January 17, 2019 ■ Volume 24 Issue 1

ISMP 25 YEARS ADVANCING MEDICATION SAFETY

Acute Care ISMP Medication Safety Alert!®

Educating the Healthcare Community About Safe Medication Practices

Safety enhancements every hospital must consider in wake of another tragic neuromuscular blocker event

Problem: National news recently exposed details about a 2017 fatal medication error that happened at a large, prestigious hospital after the Centers for Medicare & Medicaid Services (CMS) briefly placed its Medicare reimbursement status in jeopardy. The hospital's status was quickly restored following submission of a plan of correction to CMS. Upon ISMP's awareness of the event, it became imperative to share the lessons learned from the fatal event so other healthcare providers can avoid a similar tragedy.

The details of the error that follow are from a CMS report. As the story unfolds, we hope you will see that this type of error could happen anywhere given current system vulnerabilities frequently found in hospitals, particularly when using automated dispensing cabinets (ADCs). In fact, ISMP has observed many of the same system vulnerabilities in other hospitals, and they are frequently at the root of a variety of medication errors reported to the ISMP National Medication Errors Reporting Program (ISMP MERP). Make no mistake—this type of error could happen in your hospital, and it is crucial to take steps now to reduce the risk of a similarly tragic event.

continued on page 2—Neuromuscular blocker event >

Table 1. ADC safety features to reduce the risk of errors when removing medications from cabinets*

General Safety Features	Description
Optimize profiled ADCs	Optimize the use of profiled ADCs that allows drug selection after pharmacy verification of orders in inpatient and outpatient settings (e.g., emergency department [ED], pre- and post-procedural locations)
Manage override lists	Limit the variety of medications that can be removed from an ADC via override for defined urgent/emergent situations
Block staff from loading inappropriate medications	Activate ADC software that prevents clinically inappropriate medications from being loaded into specific cabinets without prior approval
Utilize warnings during medication removal	Configure interactive alerts that require users to enter or select clinically relevant information (e.g., purpose for drug removal, whether the patient is ventilated [for neuromuscular blockers]) prior to removal
Witness override medication removal	Require a second individual to verify the correct patient, medication, strength, route, and indication upon override removal of a select list of medications or from certain ADCs; document the verification process
Allow simultaneous searching by brand and generic names	Configure ADCs to search simultaneously by brand and generic names; if searches are limited to either brand or generic names, educate staff how to toggle between these two functions
Support distraction-free ADC medication removal	Avoid distractions and talking at the ADC while searching for and removing medications
Neuromuscular Blocker Safety Features	**Description**
Limit access	Strictly limit availability in ADCs to perioperative, labor and delivery, critical care, and ED settings; in these areas, store in a sealed box, rapid sequence intubation (RSI) kit, or locked-lidded ADC pockets
Affix warnings to ADC pockets	Place auxiliary labels on ADC pockets/drawers/lids that clearly state, **"WARNING: CAUSES RESPIRATORY ARREST—PATIENT MUST BE VENTILATED**," the warning should be visible when ADC pockets/drawers/lids are open

**Assistance with implementing these recommendations is welcomed by vendors.*

Finalized guidelines for electronic communication

ISMP has finalized a set of ***Guidelines for Safe Electronic Communication of Medication Information*** (see **pages 7-14**), which are now posted on our website at: www.ismp.org/node/1322. We published the first draft of these guidelines in our February 20, 2003 newsletter, when implementation of electronic health records (EHRs), electronic prescribing (e-prescribing), and other health information technology (HIT)-related tools began to evolve in both inpatient and outpatient settings. These technologies are now a mainstay in healthcare, and their introduction has brought about significant changes in how medications are prescribed, dispensed, and administered. If the conventions used to communicate medication information electronically are not carefully considered, these technologies may contribute to medication errors rather than mitigate risks.

In 2015, we again examined the literature and other credible sources to identify potential confusion that is unique to electronic communication or that affects both paper and electronic records. We then updated the draft guidelines, which were published in our August 27, 2015 newsletter (www.ismp.org/node/384). We solicited and received detailed comments about the updated draft guidelines from dozens of clinicians and more than 50 large groups, including federal and state government agencies; electronic pharmacy information, health information, and prescribing system vendors; and standards-setting, professional, and international organizations. Those who submitted comments were widely supportive; however, before we could publish the finalized guidelines, changes were made in the standards associated with the e-prescribing drug name (EPN) field in e-prescribing systems, and the ISMP guidelines con-

continued on page 2— Guidelines >

> Neuromuscular blocker event—continued from page 1

The Error

A patient was admitted to the neurology intensive care unit (NCU) with a headache and vision field loss in the left eye. Magnetic resonance imaging (MRI) confirmed an intraparenchymal hematoma of the brain, possibly related to a suspected mass behind it. Two days later, the patient's physician entered an order to transfer the patient to a step-down unit. The patient was then transported to radiology for a full body positron emission tomography (PET) scan. While a radiology technician was explaining the PET scan to the patient, she requested medication to help ease anxiety due to claustrophobia. The patient's physician was contacted, and he entered two electronic orders. The first order was for **VERSED** (midazolam) 2 mg intravenously (IV), with instructions, "For PET scan, if first mg insufficient, can give 1-2 additional if needed." (Note: Versed is no longer available as a brand of midazolam.) The physician then clarified the order by prescribing a one-time dose of Versed 1 mg IV prior to the PET scan. A pharmacist verified the orders within a few minutes.

According to the CMS report, a radiology technician called the patient's primary nurse to ask if she could send a nurse to administer the IV Versed. The primary nurse asked if a radiology nurse could administer the IV Versed, but the technician said that the nurse was uncomfortable administering this drug and that the patient would need to be monitored. The primary nurse said she would send a nurse to radiology to administer the IV Versed. The technician then administered a radioactive tracer to the patient so the PET scan could be completed in an hour after tracer absorption.

Because the primary nurse was covering another nurse's patients, she asked a help-all (resource/floater) registered nurse, who was also orienting a new nurse, to go to radiology to administer the IV Versed. The help-all nurse had been on her way to the emergency department (ED) to conduct a swallowing study but agreed to first administer the IV Versed to the patient in radiology. At the NCU ADC, the help-all nurse entered the first two letters of the drug name, "VE," into a search field under the patient's profile, which was still active pending transfer to the step-down unit. No medications populated the search results, although the ADC allowed searches using just the first few letters of a medication's name. "Versed" was not found because the ADC defaulted to generic drug name searches. To search by brand names, the setting needed to be changed on the ADC screen.

When the help-all nurse could not find "Versed" on the list, she initiated an override setting, entered "VE" again into a search field, and selected the first medication that populated the results, which was the neuromuscular blocker vecuronium, not Versed. Because the override function had been engaged, a red box warning on the screen noted that the medication should be associated with a STAT order. But the ADC opened, and the nurse removed a vial of the neuromuscular blocker, vecuronium bromide lyophilized powder, 10 mg (1 mg/mL when reconstituted with 10 mL), believing it was Versed. Although neuromuscular blockers were on the hospital's list of high-alert medications, there were no specific precautions in place prior to removal of the drug via override.

While removing the vial from the ADC, the help-all nurse noticed that the medication was a powder and turned the vial over to read the reconstitution directions on the back of the label, never reading the actual drug name on the front of the vial label. She also did not recognize that Versed is available only in a liquid injectable form, not a powder requiring reconstitution. The CMS report noted that the nurse placed the vecuronium vial in a plastic bag along with two 10 mL normal saline flush syringes, alcohol pads, and a blunt tip needle, and labeled the bag with a patient sticker and a handwritten note that said, "PET scan Versed 1-2 mg." She then went to radiology to administer the medication.

The patient had been moved into a radiology holding room to await tracer perfusion. The nurse found the patient, verified her identity, and told her that the medication would help

continued on page 3—Neuromuscular blocker event >

> Guidelines—cont'd from page 1

flicted with the new standard. The EPN standard had been changed to help clarify the specific drug prescribed; however, the change led to unanticipated medication errors. The issue has now been resolved through revision of the EPN standard, and the final ISMP guidelines are now harmonized with the new EPN standard.

The scope of the ***ISMP Guidelines for Safe Electronic Communication of Medication Information*** is narrow and covers only issues that deal with how information about medications is communicated in electronic formats, including EHRs, pharmacy computer systems, e-prescribing systems, and other displays of electronic health information when using medication administration records, barcode scanning systems, smart infusion pumps, and automated dispensing cabinets. If you have any concerns with the finalized guidelines, please contact ISMP to let us know (ismpinfo@ismp.org), and we will consider your comments. Because HIT changes are rapid, we anticipate the need for biannual review and update of these guidelines.

Worth repeating...

Don't confuse Rituxan Hycela with Rituxan

ISMP and the US Food and Drug Administration (FDA) are aware of multiple cases where **RITUXAN HYCELA** (ri**TUX**imab and hyaluronidase), a subcutaneous-only form of **RITUXAN** (ri**TUX**imab), was given intravenously (IV). Fortunately, none of the patients involved in the reported errors have experienced serious reactions.

When drugs are given by subcutaneous injection, volumes are normally limited to 1-2 mL. However, the volume of subcutaneous Rituxan Hycela is unusual—11.7 mL or 13.4 mL provided by pharmacy in a 20 mL syringe. In October 2017 we theorized that some practitioners may think that this volume of drug should be administered IV, and now wrong route errors are being reported.

continued on page 3—*Worth* repeating >

> Neuromuscular blocker event—continued from page 2

her relax. She reconstituted the medication with 10 mL of 0.9% sodium chloride from the flush syringe and drew the reconstituted medication back into the flush syringe. During reconstitution, the nurse did not notice (or misunderstood) a warning on the red vecuronium vial ferrule that said, "**WARNING: PARALYZING AGENT**," which has been previously overlooked or misunderstood with other neuromuscular blocker errors.

The help-all nurse administered an unknown quantity of IV vecuronium to the patient, believing it was Versed, and used the second 0.9% sodium chloride syringe to flush the patient's IV line. The nurse thought she administered 1 mL (1 mg) of the drug; however, the empty vecuronium vial and the two flush syringes, both labeled 0.9% sodium chloride, were later brought back to the NCU to witness the wasting of what was thought to be Versed. One syringe had 8 mL remaining in it, and the other had 1.5 mL remaining. There was no way to determine which syringe contained the reconstituted vecuronium or how much drug the patient actually received.

The help-all nurse left the patient in the radiology holding room and went to the ED to conduct the swallowing test. She did not monitor the patient's reaction to the medication, take vital signs, observe the patient for respiratory sufficiency, or determine if the patient needed an additional dose of what was thought to be Versed. Moderate sedation agents, including Versed, were not on the hospital's list of high-alert medications. Although policies on conscious and moderate sedation were in place, the hospital's drug administration policy did not specify the manner and frequency of physical assessment and monitoring of patients during and after drug administration. A radiology technician periodically observed the patient in the holding room via a camera. Because the patient's eyes were closed, the technician assumed the patient was relaxing or bothered by the lights in the room. The camera was not sharp enough to visualize that the patient's chest was not rising and falling. About 25 to 30 minutes after the vecuronium was administered in error, a transporter noticed that the patient was unresponsive. The patient was found pulseless and breathless, and a rapid response team/code blue was called. The patient was intubated and eventually regained spontaneous circulation.

The help-all nurse responded to radiology when the rapid response team was called and transferred the patient back to the NCU after resuscitation. She told the patient's physicians that she had administered IV Versed to the patient about 30 minutes before the code was called. She also handed the bag containing the empty vial and syringes with leftover drug to the patient's primary nurse to document the waste. The primary nurse noticed the error, which was reported to the patient's physicians and disclosed to the patient's family.

After a few hours in the NCU, the patient began displaying myoclonic jerks and posturing consistent with anoxic brain injury. Computed tomography (CT) of the head showed some increase in swelling but the area of bleed had not worsened. It was suspected that the medication error, not worsening hemorrhage, was responsible for the patient's arrest and subsequent anoxic brain injury. By the next day, the patient's neurological sequelae had worsened, and the patient died after life support was withdrawn.

Safe Practice Recommendations: This fatal error involved accidental administration of a neuromuscular blocker to an unventilated patient by a practitioner who thought she was administering a different drug—an all-too-common scenario with errors involving neuromuscular blockers. We urge healthcare providers, ADC vendors, drug manufacturers, and regulatory/standards-setting agencies to implement the following recommendations, as applicable, many of which address the causal factors in this tragic event. Most of the recommended strategies can help reduce the risk of an error when removing certain facility-designated medications from an ADC, including via override. Many of these recommendations are summarized in **Table 1** (page 1). For additional strategies critical to the safe prescribing, storage, selection, preparation, and administration of neuromuscular blockers, please refer to our June 16, 2016 newsletter article, *Paralyzed by mistakes—Reassess the safety of neuromuscular blockers in your facility* (www.ismp.org/node/247).

continued on page 4—Neuromuscular blocker event >

> Worth repeating cont'd from page 2

The advantage of the subcutaneous form of riTUXimab is that it can be administered in minutes instead of the hours needed with an IV infusion of Rituxan. The hyaluronidase component helps increase the dispersion and absorption of riTUXimab when administered subcutaneously, allowing larger volumes to be absorbed more quickly. It is more convenient and reduces chair time for oncology patients. Giving subcutaneous injections of chemotherapy at an outpatient infusion center is relatively uncommon compared to IV push doses or infusions, so the risk of mix-ups is increased, especially when the product is first utilized. More of these types of formulations (larger volumes to be given subcutaneously) will be coming to market because they can be given over just a few minutes, so patients don't have to spend hours at a clinic or infusion center. Also, because of name similarities, it is not surprising that mix-ups and confusion occurs with these products.

Rituxan Hycela is not intended for initial therapy. The IV form of Rituxan must be administered as the first treatment dose. If the first full IV dose of Rituxan was tolerated without severe reaction, subcutaneous Rituxan Hycela can be given as subsequent treatment. Rituxan Hycela should be injected into the subcutaneous tissue of the abdomen over approximately 5 to 7 minutes, and never injected into areas where the skin is red, bruised, tender, hard, or covered with moles or scars. No data are available on injection at other sites of the body.

If both formulations are available on your formulary, make sure oncologists and nurses who may administer either form are educated about the possibility of administering the drug by the wrong route. Also educate nurses regarding the recommended procedure for administering the large subcutaneous dose of Rituxan Hycela. Store these products in a way that will clearly indicate that they are different formulations, and use barcode scanning to verify storage and administration. Be sure that the syringe includes a prominent auxiliary warning that states, "**Administer subcutaneously in the abdomen.**"

> Neuromuscular blocker event—continued from page 3

Recommendations for Healthcare Providers

Plan for sedation. Establish a standard process for patients who require sedation prior to radiology procedures due to claustrophobia, that starts with an *oral* anxiolytic (e.g., **LOR**azepam) as the medication of choice, when appropriate, and includes patient monitoring requirements during and after drug administration.

Include IV moderate sedation agents on high-alert medication lists. Include medications commonly used for moderate sedation (e.g., IV midazolam) on the hospital's list of high-alert medications and implement risk-reduction strategies to prevent errors and patient harm with these medications. For example, administration of IV medications commonly used for moderate sedation should require specific patient monitoring, regardless of the setting in which the sedation occurs or its intended use (e.g., anxiety vs. moderate sedation).

Store neuromuscular blockers safely. Eliminate the storage of neuromuscular blockers in areas where they are not routinely needed. In patient care areas outside perioperative settings where they are needed (e.g., critical care, ED), provide neuromuscular blockers in a sealed box or rapid sequence intubation (RSI) kit. For ADCs in areas not authorized to stock neuromuscular blockers, enable the ADC block load feature, if available, to prevent users from inappropriately stocking the cabinet with these high-alert medications. If vials must be stored in ADCs, keep them in locked-lidded pockets.

Affix warnings. Place auxiliary labels on all storage locations and/or ADC pockets/drawers/lids that contain neuromuscular blockers that clearly warn that respiratory paralysis will occur, and ventilation is required (e.g., "**WARNING: CAUSES RESPIRATORY ARREST—PATIENT MUST BE VENTILATED**"). The warning should be visible when ADC pockets/drawers/lids are open. As an alternative (or in addition) to labeling storage bins and/or ADC pockets/drawers/lids, affix an auxiliary warning label directly on all vials and other containers. Be aware that the use of a shrink wrap sleeve (**Figure 1**) for this purpose on different neuromuscular blockers can make them look similar and contribute to mix-ups. Limiting the variety of neuromuscular blockers available in ADCs can help reduce similar appearance.

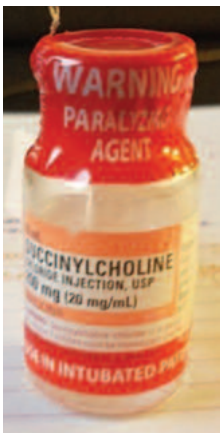

Figure 1. Shrink wrap sleeve on a neuromuscular blocker.

Build interactive warnings. Display an interactive warning (e.g., "**Patient must be intubated to receive this medication**") on ADC screens that interrupts all attempts to remove a neuromuscular blocker via a patient's profile or on override. The warning should require the user to enter or select the purpose of the medication removal ("other" should not be a choice) and verify that the patient is (or will be) manually or mechanically ventilated. This type of warning provides an opportunity to specify why the user is being interrupted and requires the user to document a response. However, it may not be possible to block access to the medication based on the response. In most ADC systems, this type of warning is configurable by medication, and in some systems, by cabinet.

Clarify override policies. Review the hospital's ADC override policy to confirm its permitted use is limited to emergency or urgent situations when a patient would be significantly compromised by the delay that would result from pharmacy review (or if a licensed independent practitioner controls the medication use process). Be sure the policy clearly communicates the hospital's overall expectation of very limited overrides for urgent and emergent situations that are defined (e.g., antidotes, rescue agents, reversal agents, lifesaving medications, comfort care medications for acute pain and intractable vomiting), along with an explanation of the safety risks of removing and administering a medication via override before pharmacy verifies the order.

continued on page 5—Neuromuscular blocker event >

SAFETY briefs

Flavoring should not be part of a drug name. A patient's medication history listed "**SAPHRIS** (asenapine) black cherry" as one of his medications. Fortunately, the patient was interviewed before Saphris was dispensed and administered, and he denied taking Saphris, an atypical antipsychotic, at home. However, he mentioned that he takes black cherry tablets as an herbal supplement. In researching the issue, it was discovered that a nurse had entered Saphris into the medication history on a previous admission. The product is available in 2.5, 5, and 10 mg tablets, all with a black cherry flavor. Cerner Multum, which the hospital uses, lists the product description as "Saphris black cherry." But when searching for "black cherry" (meaning the herbal supplement), Saphris black cherry tablets appeared as an option. The nurse selected this when documenting the patient's medication history without realizing it was a drug, not a supplement. There was no other option for a black cherry supplement, so it's easy to understand how the error occurred. Of note, when entering the generic name for Saphris, asenapine, no wording relating to the black cherry flavoring appears.

Including the tablet flavoring in the drug description can increase the risk of selecting the wrong product since the flavoring is not part of the official product name. ISMP has contacted Cerner Multum to recommend removing the flavoring agent from the drug description. You may want to test your drug database to see if a similar problem exists.

Doggone veterinary product dispensing error. ISMP occasionally publishes reports of veterinary medication errors. Not only are many of our readers pet owners interested in animal safety issues, but pharmacists and community pharmacies are increasingly making veterinary medicine a specialty, dispensing both veterinary and human products. Under the Animal Medicinal Drug Use Clarification Act (AMDUCA) of 1994, the US Food and Drug Administration (FDA) recognizes the professional judgement of veterinarians and permits *extra label drug use*, or the use of an approved drug that is not in accordance with the approved labeling, including use in another species; at a different dose, route, or frequency; or for a different indication.

continued on page 5 —SAFETY briefs >

> Neuromuscular blocker event—continued from page 4

Avoid unjustifiable overrides. Overrides should be limited to a handful of medications and can be configured by medication, user, and cabinet. Many high-alert medications should not be on an override list. However, neuromuscular blockers may be needed via override for emergency intubation. Nevertheless, if neuromuscular blockers are on a list of overridable medications, each override should be situation dependent and justifiable, and not based alone on its availability on a list of overridable medications.

Require a witness upon removal of certain medications on override. Provide an automated prompt and require documentation of an independent double check with another practitioner at the ADC when removing specific facility-defined medications via override. The second practitioner should verify the correct patient, medication, strength, route, and indication (against the electronic order when available). "Witness on dispense" by cabinet and by drug is an available prompt with some ADC systems that also allows documentation of the verification process.

Implement barcode scanning verification in all areas. Prior to administration, verify each medication via barcode medication administration (BCMA) to ensure accuracy.

Require patient monitoring. Patients who receive sedation for procedures (e.g., IV midazolam) require some level of monitoring, regardless of the indication. Hospital procedures should specify required monitoring, including use of pulse oximetry and other means of evaluating the adequacy of ventilation, along with criteria for when monitoring can be stopped. Monitoring requirements should be approved by the anesthesia department to standardize the care of patients who receive IV sedation and provide oversight.

Avoid reconstitution using flush syringes. Do not dilute or reconstitute medications by drawing up the contents into a commercially available, prefilled 0.9% sodium chloride flush syringe. This results in the syringe, now containing medication, being mislabeled as 0.9% sodium chloride. Also, these syringes have not been approved by the US Food and Drug Administration (FDA) for reconstitution, dilution, and/or subsequent administration of IV push medications.

Distraction-free ADC drug removal. Avoid distractions and talking at the ADC while searching for and removing medications.

Educate staff. Teach practitioners to access and remove medications in profile mode whenever possible, as it directs them to a patient-specific medication profile and limits their access to medications that were verified by a pharmacist. Be sure practitioners understand the safety risks with obtaining medications via override and required safeguards for drugs removed via override. Also teach practitioners how to toggle between brand and generic name search functions if they are separate, and to verify the drug search criteria if initially unable to find the desired medication, rather than triggering an override. Be sure practitioners who administer procedural sedation (e.g., IV midazolam) are familiar with patient monitoring parameters.

Monitor overrides. Monitor ADC overrides daily to verify appropriateness, transcription of orders, and documentation of administration. Any overrides that are not appropriate or do not have corresponding medication orders require follow up. Also review aggregate override usage reports monthly, trending by medication, user, and location, to assess appropriateness, determine how well the hospital is managing overrides, and address barriers to the pharmacists' review of medication orders prior to drug removal.

Recommendations for ADC Vendors

Increase number of drug name letters required when searching. Current ADC systems allow users to enter just one letter (e.g., Omnicell XT, AcuDose-Rx) or two

continued on page 6—Neuromuscular blocker event >

> SAFETY briefs cont'd from page 4

We recently received a report about an error in which **HYDRO**codone and acetaminophen 5 mg/325 mg (**NORCO**) was dispensed for a dog instead of **HYDRO**codone 5 mg. The veterinarian had prescribed **HYDRO**codone 5 mg without realizing that the medication is only available in this strength in combination with other products such as acetaminophen, ibuprofen, or homatropine methylbromide. **HYDRO**codone as a singular product is available in an extended-release formulation (**ZOHYDRO ER** and **HYSINGLA ER**) at higher strength capsules or tablets starting at 10 mg, which cannot be opened or cut. Thus, the pharmacist assumed that the prescriber was using a shortened name for the combination product with acetaminophen. However, acetaminophen is often avoided in dogs due to the increased risk of toxicity.

Dogs typically experience acetaminophen toxicity when doses exceed 75 mg/kg of body weight, which can lead to serious adverse outcomes such as permanent liver damage (Almgren CM. Acetaminophen [Tylenol] poisoning alert for dogs and cats. VCA Hospitals; www.ismp.org/ext/98). Symptoms of acetaminophen toxicity in dogs include: brownish-gray colored gums; labored breathing; swollen face, neck, or limbs; hypothermia; vomiting; jaundice; and even coma. Dogs are not the only pets affected by acetaminophen. Cats are 7 to 10 times more susceptible to acetaminophen toxicity than dogs (Richardson JA. Management of acetaminophen and ibuprofen toxicoses in dogs and cats. *J Vet Emerg Crit Care*. 2000;10:285-91). Therefore, acetaminophen should never be given to cats, even at low doses.

Pharmacies that dispense human drugs to veterinary patients should contact the prescribing veterinarian if there are questions about a prescription, without making assumptions regarding what the veterinarian intended if the prescription does not make sense or is not available (e.g., **HYDRO**codone 5 mg). For more information on veterinary medication error prevention and analysis, see the FDA Center for Veterinary Medicine (CVM) webpage (www.ismp.org/ext/94). If you think that your pet may have ingested a potentially poisonous substance, visit the American Society for the Prevention of Cruelty to Animals (ASPCA) Poison Control webpage (www.ismp.org/ext/95) or call (888) 426-4435 or your veterinarian.

> Neuromuscular blocker event—continued from page 5

letters (e.g., Pyxis) of a drug name before populating a list of potential choices. Older software versions may require entry of more letters, but more recent changes were made to require fewer letters, sometimes to accommodate international language requirements. While efficiency is important, and spelling errors are a concern, safety may be jeopardized by allowing fewer than 5 letters of a drug name to populate the search results. (See item #19 in the ***ISMP Guidelines for Safe Electronic Communication of Medication Information***, which begins on **page 7**.) It is recommended that vendors review potential software changes to allow a configurable option for the required number of letters to narrow the choices, ideally to one drug or drug category. (BD/Pyxis has agreed to consider this revision, although the search would likely not require a set number of letters to be typed, but instead be dynamic, allowing only the necessary letters to be typed to isolate a single medication). As an alternative, vendors could require a minimum of the first 5 letters of a drug name before populating search fields (Omnicell has agreed to consider this revision for Omnicell XT and AcuDose-Rx).

Alert users to generic/brand name searches. Some newer ADC systems allow both brand and generic drug names to be displayed and searched. Earlier versions may allow only one or the other. Vendors should enable simultaneous searching by both brand and generic drug name. If brand and generic search capabilities are separate, the ADC screen should clearly display to the user which type of search is currently being conducted (generic or brand) and make it easy to toggle between the two functionalities.

Recommendation for Manufacturers and Regulatory/Standards-Setting Agencies

Labeling changes. ISMP has discussed with FDA the need for overall improvements to neuromuscular blocker container labeling. While the caps and vial ferrules note, "**WARNING: Paralyzing Agent**," it's clear that these warnings have not been effective consistently and may go unheeded, misunderstood, or missed altogether.

As a result, between March and November 2018, FDA requested manufacturers of neuromuscular blockers to revise the carton, container, and prescribing information to further promote safe use. These recommendations were partly influenced by publication of our June 16, 2016 newsletter article, *Paralyzed by mistakes—Reassess the safety of neuromuscular blockers in your facility.* Specifically, FDA asked manufacturers to add the statement, "**WARNING: Paralyzing Agent**" in red, bold font to the principal display panel on the carton and container label, directly below the strength. They also asked manufacturers to add a statement to the side panel in red, bold font: "**WARNING: Paralyzing Agent. Causes Respiratory Arrest. Facilities must be immediately available for artificial respiration.**" Warnings about inadvertent administration to patients for whom the drug was not intended, and the catastrophic outcomes, were also requested in the prescribing information under the WARNINGS section, and a recommendation to store neuromuscular blocker vials with the cap and ferrule intact (which carries a warning) to help prevent errors was also requested in the DOSAGE AND ADMINISTRATION section. Look for these labeling changes soon.

ISMP greatly appreciates the cooperation of BD/Pyxis and Omnicell for providing us with information about available cabinet configurations that could be utilized and may be considered in the future to prevent product selection errors. Also, look for an announcement in February about our newly updated* ***ISMP Guidelines for Safe Use of Automated Dispensing Cabinets**!*

Special Announcements

Become an ISMP fellow

ISMP fellowships can help you grow in your career and make major contributions to medication safety worldwide. ISMP is now accepting applications for three unique programs that begin this summer/fall—the **ISMP Safe Medication Management Fellowship**, **ISMP International Medication Safety Management Fellowship**, and the **FDA/ISMP Safe Medication Management Fellowship**. The deadline for applications is **March 31, 2019**. For more information, including program descriptions and the application, visit: www.ismp.org/node/871.

Please consider donating $25 or more for ISMP's 25th Anniversary

In 2019, ISMP is celebrating **25 years** of leading the way in medication safety. Many have benefited from shared reports of medication errors, free error prevention resources, and advocacy for safer packaging and labeling—and there is more to come. Please help us ensure a safer future for all patients by making a donation of $25 or more to honor this milestone anniversary. For information and to contribute, visit: www.ismp.org/node/1242.

Get intensive about medication safety

The **Medication Safety Intensive (MSI)** Workshops sold out quickly last year! Act now to avoid being put on the waiting list in 2019; you won't want to miss this unique opportunity to maximize your error prevention efforts and learn to look at your organization through the eyes of leading safety experts and regulatory agencies. For information and to register, visit: www.ismp.org/node/127.

2019 MSI Dates

- **April 25-26**—Houston, TX
- **September 12-13**—Orlando, FL
- **December 6-7**—Las Vegas, NV

ISMP Medication *Safety Alert!* Acute Care (ISSN 1550-6312)

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ISMP Guidelines for Safe Electronic Communication of Medication Information

Safe Presentation of Drug Names

1. When expressing a generic drug name, use all lowercase letters (unless using tall man letters as mentioned in item #5) as the primary expression of drug nomenclature, ensuring that each matches the US Food and Drug Administration (FDA)-approved nomenclature so that electronic medication records agree with all carton and container labels.

2. When expressing a generic drug name, do not include the salt of the chemical unless there are multiple salts available (e.g., hydr**OXY**zine HCl and hydr**OXY**zine pamoate) or the salt alters the drug release (e.g., flu**PHENAZ**ine HCl and flu**PHENAZ**ine decanoate) and thus conveys meaningful information. If the salt is used as part of the name, display the full name of the salt unless an abbreviation has been approved by USP (i.e., K [potassium], Na [sodium], HBr [hydrobromide], and HCl [hydrochloride]). The salt should follow the drug name.

   Comment: The symbols Na and K are intended for use in abbreviating the names of the salts of organic acids, but these symbols should not be used when the word sodium or potassium appears at the beginning of an official drug name (e.g., Na bicarbonate is not acceptable because it may be misread as "no bicarbonate").

3. When expressing a brand drug name, use an uppercase first letter. Trademark symbols (e.g., TM, ®) should not be used.

   Comment: Although the use of all uppercase letters is a standard convention for trademarks, mixed case and lowercase letters are more unique and distinguishable than all block-like uppercase letters, which look similar and are more difficult to read, especially in low lighting.[1] Also, using all uppercase letters to express brand names does not allow for the use of tall man letters when indicated, as mentioned in item #5.

4. Include the word "Mix" and any numerical values that are part of the brand name for fixed combination insulin products (e.g., Novo**LOG** Mix 70/30) together on the same line on all computer screens, medication administration records (MARs), and other electronic forms of communication.

5. Use **bolded**, UPPERCASE tall man letters (e.g., vin**CRIS**tine, vin**BLAS**tine) for specific groups of dissimilar letters in look-alike drug name pairs or trios to visually differentiate them on electronic screens. This helps minimize the risk of selecting the wrong product, particularly when medication names appear alphabetically in drop-down menus and search results. To promote standardization of the letters presented in UPPERCASE and **bold** font, follow the recommendations on the ***FDA and ISMP Lists of Look-Alike Drug Names with Recommended Tall Man Letters*** (www.ismp.org/ext/78).

   Comment: FDA encourages manufacturers to visually differentiate specific look-alike drug names identified with its Name Differentiation Project (www.ismp.org/ext/77) using the recommended tall man letters on all packaging and labeling materials.

6. For drug names ending with the letter "l," capitalize the "L" (e.g., propranololL 20 mg) to avoid confusion with the numeral 1 in the dose that follows the drug name. See item #27 for a recommendation to provide adequate space between the drug name and dose.

   Comment: A lowercase letter "l" at the end of a drug name has been confused as the numeral "1" and mistaken as part of the dose, particularly if adequate space has not been provided between the drug name and dose (e.g., propranolol20 mg has been mistaken as propranolol 120 mg). Always leave a space between the end of the drug name, the dose or strength, and the unit designation (e.g., mg).

continued on page 8 — **Guidelines**

continued from page 7 — **Guidelines**

7. Avoid the use of superscripts and subscripts with drug names unless they are a necessary part of the drug name (e.g., vitamin K_1). When superscripts or subscripts are necessary, the letter or number should be expressed above or below the line, not on the line (e.g., K_1 not K1, which could be misunderstood as potassium iodide).

8. Express suffixes (e.g., SR, CD, CR) that are part of the brand name (e.g., Cardizem CD, Cartia XT) within the drug description field. When expressing modified-release formulations of generic medications, use terms that accurately and unambiguously convey the release formulation (e.g., 12-hour extended-release, 24-hour extended-release).

   *Comment: When expressing an extended-release formulation of a generic medication that does not share the same pharmacokinetics with similar medications with which it may be confused (e.g., three types of 24-hour extended-release formulations of dil**TIAZ**em that are not AB rated), include the corresponding brand name.*

9. When possible, avoid expressing a drug name in a manner that incorporates a number (e.g., 5-fluorouracil, 6-mercaptopurine), as these numbers have been confused with the dose or number of tablets/capsules to be administered. Express the drug name without the number if it is not needed or is not part of the official drug name (e.g., fluorouracil, mercaptopurine).

10. Do not abbreviate drug names or refer to them by shortened names. Exceptions may be made for multi-ingredient drug formulations, especially vitamins, when there are drug name field space constraints; however, drug abbreviations should **NOT** be used for any medications on the ***ISMP List of High-Alert Medications*** (in Acute Care Settings [www.ismp.org/node/103], Community/Ambulatory Settings [www.ismp.org/node/129], and Long-Term Care Settings [www.ismp.org/node/130]).

    *Comment: Drug name abbreviations and shortened names have frequently been misunderstood, sometimes leading to harmful or fatal medication errors. For example, MTX for methotrexate has been misunderstood as mito**XANTRONE**; MSO_4 for morphine sulfate has been misinterpreted as magnesium sulfate; and "nitro drip" has been misinterpreted as either nitroglycerin or nitroprusside infusions.*

11. Avoid using drug regimen or protocol acronyms without defining the regimen or protocol at least once within the order set or other form of electronic communication. Avoid the use of all acronyms that may have a dual meaning or may be confused with other common acronyms (e.g., TAC may mean Taxotere, Adriamycin, and cyclophosphamide; or tetracaine, Adrenalin, and cocaine).

    *Comment: A drug regimen or protocol acronym that also represents a common medical term can be confused, even if defined in an order set. For example, AC could mean Adriamycin and Cytoxan, or before food/meals (ante cibum); CVP could mean central venous pressure or cyclophosphamide, vin**CRIS**tine, and predni**SONE**.*

12. Do not use slang or outdated terminology when referring to medications or solutions (e.g., referring to a saline lock as a heparin lock).

Safe Presentation of Doses, Dosing Units, Weights, Measures, and Directions

13. Use standard terminology and safe expressions that are clear of ambiguity when expressing doses, dosing units, weights, measures, and directions for use. Avoid the use of known error-prone abbreviations, symbols, and dose designations, including those on the organization's "Do Not Use" list and the ***ISMP List of Error-Prone Abbreviations, Symbols, and Dose Designations*** (www.ismp.org/node/8). Examples most relevant to electronic communication of medication information include the following:

    a. Do not use trailing zeros at the end of a dose for medications/solutions (e.g., 5 mg, never 5.0 mg).

    b. Use leading zeros for doses less than one measurement unit (e.g., 0.3 mg, never .3 mg).

    c. Spell out the word "units." Never use the abbreviation U, which easily can be mistaken as a zero, causing a 10-fold overdose. Never abbreviate international units as IU; this measure, which has been misread as IV (intravenous), can be expressed as "units" alone.

continued on page 9— **Guidelines**

continued from page 8 — **Guidelines**

d. Do not use the abbreviations M or MM for "million" and K or M for "thousand" when expressing doses.

Comment: These abbreviations may not be understood or may be misinterpreted. For example, M has been used to abbreviate both "million" and "thousand" because "million" begins with the letter M, and M is also the Roman numeral for "thousand."

e. Include properly spaced commas for dose numbers expressed in thousands or millions (e.g., use 500,000 units, never 500000 units).

*Comment: Use commas to separate digits expressing doses in thousands or millions **only** in the US. Commas sometimes are used in place of decimal points in other countries.*

f. Express weights and measures in a standard fashion using USP standard abbreviations for dosage units as follows:

- cm = centimeter(s)
- m (lowercase) = meter(s)
- kg = kilogram(s)
- g = gram(s)
- mg = milligram(s) (do not use mgs)
- mcg = microgram(s) (do not use the Greek letter mu [μ], which has been misread as mg)
- L (uppercase) = liter(s)
- mL (lowercase/uppercase) = milliliter(s) (do not use cc, ml, mLs, or mls)
- mEq = milliequivalent(s)
- mmol = millimole(s)
- nanog = nanogram(s)

Comment: The abbreviation nanog for nanogram, which is not a standard USP abbreviation, can be used when expressing certain medication doses in electronic devices such as smart infusion pumps (e.g., nanog/kg/min), if space limitations prohibit full expression of the dosing unit (e.g., nanogram/kg/min). If ng is used as an abbreviation, it can be misinterpreted as mg.

g. Do not include a period after dosage unit abbreviations (e.g., use mg, never mg.).

h. Do not use apothecary system designations or symbols (e.g., grains, drams, minims, ounces), or household measurements (e.g., teaspoons, tablespoons).

Comment: Explicit apothecary or household measurements may be used to express the directions for mixing dry ingredients to prepare topical products (e.g., dissolve 2 capfuls of granules per gallon of warm water to prepare a magnesium sulfate soaking aid).

i. Use only Arabic numerals to express doses; never use Roman numerals (e.g., use 5, never V).

j. Do not use IN as an abbreviation for intranasal (it may be confused with IV [intravenous] or IM [intramuscular]); write out the word "intranasal" or use "NAS."

k. Do not use IT as an abbreviation for intrathecal (it may be confused with other routes, intratracheal, intratumor, inhalation therapy, intratympanic); write out the word "intrathecal."

l. Do not use the abbreviations o.d., OD, q.d., QD, or q1d for daily; write out the word "daily."

m. Do not use the abbreviations q.o.d. or QOD for every other day; write out "every other day."

n. Do not use the abbreviation "d" for "day" or "dose" with parameter-based dosing formulas (e.g., mg/kg/d), which could be interpreted as either "day" or "dose" (e.g., mg/kg/day or mg/kg/dose); write out "day" or "dose."

o. Do not use the abbreviations AD, AS, AU, OD, OS, and OU, to direct into which ear(s) or eye(s) to instill a medication; write out the directions clearly (e.g., left ear, right eye, both eyes).

continued on page 10 — **Guidelines**

continued from page 9 — **Guidelines**

p. Do not use the abbreviation UD (intended to mean as directed).

q. Do not use the abbreviation SS (intended to mean single strength, half, signs and symptoms, or sliding scale).

r. Do not use the abbreviations sq or sub q for subcutaneous or subcutaneously; use "SUBQ" (all UPPERCASE letters) or write out the word "subcutaneous."

s. Do not use > or < signs; spell out the intended terms "more than" or "less than."

t. Express doses that cross a threshold from one dosing unit of measure to the next possible dosing unit of measure (e.g., mcg to mg, mg to g) the same way the dose or concentration/strength is expressed on the product label, without using unnecessary zeros (e.g., 1 g preferred over 1,000 mg, unless this differs from the product label). For specific drugs, once a threshold is crossed (e.g., mcg to mg, mg to g), continue using that dosing unit of measure for each subsequent dose (e.g., vancomycin 750 mg, 1 g, 1.25 g, 1.5 g; **not** 750 mg, 1 g, 1,250 mg, 1,500 mg).

u. Do not express the strength of single-entity injectable drug products as a ratio (e.g., **EPINEPH**rine 1:10,000, neostigmine 1:1,000). Instead, express the strength in terms of quantity per mL (e.g., **EPINEPH**rine 0.1 mg/mL, neostigmine 1 mg/mL). Exception: local anesthetics (e.g., lidocaine 1% and **EPINEPH**rine 1:100,000).

See item #29 for a recommendation to provide adequate space in corresponding fields so these recommendations can be followed.

14 Do not use outdated or potentially confusing medical jargon when describing the route or directions for use (e.g., use PO for clinicians or oral for consumers instead of per os).

15 For acceptable route abbreviations, use all uppercase letters—IV, IM, SUBQ, PO, and NAS, without spaces or periods between the letters.

16 For acceptable frequency abbreviations, use all uppercase letters—BID, TID, QID, and HS, without spaces or periods between the letters. For frequencies according to a specific time, use "q" for "every," "h" for "hour(s)," and "min" for "minute(s)." Display time-specific frequencies without spaces or periods between the abbreviations and the time, and use Arabic numerals only (e.g., q4h, q5min).

17 Use explicit words when communicating medication doses to be administered just once (e.g., warfarin 5 mg PO for 1 dose, rather than "x 1") or for a set number of doses (e.g., ce**FAZ**olin 1 g IV q6h for 3 doses, rather than "x 3").

18 Use one consistent way of expressing half tablets and doses greater than 1 dosage unit that are half way between two whole numbers. When expressing half tablets, text (e.g., half tablet) or reduced font-size fractions (e.g., ½ tablet) are preferred over typical font-size numerals with slash marks (e.g., 1/2 tablet). When expressing doses greater than 1 dosage unit that are half way between two whole numbers, reduced font-size fractions (e.g., 2 ½ mg, 7 ½ mg) are preferred over decimal points (e.g., 2.5 mg, 7.5 mg) when practical.

Safe Presentation of Product Selection Menus and Search Choices

19 If mnemonics or short names are permitted to search for products or populate fields without entering the full drug name, require entry of a minimum of the first 5 letters of the drug name.

*Comment: The use of mnemonics or short names that employ the first two, three, or four letters of the drug name (e.g., "met"), skipped character abbreviations (e.g., "ctx"), or a combination of the first few letters and dose (e.g., "meth10") has led to presentation of similar looking drug names on the screen, which has resulted in selection errors or population of a field with an unintended drug. For example, entering "met" has led to confusion between methylphenidate, methadone, met**OL**azone, methotrexate, met**FORMIN**, and metro**NIDAZOLE**; entering "cis" has resulted in populating the drug name field with cisatracurium when **CIS**platin was intended; entering "ato" has led to confusion between atorvastatin and atomoxetine; entering "ctx" has led to selection of cyclophosphamide (Cytoxan) instead of cef**TRIAX**one; and entering "meth10" has led to confusion between methadone 10 mg and methylphenidate 10 mg.*

continued on page 11 — **Guidelines**

continued from page 10 — **Guidelines**

20 When the drug name, dose/strength, and dosage form appear together on product selection menus and search choices, list the generic and/or brand name first, followed by the strength and the dosage form (e.g., timolol [or Timoptic *if brand to be dispensed*] 0.5% ophthalmic solution; diaze**PAM** 5 mg tablet). For modified-release formulations of medications, list the terms that convey the release formulation after the product name (e.g., dil**TIAZ**em 24-hour extended release [Taztia XT] 180 mg capsule). Also see item #23.

21 When the drug description field allows for both brand and generic names on product selection menus and search choices, display the brand name of a generic product, and/or the generic name of a brand product, to aid in recognition of the correct drug, particularly for combination products, drugs with look-alike names, vaccines, and other medications with names that might otherwise be confused. The brand or generic product intended to be prescribed should be listed first, and the reference drug name provided for clarification should appear in parentheses after the intended product. The intended e-prescribing drug name and the reference drug name in parentheses should be sourced from compendia in a standardized format.

22 During drug selection searches, present possible choices alphabetically, listing medications with multiple strengths from the lowest to highest strength.

Comment: Be sure electronic systems do not list doses numerically by the first digit only (e.g., never 1 mg, 10 mg, 2 mg, 20 mg, 3 mg, 30 mg; always 1 mg, 2 mg, 3 mg, 10 mg, 20 mg, 30 mg).

Safe Presentation of Complete Medication Orders or Prescriptions

23 For electronic displays during order/prescription review, on MARs, and on inpatient product labels printed from electronic systems:

When the drug name, dose/strength, and dosage form appear together, list the generic and/or brand name first, followed by the dose, strength (if different than the dose), and the dosage form (e.g., timolol [or Timoptic *if brand to be dispensed*] 0.5% ophthalmic solution; diaze**PAM** 5 mg tablet). For modified-release formulations of medications, list the terms that convey the release formulation after the product name (e.g., dil**TIAZ**em 24-hour extended release [Taztia XT] 180 mg capsule). Also see item #20.

24 Present electronic orders as prechecked (automatically initiated without selecting) ONLY if they are appropriate or needed for at least 95% of patients and would not potentially harm the other 5% of patients (e.g., prechecked orders for a hypoglycemia protocol for patients being prescribed insulin, prechecked orders for naloxone for patients being prescribed opioids).

25 On MARs, include the name(s) of the drug and the patient-specific dose (not just the strength dispensed) on the same line/entry. Avoid situations, including automatic wraparound of entries, that result in listing the name of the drug and available dosage strength on the first line, and the patient-specific dose on the next line.

26 On MARs or other medication lists, do not include the strength (e.g., U-100, U-200, U-300) immediately after the name of the insulin (e.g., Humu**LIN** R U-100), except for regular insulin U-500 (Humu**LIN** R U-500). For all strengths other than U-500 insulin, list the dose after the insulin name, and the strength after the dose (e.g., Humu**LIN** R 20 units [U-100]). For U-500 insulin, include the strength before the dose (e.g., Humu**LIN** R U-500 60 units).

27 When the drug name, strength/dose, and the unit of measure appear together, require a space between the drug name and strength/dose, and between the dose and unit of measure to avoid misinterpretation (e.g., 10Units has been misread as 100 units).

Electronic System Design Features: Medication Information

28 When expressing electronic text, use easy-to-read, larger size fonts (e.g., 11- to 12-point font) that are not densely compressed and are without embellishments.[1,2]

Comment: Fonts designed specifically for the screen are preferred. Familiar sans serif fonts without embellishments are superior for body text, and serif fonts are best used for headings and small print. However, serifs are less important

continued on page 12 — **Guidelines**

continued from page 11 — **Guidelines**

if the font style is not extreme or unusual.

29 Provide adequate space for items in databases and data fields used to communicate drug names, dosing units, routes of administration, and frequencies. Two- or three-character fields force the use of potentially dangerous abbreviations.

30 If numbers are needed to sequence inpatient medication orders, provide adequate space between the numbers and the drug name to prevent misinterpretation of the number as the medication dose. (Each outpatient medication prescription should be transmitted separately.)

31 Automatically round weight-based doses greater than 10 dosing units (e.g., 10 mg, 10 mcg, 10 g) to the nearest whole number or dosing unit (e.g., 12.59 mg rounded to 13 mg). Assure that automatic rounding of the dose to the nearest whole number never results in a dose that is greater than or less than 10% of the originally prescribed dose.

32 For weight-based/body surface area-based medication orders for pediatric, oncology, elderly, and obese patients, include a required field for the mg/kg dose (or mg/kg/hour, mcg/kg/min, mg/m^2, or similar parameter-based dosing formula), and a field for the total dose, which should be calculated (and often rounded and/or standardized) automatically by the electronic system. See item #13(n) for a recommendation to avoid the use of "d" in dosing formulas (e.g., mg/kg/d), which could be interpreted as either "day" or "dose."

33 Provide a field to enter the purpose/indication for all medications prescribed electronically. Require entry of the purpose for the following types of medication orders: all PRN (as needed) medications; look-alike drug name products that are known to be problematic (few look-alike name pairs are used for the same purpose); and high-alert medications that have different dosing based on the indication (e.g., vasopressin may be used to treat diabetes insipidus or gastroesophageal variceal hemorrhage).

Comment: Communicating the drug's indication reduces the risk of improper drug selection and offers clues to proper dosing when a medication has an indication-specific dosing algorithm.[3]

34 Require entry of the minimum components of a complete medication order or prescription (e.g., drug name, metric dose/strength, frequency, route, indication as required [see item #33]). Specific examples follow:

a. Do not allow doses prescribed only by volume, number of tablets, or number of vials/ampuls (examples of exceptions include combination liquid medications available in a single concentration, combination oral solid medications available in a single strength, vaccines, eye and ear drops, creams and ointments, liquid multivitamins, and mineral oil).

b. Do not allow single orders for medications with range doses, various frequencies, or more than one route of administration. If orders for the same drug are prescribed at different doses, frequencies, and/or routes, require separate orders for each that specify objective measures to guide determination of which dose to administer at which frequency and by which route.

Comment: Examples of measures that may be used to guide determination of the dose, route, or frequency include a pain assessment (e.g., severity, chronicity, quality of pain; prior response to analgesics), a functional status assessment (e.g., impact on activities of daily living), NPO status, and ability to tolerate oral medication.

35 Limit the need for free-text entries during prescribing by ensuring that required designated fields are provided to promote complete and clear prescriptions and orders.

36 Provide any "special instructions" and/or "note to pharmacy" fields in a prominent location where they are noticeable, with a menu of choices related to common precautions for specific drugs.

37 Provide a field for free-text entries by pharmacists to communicate additional information about drug administration not included in the order or prescription, which appears in a prominent location clearly visible with the drug entry on the MAR for nurses, or on the pharmacy label for consumers.

38 Provide a mechanism to facilitate safe order entry of complex medication regimens (e.g., chemotherapy, electrolyte solutions, parenteral nutrition) or medications that require a tapering dosing schedule (e.g., steroids) so that the orders

continued on page 13 — **Guidelines**

continued from page 12 — **Guidelines**

appear clearly, in a logical sequence, and include all required elements (which may be different than for routine medications).

39 Provide a mechanism to place a dose or doses of a medication on hold under specified conditions (e.g., heart rate less than 50 beats/min, international normalized ratio [INR] above 3.6). Provide a mechanism to document an anticipated end date and time, if known, and/or criteria for when to resume a medication on hold (e.g., hold doses until daily INR below 3.6).

40 Provide users with ways to emphasize medication- or patient-related warnings or other important clinical notes related to prescribed medications (e.g., upper- and lowercase letters, contrasting color, bolding, italicizing, choice of fonts, audible and visible alerts). When appropriate, warning statements should be presented in the active voice using affirmative statements (e.g., IV use only) instead of negative statements (e.g., Not for intrathecal use). This helps ensure that people understand the meaning of the hazard even if they do not read every word, thus avoiding errors (e.g., missing "Not" but seeing "for intrathecal use").[1]

41 Provide users with the ability to search by brand name (including an inactive brand name) or generic name, and link all means of accessing a name to default to a description of the medication. Also, organize generic and brand names by dosage form (e.g., multiple gentamicin products should be organized by parenteral, ophthalmic solution, cream, and other dosage forms) in drop-down menus and search results. See item #22 for a recommendation regarding the order in which to organize medications that display after a search.

42 In inpatient settings, provide users with the ability to clearly communicate directions for medications prescribed for specific, non-routine administration times or under certain conditions (e.g., after dialysis on dialysis days, while NPO, until tolerating liquids, prior to surgery, start first dose now, after a missed or delayed dose).

Comment: When a scheduled medication is administered early or late at a nonstandard time, an agreed-upon method (e.g., dosing window matrix, staggered dosing times) should be used to convert subsequent doses to the standardized dosing schedule.

43 Provide prescribers with the ability to electronically communicate the cancellation or discontinuation of outpatient prescriptions that have been previously transmitted (i.e., CancelRx from Surescripts). Provide pharmacists with the ability to transmit approval or denial of the request back to the prescriber to close the loop on the message.

44 Provide users with the ability to link certain medications to ONLY the appropriate routes of administration and to filter out the ability for linking to wrong route selections. For example, vin**CRIS**tine injection should link only to the IV route of administration.

Comment: Off-label use of some medications may allow for safe administration by an alternate route of administration (e.g., ophthalmic drops administered in the ear). However, users should have the ability to link medications, particularly high-alert medications, to appropriate routes only if administration by the wrong route can cause patient harm.

45 Provide users with the ability to prescribe or enter certain medications at ONLY the appropriate frequencies of administration. For example, fenta**NYL** transdermal patches should only be permitted every 48 hours or 72 hours, not daily.

Electronic System Design Features: Patient Information Associated with Medication Safety

46 To ensure automatic screening of patient allergies against prescribed medications, provide fields that require electronic documentation of known patient allergies (including medication, environmental, and food allergies) and previous adverse drug reactions (ADRs)/sensitivities, paired with a description of the type of reaction for each allergy and/or ADR/sensitivity, prior to the entry of medication orders (except in emergencies).

47 Prominently display all allergy, ADR, and sensitivity information, including the type of reaction, in a consistent location so it is viewable by the user immediately before or during order entry, order verification, and medication administration. (Allergy alerts do not replace the need to visualize this information prior to entering and verifying orders or administering medications.)

continued on page 14 — **Guidelines**

continued from page 13 — **Guidelines**

48 Allow the entry and display of ONLY metric measurements of actual patient height (in cm only) and actual patient weight (in kg only [or grams for low-birth-weight infants]), and provide a field to document the date the height and weight were collected.

49 Provide users with a system that alerts if the patient's documented weight or height exceeds an age-based weight/height comparison threshold that suggests the possibility of an error (e.g., entering weight in pounds instead of kg, switching height and weight entries, entering an erroneous weight that exceeds a facility-defined percent gained or lost).

50 Display patient identification information containing at least two unique identifiers in a prominent area (e.g., upper left-hand corner) of all screens/windows in a consistent order so that users can efficiently and accurately find and verify patient identity. The information should continue to be displayed in the same location regardless of scrolling or other navigational mechanisms to move the screen/window.

51 Provide a mechanism that enables users to enter information or orders on only one patient's electronic record at a time. Users should be able to maintain only one record in input mode (unrestricted access to input information) at a time, along with one other record in view-only mode to coordinate care between two patients (e.g., mother and newborn). A deliberate and visually distinguishable action should be required to transition from one record to another record.

52 Allow clinicians to print a copy of all medications prescribed at discharge, or at the end of an outpatient or office visit, in a format that includes the drug name (generic, and brand if prescribed), dose, route, frequency, indication, and special instructions or precautions. In inpatient settings, include the time that any prior doses were given before discharge or the date and time the next dose is due. The list of medications prescribed at discharge, or at the end of an office visit, should include medications taken previously that have been discontinued, with a clear indication that these medications should be stopped.

Other Topics Requiring Further Investigation and Standards

53 Use human factors data to select the appropriate character, text, and colors to use with electronic displays of information. For example, the contrast ratio for alphanumeric characters/text to the self-luminous computer screens or displays should not be below 7:1. Never display pure red text on a pure blue background or vice versa; never use pure blue or red text on a black background; and never use pure blue for text or fine details on electronic displays.[2]

54 A standard process is needed for expressing combination and compounded products, including products that are often referred to by coined names (e.g., magic mouthwash).

Comment: USP is currently developing such a standard.

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