, overdoses, and exacerbation of the underlying disease and respiratory symptoms.

Common errors made by patients using any inhaler include:[5,6]

- Not holding their breath long enough after inhaling a dose (hold for about 10 seconds or as long as comfortable)
- Using an empty inhaler, often believing an inhaler still provides doses even after the dose counter is at zero because the patient can still see or feel a "spray"
- Forgetting to exhale completely before each dose or exhaling into the inhaler
- Not using maintenance inhalers when asymptomatic

Common errors made by patients using an MDI (with and without a spacer) include:[5,6]

- Not shaking the canister or container before each dose
- Inhaling at the wrong time (not in sync with pressing the inhaler)
- Aiming the inhaler at the roof of the mouth or tongue, rather than the throat
- Inhaling an unnoticed foreign body that has entered an uncapped inhaler
- Damaged or sticky spacer valves that limit the delivery of the medicine

Common errors made by patients using a dry-powder, breath-activated inhaler include:[5,6]

- Failing to load a dose before inhaling
- Loss of some medication by holding the inhaler mouthpiece upside down during or after loading a dose
- Failure to inhale strongly enough to draw the medication out of the device

Common errors made by patients using a dry-powder inhaler that requires loading and piercing of a capsule prior to each dose include:[5,6]

- Not piercing the capsule
- Forgetting to remove the spent capsule and not using a new capsule for each dose
- Failing to take a second breath (if indicated) to receive the full dose
- Swallowing the capsule instead of inhaling its contents
- Placing the capsule into the inhaler mouthpiece instead of the chamber designed to hold the capsule, which can result in swallowing or choking on the capsule during inhalation

Errors with newer inhalers

Over the past few years, several new devices for the administration of inhaled medications have been introduced. Some of the devices are used to administer newly marketed medications, while others contain previously available drugs in a different administration format. They were designed to address some of the problems with older inhalers and to improve the ability to use the inhalers correctly. Specifically, the newer inhalers include:

- A dose counter, which allows patients to see when the supply of medication is low. This was previously available on some dry-powder inhalers but not on MDIs.
- A longer duration of spray at a lower speed to help patients receive the full dose despite problems with coordinating the spray with the breath and the depth of the breath (e.g., **Respimat** soft mist inhalers).
- The inability to activate a dose when all of the medication has been used. Once the last dose has been taken and the inhaler is empty, the mechanism to prepare another dose is locked, preventing the use of an empty inhaler.

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Unless the U-500 pen is prescribed, U-500 syringes should be co-prescribed with U-500 insulin vials for outpatients and should be used in hospitals for this purpose.

FDA and ISMP believe that patients should only use the U-500 insulin syringe with the U-500 insulin vial, and switching between types of syringes should not occur. ISMP also recommends that, unless a U-500 pen is dispensed, all U-500 doses should be prepared by pharmacy, and that U-500 vials and empty U-500 syringes should not be stored outside the pharmacy.

HIGH-ALERT

Crash cart drug mix-up. During a neonatal code, a physician asked for **EPINEPH**rine, but a nurse inadvertently prepared a prefilled emergency syringe of infant 4.2% sodium bicarbonate injection. Three doses of the wrong medication were given. The outcome of the neonate that coded is unknown at this time. The error was discovered post-code when the empty packages were recognized as incorrect.

Although it's clear that the sodium bicarbonate carton's label must not have been properly confirmed, part of the problem may have been related to the way the crash cart trays were prepared with a packing slip placed inside the tray that covered the **EPINEPH**rine carton labels (**Figure 1**). Also, the sodium bicarbonate syringe labels may have been oriented upside down in comparison to the nurse's point of view. During a neonatal code, since doses are so small, more than one dose of medication might come from the same syringe, which can compound a selection error. The report we received did not specify if this was the case or if different prefilled syringes were used.

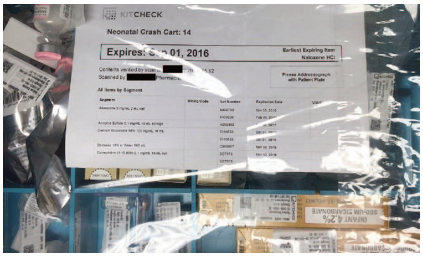

Figure 1. The packing slip inside the crash cart tray covered the **EPINEPH**rine carton labels, which led to preparation of sodium bicarbonate syringes.

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Despite these new design enhancements to improve correct use, unfamiliarity with the newer inhalers on the market has been the source of several recently reported errors.

Case #1

A patient discharged from the hospital with new prescriptions for **ADVAIR HFA** (fluticasone and salmeterol), **PROVENTIL HFA** (albuterol), **SPIRIVA HANDIHALER** (tiotropium), and predni**SONE** was readmitted to the emergency department (ED) 3 days later with complaints of feeling "jittery," increasing shortness of breath, and wheezing. When the patient was asked about taking his newly prescribed medications, the ED nurse learned that the patient had been taking 3 Spiriva capsules by mouth each day since discharge, unaware that the drug in the capsule was intended to be inhaled. The patient was treated and given both verbal and written instructions for use of his inhaled medications. The patient was also asked to return to a hospital clinic the following day with all of his medications to meet with a pharmacist, who provided hands-on education. Prior to leaving the clinic, the patient was able to demonstrate proper technique and verbalize when to use each inhaler. But keep in mind, education and repeat demonstration to verify understanding of inhaled medications should have occurred prior to the patient's initial discharge from the hospital, perhaps preventing a visit to the ED.

Case #2

A community pharmacist misread a prescription for **INCRUSE ELLIPTA** (umeclidinium), which was a new prescription for a patient upon discharge from a hospital, as "Increase Ellipta." The pharmacist was only familiar with **BREO ELLIPTA** (fluticasone and vilanterol) and had never filled a prescription for Incruse Ellipta prior to this incident. Because the patient was not taking an "Ellipta" inhaler previously, the pharmacist called the prescriber's office to clarify the dose of what he thought was an order for Breo Ellipta. The prescriber confirmed the dose for Breo Ellipta as 100/25 mcg per inhalation, evidently overlooking the fact that he had prescribed Incruse Ellipta for this patient. When the patient was readmitted to the hospital several weeks later for an unrelated diagnosis, a pharmacist discovered the error while collecting a medication history from the patient and investigating why he was taking both Advair and Breo Ellipta.

Case #3

A color-blind patient was unable to tell if the indicator window on a **TUDORZA PRESSAIR** (aclidinium) inhaler was red or green. The window turns green when the inhaler is loaded with a dose and is ready to use, and red when the dose has been completely inhaled. The patient mentioned this to his pharmacist when refilling his prescription. The pharmacist suggested that the patient use a pen to place a mark or dot on the green indicator to differentiate it from the red indicator.

Optimal use of inhalation devices

Because many practitioners and patients may not be familiar with the newer inhalers, we have compiled a list of proactive risk-reduction strategies to support the proper use of these and other inhalers by patients and practitioners. Consider the following:

Prescribers

- Ensure that prescriptions for inhaled medications include the medication name and strength, the device name, and the desired dose and frequency, particularly if the medication is available in more than one device format.
- When prescribing any inhalation device, consider pertinent patient characteristics, such as inspiratory flow, cognition, and manual dexterity, before prescribing the medication.

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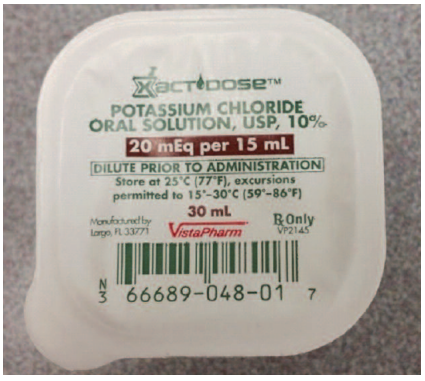
Holding mock codes would be helpful in identifying potential problems like this. Nurses, pharmacists, and others would also become more familiar with available items in code carts, how they are stored, what they look like, and so on. During an actual code, any packing slips should be immediately removed from trays so they don't interfere with content visibility. Items in trays must be properly oriented for recognition during the code. It is also helpful for the person preparing the drugs during the code to be different from the person administering them. That gives an opportunity for the preparer to say, "Here's the **EPINEPH**rine 1 mg," then hand it off and have the person administering the medication read the label to confirm (e.g., "I have in my hand **EPINEPH**rine 1 mg."). It only takes a few seconds to confirm the correct drug is in hand. Including pharmacists on code teams to help prepare the necessary medications is also an important error-reduction strategy.

Misleading VistaPharm label. We again received a report about VistaPharm's potassium chloride oral solution 10%. The unit dose cups indicate they hold 20 mEq in 15 mL. Elsewhere on the label it indicates that the volume in the cup is actually 30 mL, which is 40 mEq (**see photo**). Several patients received overdoses, although none were injured. The label is misleading and potentially dangerous. We contacted VistaPharm in March to request a label change that shows the exact quantity in the container (40 mEq per 30 mL). Although this has been done, products with older labeling are still in circulation, as no recall has been issued. Please check your supplies to make sure that these poorly labeled cups are not available.



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- Provide opportunities for patients to access videos on proper inhalation device technique while in the prescriber's office.
- If patients are not responding to treatment as expected, observe their technique using inhalation devices to ensure proper delivery of the prescribed medications.

Nurse, Pharmacist, Respiratory Therapist

- Obtain demonstration inhalers from the manufacturer or local lung association to provide hands-on education (it is best if the prescription is filled and the actual device is used). Maintain these demonstration devices in a segregated area away from actual medications so they don't find their way into the supply for patients.
- Ensure that patient education and counseling includes a demonstration of how the inhalation device is to be used. Helpful how-to videos are available from the Centers for Disease Control and Prevention (www.ismp.org/sc?id=1759), the use-inhalers.com website (http://use-inhalers.com), product-specific websites, and other websites. The use-inhalers.com website also offers free handouts for patients that provide step-by-step instructions for most inhalers in both English and Spanish.
- Focus education on essential aspects of proper inhaler use and the importance of taking all doses, and place less emphasis on aspects of treatment that allow some flexibility, such as timing between BID or q12h doses.
- Remind patients to discard an inhaler when the dose counter is at zero, even if the device continues to spray what seems to be a dose.
- Ask the patient to demonstrate inhaler technique (using a demonstration inhaler or preferably their own). Such demonstrations can create opportunities to correct improper technique, which may be a contributing factor for patients who continue to experience difficulty with symptoms of asthma or COPD. For devices using capsules, emphasize the need to place the capsule in the piercing chamber and not in the mouthpiece, and that the capsules should never be swallowed.
- Provide opportunities for patients to access videos on the proper use of inhalation devices prior to discharge.

Outpatient Pharmacists

- In addition to providing written instructions, reinforce proper and safe use of the inhalation devices during patient counseling.
- Ask the patient to demonstrate inhaler technique (using a demonstration inhaler) both when filling new prescriptions and periodically when refilling prescriptions.
- Ask patients if they discussed use of a spacer with their provider. Consider contacting the prescriber if the use of a spacer would be beneficial for the patient.
- Maintain all demonstration inhalers in a segregated area to ensure they cannot be inadvertently dispensed to patients as actual medications.

Healthcare Organizations

- Distribute this newsletter to healthcare providers to support awareness of patient errors with inhalation devices, particularly with the new inhalation devices with which they may be unfamiliar.
- Post the **summary chart** included on **pages 5 and 6** for reference and to help staff and prescribers when they are providing instructions to patients. The chart provides an overview of the newer inhalation devices, the medications they deliver, and selected safety considerations to be shared with patients. It supplements, but does not replace, the information provided by the inhaler manufacturers.

ISMP gratefully acknowledges ISMP Canada for providing most of the content for this article.[5]

References appear in the right column.

References

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Special Announcements

ISMP webinar

Join us on **July 20** for our popular annual webinar, ***2016 Update on The Joint Commission Medication-Related Standards.*** Frequent challenges associated with medication-related standards will be presented with examples of how to achieve compliance. For details, visit: www.ismp.org/sc?id=349.

ISMP Medication Safety INTENSIVE

Join us in Las Vegas on **December 2 and 3** for the ISMP **Medication Safety Intensive (MSI)** workshop. For details, visit: www.ismp.org/sc?id=351.

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Safety Tips for Using Newer Inhalers

Neohaler (dry-powder inhalers)

Arcapta Neohaler
indacaterol 75 mcg per capsule

Seebri Neohaler
glycopyrrolate
15.6 mcg per capsule

Utibron Neohaler
indacaterol 27.5 mcg and **glycopyrrolate** 15.6 mcg per capsule

Safety Tips (Neohaler)

- Capsules are packaged separately from the inhaler and must be inserted into the capsule chamber. The mouthpiece must be opened for capsule placement inside the capsule chamber.
- Take the capsule out of the foil right before use.
- Do not swallow the capsule. Only the contents of the capsule will be inhaled into the lungs.
- Inadvertent swallowing and/or choking on the capsule is possible if the capsule is mistakenly placed in the inhaler mouthpiece. If the capsule is swallowed by accident, skip that dose.
- Empty the chamber immediately after use, otherwise pieces of the capsule can remain inside and impede the free flow of medicine for the next dose.
- Discard used capsules directly into the garbage without touching, and then wash your hands.
- Put the cap back on after you are done.
- Do not use with a spacer.
- Do not take the device apart or wash it. If you want to clean your inhaler, wipe the inside and outside with a clean, dry, lint-free cloth.
- Do not breathe out into the device.
- If using more than 1 type of inhaler, ask your doctor which to use first.
- Only use the device that comes with this drug. Do not use any other devices.

Ellipta (dry-powder inhalers)

Arnuity Ellipta
fluticasone 100 or 200 mcg per dose

Anoro Ellipta
umeclidinium 62.5 mcg and **vilanterol** 25 mcg per dose

Breo Ellipta
fluticasone 100 or 200 mcg and **vilanterol** 25 mcg per dose

Incruse Ellipta
umeclidinium 62.5 mcg per dose

Safety Tips (Ellipta)

- The foil packaging and drying agent packet must be safely discarded immediately after opening.
- The colored cap should be opened before inhaling the dose. There is an audible "click" when the dose is ready to be inhaled.
- If the device cover is opened and then closed without inhalation of the loaded dose, that dose will be lost. If a dose is lost, another dose can be loaded by opening the device cover again; double-dosing will not occur.
- When the dose is ready, if the device is tipped past horizontal, medication can fall out of the mouthpiece.
- Put the mouthpiece between your lips, and close your lips firmly around it.
- Don't block the air vent (on the sides of the mouthpiece) with your fingers.
- Use only once a day, at the same time each day.
- Half of the counter turns red when there are less than 10 doses remaining, and a full solid red when the inhaler is empty.
- Do not breathe out into the inhaler.
- Close the **Ellipta** inhaler after you take your dose.
- Rinse your mouth after each use, but do not swallow the rinse water. Spit it out.
- If using more than 1 type of inhaler, ask the doctor which inhaler to use first.

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Safety Tips for Using Newer Inhalers

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Pressair (dry-powder inhaler)

Tudorza Pressair
aclidinium 400 mcg per dose

Safety Tips (Pressair)

- Before you put the inhaler in your mouth, press the green button down and release it. Do not continue to hold down the button while inhaling.
- Stop and check that the *control* window changed from red to green which means it is ready to use.
- Insert the mouthpiece into your mouth and breathe in.
- During dose inhalation, you will hear a "click." Keep breathing in even after the "click" to ensure delivery of the full dose.
- Upon proper inhalation of the dose, the *control* window will change back to red.
- When a red striped band appears in the dose window, obtain a new inhaler. The device will "lock" when the last dose has been loaded.
- Some patients experience an unpleasant taste—rinse your mouth and swallow the water.

Respimat (soft mist inhalers)

Combivent Respimat
ipratropium 20 mcg and **albuterol** 100 mcg per dose

Spiriva Respimat
tiotropium 1.25 mcg or 2.5 mcg per actuation

Stiolto Respimat
tiotropium 2.5 mcg and **olodaterol** 2.5 mcg per actuation

Safety Tips (Respimat)

- Inserting a new cartridge into the inhaler may require more force than expected; ask your pharmacist to do it for you. (Discuss whether you or the pharmacist will "prime" the cartridge as described in the next steps.)
- Once the cartridge has been inserted into the inhaler, do not remove it until you are ready to replace it with a new one.
- Before the first use of a new cartridge, you must prime it by directing three test sprays into the air. This must be completed to make sure the inhaler is ready to use.
- Before initiating the dose, your lips should be tightly closed over the mouthpiece without covering the air vents (on the sides of the mouthpiece).
- Each dose requires the following steps (a helpful way to remember the steps for daily dosing is to remember **TOP**):
  1. **T**urn the clear base
  2. **O**pen the cap and close your lips around the mouthpiece being careful not to cover the air vents on the sides of the mouthpiece
  3. **P**ress the dose-release button and inhale
- For **Spririva** and **Stiolto**, repeat these steps for a second inhalation to receive the proper dose of medicine.
- When about a 7-day supply of medication remains in the device, the red pointer will enter the red zone of the dose counter on the base.
- **Spiriva** is also available in a dry-powder format (**HandiHaler**) that delivers a different dose.

ISMP Quarterly 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–June 2016** issues of the *ISMP Medication Safety Alert!* have been prepared for an interdisciplinary committee 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 as desired. 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/sc?id=479). The Action Agenda is also available for download in a Microsoft Word format (www.ismp.org/newsletters/acutecare/articles/ActionAgenda1603.doc) 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/sc?id=480.

Key: ⚠ – ISMP high-alert medication

Issue No.	Problem	Recommendation	Organization Assessment	Action Required/Assignment	Date Completed
Reassess the safety of neuromuscular blockers in your facility					
(12) ⚠	Serious events continue to occur with neuromuscular blocking agents in the operating room, emergency department, critical care and medical-surgical units, and other patient care locations, including interventional radiology departments. Many of the harmful or fatal errors involve the accidental administration of a neuromuscular blocker when another drug is intended. These errors are caused by look-alike drug names, packaging, and labeling; unlabeled or mislabeled syringes; unsafe storage; knowledge deficits; and other causes.	Special attention should be given to proper ordering, storage, selection, preparation, and administration recommendations and requirements for neuromuscular blockers. Give highest priority to limiting access, segregating storage, affixing warning labels about respiratory arrest, dispensing patient-specific infusions from the pharmacy; and computer alerts when orders are entered for a patient in a unit that does not support mechanical ventilation. Implementation of recommendations that address errors not unique to neuromuscular blocking agents should also be considered.			
Misuse of insulin pens with higher concentrations					
(12) ⚠	A patient previously using **LANTUS** (insulin glargine) U-100 was switched to **TOUJEO** U-300 (insulin glargine) pens. Although given pen needles, he drew a dose from the pen cartridge using a U-100 syringe, filling it to the 100 unit mark (his prior Lantus dose). This resulted in a dose of 300 units of Toujeo, leading to hypoglycemia requiring hospitalization. Using a U-100 syringe to measure higher insulin concentrations could lead to a serious overdose. With U-500 insulin, there is also risk of an underdose if patients, accustomed to measuring only 20% of the actual dose when using a U-100 syringe, dial this lower dose when using a U-500 pen.	Educate patients and health professionals regarding the proper dosing and dose measurement of the higher concentration insulin products now available in pen devices. With pen devices, there is no need for dose calculations. The prescribed dose is the dose that is indicated once the dial on the pen is turned to that number. Never use a pen cartridge as a vial.			
Methotrexate and metOLazone mix-ups					
(9) ⚠	Two errors occurred in which methotrexate was dispensed instead of met**OL**azone, resulting in the death of one patient. In the fatal error, a nurse called discharge prescriptions into the pharmacy, and met**OL**azone 2.5 mg daily was transcribed incorrectly as methotrexate 2.5 mg daily. In the other error, a prescription was entered into the pharmacy computer as methotrexate, and the checking pharmacist did not compare the label with the original prescription.	Segregate methotrexate from other medications in the pharmacy, employ a hard stop in dispensing software to prevent "daily" instructions on the label, and educate the patient about weekly dosing. A methotrexate patient counseling handout is available in English and Spanish on our website (www.ismp.org/sc?id=1709). Also, pharmacists should always check the original prescription when verifying order entry and/or the final product.			

Issue No.	Problem	Recommendation	Organization Assessment	Action Required/Assignment	Date Completed
Radiofrequency identification (RFID) systems to refill medication kits can't prevent every error					
(12)	Hospitals using RFID technology to refill various emergency kits have reported problems. If a medication is used and returned to the kit, or the RFID tag falls off the vial but remains in the kit, the technology will not notify staff to replace the item. Failure to replace an empty or missing vial can delay therapy. Also, as long as the right number of vials is present and not expired, the system will not detect if they are placed in the wrong location.	During the restocking process, have pharmacy staff visually inspect each vial still in the kit to ensure it hasn't been used and placed back in the kit. Have staff verify that RFID tags have not fallen off of vials and are laying loose in the kit.			
Mix-up between insulin and influenza vaccine					
(9) ⚠	In Brazil, 50 hospital employees received a dose of insulin instead of influenza vaccine, requiring hospitalization. The person administering the vaccines confused the multiple-dose vials and took the wrong box out of the refrigerator where both insulin and influenza vaccine were stored. Similar cases have been reported around the world and, in some cases, were fatal.	The Centers for Disease Control and Prevention (CDC) recommends keeping vaccines in separate storage units dedicated only to vaccines. If this is not an option, each type of vaccine should be stocked in segregated and labeled bins in medication refrigerators. If available, use commercially available prefilled syringes of vaccines. Conduct regular assessments of drug storage and address potentially hazardous storage conditions.			
Eliminating ratio expressions					
(9) ⚠	Ratio expressions of single-entity drug products are no longer allowed as of May 1, 2016. Manufacturers have begun conversion, but complete inventory turnover will likely take time. During transition, errors are possible. For example, if a prescriber calls for "1:10,000 **EPINEPH**rine" during a code and the product label displays the strength as 0.1 mg/mL, practitioners could be confused and administer the wrong dose.	Inform healthcare professionals about the elimination of ratio expressions, and to prevent confusion, encourage them to use the new dosing nomenclature in metric units when referring to these medications. Also review order sets, policies, procedures, code carts, and other emergency kit listings, and all databases, and make changes in the dosing nomenclature when necessary to ensure consistency in the message.			
Prescribing errors with levETIRAcetam (KEPPRA) oral solution					
(8)	A 3-month-old infant was hospitalized with a respiratory infection. The parents said she had been receiving 8 mL (800 mg of a 100 mg/mL solution) of Keppra every 12 hours prior to admission for a seizure disorder. A pediatric resident prescribed the same dose without noticing that it was excessive. A pharmacist following up on the dose learned that the baby had been receiving the correct dose of 80 mg every 12 hours after birth, but after a prior admission, had been discharged on "8 mL" of medication for each 12-hour dose.	Express single-entity drug doses in metric weight, not volume alone. Add weight-based and calculated doses on orders and prescriptions, and include the patient's age/birth date and weight on prescriptions. Require prescribers to perform discharge medication reconciliation, converting appropriate medications to prescriptions, and clearly noting any changes, discontinuations, or additions in the discharge summary given to the patient. Require nurses to verify discharge medications by comparing them with the patient's inpatient and home medication lists. Build alerts to warn prescribers and pharmacists about unsafe doses.			

Issue No.	Problem	Recommendation	Organization Assessment	Action Required/Assignment	Date Completed
Availability of mL-only liquid dose cups with printed scale					
(12)	ISMP has long called for the elimination of teaspoons, tablespoons, and drams on devices used for measuring liquid doses of medications (www.ismp.org/sc?id=1750). However, the few mL-only dosage cups previously had embossed scales that were difficult to read.	To prevent mix-ups between milliliters and household measures, use oral liquid dosing devices that only display the metric scale. For improved readability, consider purchasing mL-only liquid dose cups with easy-to-read printed scales instead of embossed scales, which are now available from Comar (distributor: Medi-Dose).			
Reporting and second-order problem solving can turn short-term fixes into long-term remedies					
(10)	Practitioners who are repeatedly challenged by unexpected work system failures that hinder patient care have become proficient in working around these failures to get the job done. These quick fixes, called first-order problem solving, are often considered to be signs of resourcefulness. However, these quick fixes, which occur more than 90% of the time, transfer problems to another time, person, or place. Failure to use second-order problem solving (i.e., report problems, understand why they exist, correct the problem) hinders long-term remedies. The culture often emphasizes quick fixes above learning from failures and improving system reliability.	To promote organizational learning, create an environment of psychological safety that fosters open reporting, active questioning, and frequent sharing of insights and concerns. Encourage practitioners to both handle the unexpected problem and then report it so steps can be taken to address its underlying causes. Create capacity for second-order problem solving to occur as close as possible to when and where the problem occurred. Once a problem has been identified and the underlying causes examined, proper attention must be paid to reducing its recurrence.			
Look-alike packaging of liquid megestrol and metoclopramide by Pharmaceutical Associates					
(10)	A pharmacy stored megestrol 400 mg/10 mL and metoclopramide 10 mg/10 mL liquid dosing cups in bins near each other. Both products have similar packaging, including the same size cups and crowded text in blue on the labels. The pharmacy stocked an automated dispensing cabinet (ADC) with metoclopramide instead of megestrol.	Consider not storing these medications next to each other and purchasing one of the medications from a different manufacturer or packager. Implement barcode scanning in the pharmacy, during ADC stocking, and at the bedside prior to administration.			
Health Care Logistics "vial grippers" may lead to safer drug storage					
(10)	One of the most common types of errors reported to ISMP is a mix-up between look-alike vials. There are many problem pairs of drug vials that could benefit from organized storage that ensures that all labels face forward.	Consider using "vial grippers" similar to those marketed by Health Care Logistics to neatly organize medications, keeping the labels facing up to promote readability. Avoid using the color of the grippers as a means of color-coding medications.			
Don't use liquid docusate					
(13)	Preliminary information continues to indicate that contaminated oral liquid docusate products might be related to a breakout of *Burkholderia cepacia* infections primarily in ventilated patients without cystic fibrosis. At this time, there is no evidence to suggest oral capsules or enemas are affected.	As of July 8, 2016, the Centers for Disease Control and Prevention (CDC) recommends not using liquid docusate products for all patient populations (www.ismp.org/sc?id=1756). Refer to the CDC website for recommendations in reporting cases to public health authorities.			

Issue No.	Problem	Recommendation	Organization Assessment	Action Required/Assignment	Date Completed
Intravenous (IV) line disinfection caps can become foreign bodies					
(7)	A recent report cautioned about applying disinfection caps to pediatric patients' IV catheter hubs and needleless ports to help prevent catheter-associated bloodstream infections. The caps have become lodged in the esophagus of several babies, and could cause an airway obstruction.	The authors of the report call for disinfection caps to be used with discretion in the pediatric population. They also suggest limiting the use of caps on peripheral lines, citing a 2014 study that showed no infection reduction with caps on peripheral lines. See the full *Safety Brief* for references.			
RESTASIS (cycloSPORINE ophthalmic emulsion) mixed up with REFRESH CELLUVISC (carboxymethylcellulose) lubricant eye gel					
(7)	ISMP has received reports of several mix-ups between Restasis and Refresh Celluvisc. The two plastic ampuls look identical and the text on the unit dose packages also look similar. These low-density polyethylene ampuls are currently exempt from the FDA barcode rule.	Pharmacy should print labels with barcodes and place them on these products for nurses to scan prior to administration. When this is done, we recommend placing the label on either end of the container, not on the breakaway cap, away from the solution.			
New brand name for vortioxetine					
(9)	After frequent reports of mix-ups between the look- and sound-alike drug names, **BRINTELLIX** (vortioxetine) and **BRILINTA** (ticagrelor), FDA announced that Brintellix will now be called **TRINTELLIX** to decrease the risk of errors. Because of the lag time associated with manufacturing bottles with the new brand name, you may continue to see bottles labeled with the brand name Brintellix during the transition period.	Pharmacy staff who order and stock the medication should be aware that Trintellix will have a new National Drug Code (NDC) number. Drug information and electronic system vendors should start using the new brand name and NDC number. Until a full changeover of products is completed, include the indication with orders and prescriptions for either drug.			
Colestipol confusion due to different size scoops					
(13)	Two colestipol products both include scoops that provide 5 g of colestipol, but Pfizer's **COLESTID** scoop holds 7.5 grams of product, which includes flavoring agents and fillers, and Global Pharmaceuticals' generic, unflavored colestipol scoop measures out just 5 g. A pharmacist evaluating the unflavored product thought that the scoop provided 50% less drug than a scoop of the Pfizer flavored product.	Follow the dosing information for the specific colestipol product in use.			
Adverse effects of fluoroquinolones					
(13)	Fluoroquinolone antibiotics accounted for the largest number of persistent, long-term adverse effects in reports submitted to FDA in 2015. These potentially permanent adverse effects involve tendons, muscles, joints, nerves, and the central nervous system. Patients with organ transplants, renal impairment, recent exposure to topical or systemic corticosteroid therapy, and the elderly are at greater risk.	The adverse reactions outweigh the benefits for patients with acute sinusitis, acute bronchitis, and uncomplicated urinary tract infections. Reserve fluoroquinolones for patients without alternative treatment options. Stop therapy if a patient reports serious side effects and switch to a non-fluoroquinolone antibacterial drug to complete the treatment course.			