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ISMP
An ECRI Affiliate

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

A hard look at hard stops and workarounds in the acute care setting

Problem: A medication order with a soft stop provides a warning to the practitioner, communicating information about a potential drug safety or efficacy problem. The soft stop may offer alternative suggestions to consider. To proceed, the practitioner may be required to acknowledge the warning with minimal action or no action. The practitioner might choose to ignore the warning, or, due to alert fatigue, may not read the warning at all. This desensitization may lead practitioners to disregard valuable information meant to safeguard patients from harm.

On the other hand, a hard stop is used to completely halt the progression of prescribing, dispensing, or administering a medication that would likely cause harm to a patient. The intent is to block further execution of the order. Consider how a hard stop may have helped prevent patient harm in the following scenario. Had a hard stop been in place, chances are a potential adverse event would have been identified and prevented before reaching the patient.

A patient was admitted with deep vein thrombosis that required surgery to remove the blood clot. The prescriber started the patient on apixaban, a direct oral anticoagulant. The patient had been on phenytoin at home for a seizure disorder. When processing admission orders for the phenytoin, the pharmacist received a severe drug-drug interaction alert—phenytoin reduces the effectiveness of apixaban and increases the risk of clot formation. Even though the combination of these medications should be avoided, the alert was not a hard stop. Unfortunately, the pharmacist failed to read or consider the alert and verified the order without further investigation or documentation as to why the order was approved. The patient was discharged on both medications, which were dispensed by an outpatient pharmacy after a pharmacist overrode a similar soft stop. Fortunately, the error was identified a few days later during a nurse discharge call and the therapy was adjusted.

Unfortunately, practitioners are sometimes confronted with situations they must troubleshoot to work around a barrier to provide patient care. Practitioners may become creative and think of ways to circumvent unexpected barriers and even hard stops within their practice setting. This is usually because the rationale for the hard stop is unclear, or they do not recognize the problem the hard stop is attempting to prevent. Consider why the practitioner used a workaround in the following scenario:

A prescriber ordered propofol 220 mcg/kg/minute for a patient with refractory status epilepticus. Since this indication was an off-label use, the organization had no clinical decision support (CDS) in the electronic health record (EHR) or a protocol for this indication. The pharmacist verified the order, knowing that the dose was higher than usual but thinking it was an appropriate dose for the patient. The organization's smart infusion pump dose error-reduction system (DERS) was set with a soft limit of 50 mcg/kg/min and a hard limit of 130 mcg/kg/min for propofol. The hard limit was based on external literature and internal data analyses. When the patient's nurse attempted to program the dose using the DERS, the hard limit prevented it. To administer the ordered dose, the nurse used two vials of propofol and programmed two infusion pumps each with a rate of 110 mcg/kg/min. The patient's condition deteriorated, and symptoms resembling propofol-related infusion syndrome were exhibited (e.g., metabolic acidosis, acute renal failure, hyperkalemia). The prescriber was notified, the propofol order was discontinued, and the patient's condition improved.

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Update on imported CISplatin. In our last newsletter, we discussed concerns about imported **CIS**platin from China (www.ismp.org/node/82965). Apotex has since confirmed with us that the full 50 mg/50 mL can be withdrawn from the vial without using the "washing" process described in the letter. The company told us they are in contact with the manufacturer and will update us with any further details.

Oral amiodarone loading dose continued for 8 months in error. A patient who had been receiving amiodarone for previous bouts of ventricular tachycardia, was admitted to an intensive care unit (ICU) with significantly elevated liver enzymes. The pharmacist who completed the admission medication history discovered that the patient had been receiving amiodarone tablets at a loading dose of 400 mg per day for 8 months, which had only been intended for 4 weeks. The patient had been receiving outpatient care from several

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ISMP/ECRI survey on drug, supply, and equipment shortages

ISMP and ECRI are conducting a short survey on the continuing crisis with **drug shortages and supply chain disruptions** resulting in ongoing patient safety and cost concerns. We are interested in learning about your experiences with drug, single-use supplies (e.g., tubing, syringes, cassettes), and durable medical equipment (e.g., infusion devices) shortages during the past 6 months. Please take a few minutes to complete the survey and submit your responses to ISMP and ECRI by **July 27, 2023**, by visiting: www.ismp.org/ext/1195. We plan to use the results of this survey to advocate for changes on a national level aimed at reducing the occurrence of serious shortages. Thank you for your participation in this survey.

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Safe Practice Recommendations: Organizations should determine the circumstances in which hard stops should be implemented. Consider the following recommendations:

Determine oversight. Assemble an interdisciplinary team (e.g., clinical informatics specialist, medication safety officer, prescriber, pharmacist, nurse) to review current hard stops in the organization's various technologies (e.g., EHR, intravenous workflow management system [IVWMS], automated compounder software, smart infusion pumps, automated dispensing cabinets [ADCs]). This team should be tasked with assessing the need for modifying and/or adding additional hard stops on a regular basis. Designate approval committees (e.g., Pharmacy and Therapeutics Committee, Medication Safety Committee, Smart Pump Committee, Medical Executive Committee) to approve hard stop changes and additions and consult with specialty departments (e.g., oncology, neonatology/pediatrics, cardiology) when considering modifying or adding a hard stop.

Evaluate EHR systems. EHR systems often have pre-set severity levels for alerts that have intervention requirements that vary. Lower level alerts may not require practitioners to enter reasons for bypassing the alert, whereas higher level alerts may require the practitioner to select or enter a free text acknowledgment of the alert and justification for bypassing it. Work with your EHR vendor to determine if alert levels can be adjusted if deemed appropriate by your oversight committee. Also, determine which practitioner types are presented with these warnings. EHR systems often allow for alerts to be turned on or off at the prescribing, verification, and administration steps. Include these considerations in discussions with the interdisciplinary oversight team.

Use hard stops judiciously. Hard stops should be limited to preventing absolute contraindications or catastrophic errors. They should not prevent practitioners from prescribing, dispensing, or administering a clinically appropriate, but perhaps unusual dose. Rather, hard stops should be in place to at least force a time-out and protect against massive overdoses or contraindications. Previously, ISMP has published (www.ismp.org/node/622) concerns related to soft stops that were unheeded for amphotericin B, methotrexate, and fenta**NYL**. While organizations need to address practitioners' concerns with hard stops and make every effort to minimize any unintended effects, we recommend using hard stops judiciously for catastrophic drug doses. In addition, the rationale for hard stops should be clearly displayed for practitioners to help identify the problem.

Consider the need for hard stops when medications are assessed for formulary addition. When a medication is considered for formulary addition or when conducting an annual formulary review, think through the entire medication-use process to consider if hard stops are necessary and, if so, where they might be incorporated. To cite a few examples that ISMP has previously recommended, please refer to the following:

- For intravenous (IV) infusions, use DERS (upper and lower, soft and hard limits) for medication doses, concentrations, infusion rates, intermittent infusion time duration, bolus and loading dose infusions (e.g., dose, duration, rate, bolus interval), and patient weights (ISMP ***Guidelines for Optimizing Safe Implementation and Use of Smart Infusion Pumps*** [www.ismp.org/node/972]).
- Require a hard stop verification of an appropriate oncologic indication for any daily oral methotrexate orders (ISMP ***Targeted Medication Safety Best Practices for Hospitals***, *Best Practice #2* [www.ismp.org/node/160]).
- Require a patient's opioid status (naïve versus tolerant) and type of pain (acute versus chronic) to be documented before prescribing and dispensing extended-release and long-acting opioids (ISMP ***Targeted Medication Safety Best Practices for Hospitals***, *Best Practice* #15 [www.ismp.org/node/160]).

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practitioners, including cardiologists, and had been hospitalized at different locations during those 8 months, all while taking the 400 mg daily loading dose of amiodarone. The overdose was not identified until the patient was admitted with toxicity.

Amiodarone is intended for use only in patients with life-threatening arrhythmias because its use can result in significant adverse reactions. The drug has a Boxed Warning that includes hepatoxicity, which can be fatal. Amiodarone has many off-label indications for various ventricular and supraventricular arrhythmias with corresponding dosing regimens. Amiodarone is unique in that, based on the indication, treatment is usually initiated with a loading dose until a therapeutic response occurs, followed by a tapered dose, and then a maintenance dose. Even though 400 mg per day can be used as a maintenance dose for ventricular tachycardia per the package insert (www.ismp.org/ext/1185), this was not the intended dose for this patient's maintenance regimen. In contemporary practice, once a patient is stable, the dose may be reduced to 100 to 200 mg per day to lessen the risk of adverse effects and toxicity (www.ismp.org/ext/1193, www.ismp.org/ext/1194).

Transitions of care and multiple handoffs between providers (e.g., cardiologists, hospitalists, primary care providers) may contribute to the failure to identify extended loading dose errors or doses that were intended to be re-evaluated for dose reduction. Poorly designed processes for medication reconciliation and/or breakdowns in the system in both inpatient and outpatient settings may also lead to missing this type of dosing error. Finally, since the dose that the patient was receiving was within the limits listed in product labeling, prescribers and other healthcare practitioners may find it difficult to identify that the loading dose was extended beyond the recommended duration, until significant patient harm brings attention to the matter. (Note: due to amiodarone's prolonged half-life [15 to 142 days], even after the drug has been discontinued, patients may still be at risk for amiodarone toxicity.)

Organizations should consult with key stakeholders (e.g., cardiologists, hospitalists,

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- For vinca alkaloids (e.g., vin**CRIS**tine, vin**BLAS**tine), default orders to the IV route and do not allow prescribers to modify it since this can be fatal if administered by other routes (ISMP ***Targeted Medication Safety Best Practices for Hospitals***, *Best Practice* #1 [www.ismp.org/node/160]).

- Restrict prescribers from being able to order medications/formulations that are contraindicated for enteral feeding tube administration (www.ismp.org/node/48786).

- When possible, institute a hard maximum dose limit for conventional amphotericin B in order-entry software (prescriber and pharmacy) and infusion pumps. A single daily dose of the conventional amphotericin B should never exceed 1.5 mg/kg.

Develop an escalation process to address hard stop workarounds. During orientation and annual competency assessments, educate practitioners about what they should do if they receive a hard stop (e.g., do not assume the system is wrong). If a prescriber orders a dose above the organization's approved protocol, a reference to support this dose should be available to ensure the dosing is appropriate and not an error. If a practitioner programming an infusion using the smart pump DERS receives a hard stop because it exceeds the maximum dose, they should know the appropriate individual(s) to contact to reconcile this before bypassing the system. While bypassing a hard stop should be rare, there may be times when it is clinically necessary. Organizations should have an escalation process that outlines required actions or notifications to designated individuals for assessment prior to hard stops being circumvented (e.g., independent double-check, approval by a supervisor). The need and frequency of bypassing a hard stop should be monitored and the hard stop design should be re-evaluated to determine if modifications are needed.

Use objective measures to determine alert appropriateness and utility. Use technology to evaluate practitioners' response to an alert.[1] Did the practitioner make an alert-indicated change? Was the response appropriate? Technology should also be used to aggregate instances of workarounds. If a hard stop or system is bypassed frequently then it should be reviewed for appropriateness. Metrics within technologies that should be evaluated include:

- EHR (e.g., hard stops generated through CDS, orders changed to free-text order entries)

- Automated compounder software that is used for parenteral nutrition (PN) (e.g., hard maximum dose override attempts, compounds programmed outside of PN library templates)

- IVWMS (e.g., doses made in which scanning was bypassed, direct observation of proxy scans [scanning the barcode not affixed to what is actually being used])

- ADCs (e.g., ADC overrides, clinical alerts and subsequent actions taken)

- Bedside barcode scanning (e.g., scanning compliance by medication and user, review events where barcode scanning was bypassed or occurred after administration)

- Smart infusion pump (e.g., DERS usage, infusions programmed outside of the DERS, use of custom concentrations, actions taken in response to alerts, hard stops for minimum concentrations [www.ismp.org/node/1084])

Perform functional testing. Test hard stop functionality to ensure it will capture the errors that it is intended to prevent, including 10-fold under- and overdose errors or other dosing errors for medications with narrow therapeutic windows. Look for any unintended consequences that the hard stop could create. Offer end users the chance to participate in hard stop evaluation and planning.

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primary care providers, retail pharmacies) and consider the following recommendations to prevent these types of errors with amiodarone:

- Run a query in your health system's electronic health record (EHR) to evaluate amiodarone inpatient orders and outpatient prescriptions (e.g., for the past 12 months) and review the orders for dose and duration appropriateness.
- Stakeholders should review inpatient orders and outpatient prescription defaults, and through consensus, create order sets (e.g., inpatient, discharge/outpatient) that offer specific ordering options and educational instructions for the various indications including the loading dose, how to taper, and the maintenance dose by indication (e.g., ventricular arrhythmias, supraventricular arrhythmias).
- Ensure order sets have appropriate default doses and durations based on the indication and route (e.g., oral loading dose, oral maintenance dose).
- Consider restricting amiodarone ordering only through an order set that includes the duration of therapy.
- If a patient is admitted to the hospital and is taking amiodarone that is continued throughout their stay, automatically monitor liver enzymes to identify early toxicity.
- Consider adding intermittent liver function monitoring to amiodarone outpatient/discharge order sets.
- During the medication reconciliation process, if a practitioner has concerns about the dose or duration of therapy, encourage them to speak up to help intercept errors and avoid adverse patient outcomes (i.e., do not defer blindly to the presumed expertise of a specialist without clarifying).
- For all patients receiving amiodarone, scripted education should be required regarding the need for loading and maintenance doses and how these doses should only be adjusted in conjunction with their cardiologist's recommendations.

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Gather feedback. Encourage practitioners to provide feedback on the hard stop design with a focus on unintended consequences that may lead to error-prone scenarios or unsafe choices (www.ismp.org/node/254). Elicit ways in which the hard stop may be or has been bypassed. Use this information to adjust hard stops as needed.

Collaborate with vendors. Work with technology vendors to discuss software capability for hard limits and provide feedback for upcoming enhancements to prevent patient harm.

Reference

1) McCoy AB, Waitman LR, Lewis JB, et al. A framework for evaluating the appropriateness of clinical decision support alerts and responses. *J Am Med Inform Assoc.* 2012;19(3):346-52.

Special Announcements

Welcome to our newest staff member!

We are pleased to announce that **Jennifer Young**, PharmD, BCPS, CSP has joined ISMP as a Medication Safety Specialist, supporting ISMP's Specialty Pharmacy Membership and contributing to newsletters and consulting efforts, particularly in the community and specialty pharmacy practice settings. She comes to us from Atrium Health Wake Forest Baptist in North Carolina, where she most recently served as Program Director for Specialty Pharmacy Services, including two outpatient specialty pharmacies, a specialty pharmacy call center, clinic-embedded pharmacy staff, and a medication access center. Please join us in welcoming Jen!

ISMP represented on GEDSA's Board of Directors

We are happy to announce that **Shannon Bertagnoli**, PharmD, ISMP Medication Safety Specialist, Publications, has been elected to the Global Enteral Device Supplier Association (GEDSA) Board of Directors. She will be filling one of three clinical seats, and is the only pharmacist on the Board. ISMP has worked with GEDSA for several years on the implementation of the International Organization for Standardization (ISO) standards in promoting tubing connectors designed to reduce the risk of misconnections.

Virtual MSI workshops

Do not miss the opportunity to register for one of our unique 2-day, virtual ***ISMP Medication Safety Intensive (MSI)*** workshops. To join us **August 3-4, 2023**, visit: www.ismp.org/node/127.

Foundations in Medication Safety

ISMP's new online, interactive course offers healthcare organizations a standardized, cost-effective way to ensure staff involved in the medication-use process have the basic knowledge they need. For details, visit: www.ismp.org/node/74900.

Nominations open for CHEERS Awards

Nominations for this year's **CHEERS Awards** are now open and will be accepted through **August 6, 2023**. For more information, visit: www.ismp.org/node/123.

Report medication and vaccine errors to ISMP: Please call 1-800-FAIL-SAF(E), or visit www.ismp.org/report-medication-error. ISMP guarantees the confidentiality of information received and respects the reporters' wishes regarding the level of detail included in publications.

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ADC drug description leads to mannitol overdose. A prescriber in the emergency department (ED) gave a verbal order for 60 g of intravenous (IV) mannitol for a trauma patient. The organization did not have profiled automated dispensing cabinets (ADCs) or pharmacist order verification in the ED, so the nurse had free access to mannitol from the ADC without pharmacist review. The drug description on the ADC screen displayed the product as "mannitol 20 g/100 mL," but the infusion bags were 500 mL and labeled "100 g/500 mL." Thinking each bag only contained 20 g, the nurse removed and administered 3 bags (300 g/1,500 mL of mannitol) to the patient when only 60 g (300 mL) should have been infused.

The organization has since updated the ADC drug description to display mannitol 100 g/500 mL to reflect the total amount in the container. They now provide an auxiliary label on the mannitol bags, warning that each contains a total of 100 g. They also reduced the par level (the number of bags stored) in the ADC from 3 to 1; additional bags must be requested from the pharmacy if needed. This error along with the corresponding system and process changes was shared throughout the organization for practitioner learning.

It is important to review how medications are displayed on drug selection screens (e.g., electronic health record [EHR], ADC, smart infusion pump). Concentrations should reflect the total quantity per total volume (e.g., 100 g/500 mL) in the container. Use the profiled mode in ADCs in all areas of the hospital, including the ED, so that medications are reviewed and verified by a pharmacist prior to removal. This will prompt the removal of the appropriate number of bags from the ADC based on the order, and also allow for bedside barcode scanning, which may identify an error before it reaches a patient. Limit the use of verbal orders to times of real emergencies. Implement additional strategies to reduce the risk of error, such as limiting the quantity of vials, tablets, and infusion bags that are available on override. For further recommendations, review the ISMP ***Guidelines for the Safe Use of Automated Dispensing Cabinets*** (www.ismp.org/node/1372).