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ISMP Institute for Safe Medication Practices
An ECRI Company

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

Enhance interoperability workflow and end user alerts to ensure meaningful action

Problem: Interoperability between smart infusion pumps and the electronic health record (EHR) is a huge step forward for patient safety, which many hospitals have implemented. However, interoperability does not solve all problems and has the potential for unintended consequences if the workflow has not been carefully vetted. Throughout the implementation process, practitioners have identified challenges including vague alerts from the smart pump that appear on the medication administration record (MAR) and do not explain what the user is expected to do. Organizations must also have access to compliance metrics to make meaningful changes, along with a plan for initial and routine education/competency assessments to coach staff about optimal workflow and share lessons learned.

In our March 13, 2025 article, *Infusion errors can still occur with interoperability*, we shared a tragic event in which a patient died after receiving a massive overdose of amiodarone. When a nurse went to administer a replacement amiodarone infusion bag to the patient, they inadvertently scanned the manufacturer barcode on the 5% dextrose in water (D5W) diluent bag that the pharmacy used to compound the amiodarone infusion, instead of the barcode on the patient-specific label. The patient also had a D5W maintenance fluid order, and interoperability populated the pump rate based on the ordered D5W infusion rate (100 mL/hr). The nurse bypassed an alert that stated, "This pump is associated to a different order," perhaps due to confusion about what the warning meant. The entire amiodarone bag infused at 100 mL/hr instead of 16.7 mL/hr, before the nurse identified the error. The following examples of additional interoperability-related medication errors have been reported to ISMP.

Failure to Recognize Alerts in EHR When Pulling Data from Pump

Two nurses completed an independent double check for a patient's heparin infusion titration. They documented that the double check was completed in the MAR. For this organization for titratable infusions, nurses must manually program titrations of medications on the pump. When the nurse entered the dose/rate titration parameters on the pump, they transposed the numbers and the wrong dose/rate was programmed. The second nurse did not recognize the error. Later, when the primary nurse was pulling data from the pump back into the EHR, the nurse overrode a wrong dose alert, leading to a second missed opportunity for the error to be corrected.

Scanning the Incorrect Channel

A patient had multiple infusion bags hanging on their intravenous (IV) pole that were no longer infusing, but were still connected to the patient, including a norepinephrine infusion. When one nurse went to administer a prescribed bolus dose of D5W, they scanned the patient's identification band (ID), D5W barcode, and mistakenly scanned the wrong pump channel, initiating the norepinephrine infusion. They did not trace the infusion lines from the pump to the patient (and vice versa), and inadvertently administered a bolus of norepinephrine to the patient. The patient's blood pressure became elevated, and the error was identified.

A prescriber ordered a continuous infusion of Lactated Ringer's for a patient who had previously been receiving an insulin infusion. The insulin infusion had been held for the past hour due to the

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SAFETY briefs

Contaminated WG Critical Care calcium gluconate 2,000 mg/100 mL bag. A hospital reported sterility concerns with a calcium gluconate 2,000 mg/100 mL injection bag manufactured by WG Critical Care (NDC 44567-621-24, lot number 24Y00103, expiration date April 2027). A nurse went to remove a patient's dose from the automated dispensing cabinet (ADC) and, upon removing the overwrap, observed a floating black substance resembling mold inside the sealed, unopened inner bag (**Figure 1**). The nurse never spiked or administered the product. It was immediately sequestered and reported to the pharmacy and charge nurse. The hospital returned the bag to WG Critical Care for further investigation. The pharmacy removed all products with this lot number across the health system and has transitioned to an alternative manufacturer.

Figure 1. A black substance was found inside a sealed, unopened bag of calcium gluconate 2,000 mg/100 mL.

We have reported this issue to the US Food and Drug Administration (FDA) and the manufacturer. The manufacturer immediately initiated an investigation. They told us they completed a comprehensive investigation and attributed the contamination to a microchannel defect at the seal between the tubing and the

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patient's blood glucose being lower than the prescribed parameter. When attempting to initiate the Lactated Ringer's infusion, the nurse did not trace the IV lines and inadvertently scanned the insulin channel, resulting in insulin infusing at 75 mL/hr. The error was identified during a routine pump check thirty minutes later. A dextrose bolus was given proactively to prevent hypoglycemia, but the patient experienced mild hypoglycemia.

One academic health system, Nebraska Medicine, which went live with interoperability in fall 2020, shared how they addressed common pitfalls related to interoperability. The network is comprised of two hospitals that have more than 800 licensed beds that provide care across multiple specialties including trauma, transplant, oncology, and pediatric/neonatal populations. The system also has multiple infusion centers and ambulatory surgical sites.

Safe Practice Recommendations: We encourage organizations to learn from Nebraska Medicine's experiences when implementing or optimizing interoperability.

Gather a team. Successful execution and optimization of interoperability requires interdisciplinary input and expertise. To ensure a thorough and thoughtful structure, Nebraska Medicine established a dedicated smart pump committee that includes nurses, pharmacists, biomedical engineers, and information technology (IT) representatives to oversee interoperability implementation and quality improvements. The team meets every 2 months and reports to the medication management committee. Together, the team reviews compliance data, errors related to interoperability, and plans for drug library updates. For additional information about establishing a team, refer to the ISMP ***Guidelines for Optimizing Safe Implementation and Use of Smart Infusion Pumps***.

Establish a dashboard and monitor data. The ISMP ***Targeted Medication Safety Best Practices for Hospitals***, *Best Practice 8*, calls for maintaining a compliance rate of greater than 95% for the use of dose error-reduction systems (DERS). To make interoperability compliance visible, Nebraska Medicine created a dashboard by unit and user level. The dashboard is reviewed routinely by unit leaders, monthly by the medication safety team, and bi-monthly at the smart pump committee. Outliers and trends are investigated and shared with staff so corresponding actions can be taken. This monitoring has helped identify opportunities to better allocate resources, uncover workflow challenges, and has helped identify specific medications that may need to be updated in the drug library to promote compliance. Examples of changes made through this review include the following:

- Collaboration with the Acute Pain Service team to update **HYDRO**morphone settings (e.g., soft maximum dose) for continuous and bolus dosing
- Collaboration with the antimicrobial stewardship pharmacist to update multiple antibiotic DERS, including maximum dose, administration rate, and concentration
- Validation with various subject matter experts (e.g., anticoagulation stewardship pharmacist, diabetes stewardship pharmacist, transfusion safety coordinator) that the current DERS are appropriate

Respond to alerts safely. With the Nebraska Medicine's medication safety team, a nurse/pharmacist dyad is responsible for helping to investigate and troubleshoot error codes to understand if it was a user or system issue. For example, if there is a mismatch between the order in the EHR and what is infusing on the smart pump when the nurse pulls integrated data (e.g., titrations, intake volume) from the pump to the EHR, they may receive an alert/banner warning, which should be a red flag that something is wrong. The following are examples of alert types in the EHR:

- **Order not active:** This alert signifies that since the last data pull from the pump to the EHR, the order has been discontinued and should no longer be infusing.
- **Mismatch between order and pump:** This alert signifies there is an issue with the association between the EHR and the pump. The nurse should disassociate the pump (break

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bag, compromising the product's sterility. The manufacturer confirmed that the bag was contaminated with mold, and this was an isolated event. This incident underscores how critical it is for end users to stay vigilant in reviewing product integrity and escalate potential safety issues. If your organization purchases calcium gluconate 2,000 mg/100 mL from WG Critical Care, review your inventory and ensure end users are aware of this concern. According to instructions on the bag label, practitioners should check for leaks by squeezing the container. If potentially impacted product is found, sequester it and report it to the manufacturer, FDA, and ISMP. Remind staff to visually inspect all medication injectable solutions for particulate matter, discoloration, and potential contaminants prior to use.

Irrigation solution infused intravenously. A nurse administered 0.9% sodium chloride irrigation solution intravenously (IV) to a patient in the emergency department (ED) instead of the prescribed 0.9% sodium chloride injection solution. Both products (ICU Medical) come as 1-liter bags, and the word "Irrigation" or "Injection" is printed in a smaller font, below the name of the solution (**Figure 1**). The hospital lacks 24/7 central supply and

Figure 1. ICU Medical's 1-liter bag of 0.9% sodium chloride irrigation solution (left) was administered IV instead of 0.9% sodium chloride injection (right).

pharmacy services. Over the weekend, the ED ran out of 0.9% sodium chloride injection, so a nurse sought out product to restock it. Due to a shortage of 0.9% irrigation bottles, central supply had purchased 0.9% irrigation bags and stored them near cardboard boxes containing 0.9% sodium chloride injection.

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the link between the EHR and pump) and reassociate the order (scan the patient ID band, appropriate infusion bag, and channel).

- **Dose/rate mismatch:** This alert signifies that the dose/rate currently running on the pump does not match the MAR order. The nurse should review the MAR, medication, and pump to identify the discrepancy.

Educate staff. Prior to implementation and during new hire orientation and annual competency assessments, educate practitioners about the proper use of interoperability. Ensure end users understand the steps required (e.g., after scanning, review the order populated in the EHR, validate pump settings, trace infusion lines before starting the infusion, respond to or investigate alerts) to use interoperability safely. For infusion types that are not compatible with pump interoperability (e.g., titrations), educate staff about the required steps (e.g., a double check of manual programming of high-alert drugs) and have a plan for monitoring this process. Whether interoperability has been implemented or not, medications no longer needed should be immediately removed from the IV pole and discarded.

Use simulation. Use simulation to evaluate the systems in a test environment that simulates an actual patient room. Work directly with software vendors to understand potential problems that users have reported and recommendations to prevent them. Simulate the workflow to test what does and does not work, gain crucial feedback from end users and identify any potential safety gaps. Consider holding "a day in the life" to run real-life simulations to see how interoperability works in your settings with a diverse group of end users and compare to vendors' testing environments. Ask end users to identify vulnerabilities and discuss concerns with the team so they can address any issues before implementation. At Nebraska Medicine, nursing professional development specialists use an interactive wall, a technological tool designed to create an engaging learning experience for learners. This dynamic experience educates new nurses on pump interoperability workflows.

Gather feedback. Routinely meet with end users to foster increased communication and feedback. Nebraska Medicine's medication safety team brings any workflow related concerns or questions to the medication management committee for discussion. If issues with pump interoperability occur, staff are encouraged to escalate them to nurse leaders on their unit and through the organizational error-reporting program so that the medication team and clinical informaticists/analysts can investigate.

Understand barriers. Nebraska Medicine investigates instances when there is an opportunity to understand barriers to successful interoperability, correct system issues, and/or coach staff as needed. One way to do this is to review data to compare the pump programming to what nurses documented in the EHR and assess discrepancies. Investigate cases and share lessons learned from instances when the system generated alerts, such as:

- **Failure of pump to start:** This is a workflow issue. The nurse likely sent the infusion details to the pump but did not press start on the pump before the session timed out.
- **Missing rate:** Some PRN flush orders may be ordered as a range volume so the nurse can enter the rate needed for post-medication flushes. If the nurse forgets to enter a rate for the flush, the infusion cannot be initiated through interoperability. Entering an infusion rate in the administration window on the MAR should resolve this issue.
- **Offline pump:** This could be a systemic Wi-Fi issue, or, it is possible the nurse did not turn on the pump and allow enough time to pass for the pump to connect to Wi-Fi before attempting to use pump interoperability.
- **Order not sent to pump:** The nurse likely did not initiate the pump interoperability workflow.
- **Secondary workflow issue:** The nurse attempted to run a secondary infusion before starting the primary infusion.

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The organization has not implemented barcode medication administration (BCMA) in the ED.

It is time for all organizations to use barcode scanning when receiving, dispensing, restocking storage locations, and before administration. The ISMP ***Targeted Medication Safety Best Practices for Hospitals***, *Best Practice 18*, calls for maximizing the use of barcode verification prior to medication administration by expanding use beyond inpatient care areas, and specifically targeting clinical areas with a short or limited patient stay, including the ED. When possible, purchase irrigation bottles or larger bag sizes (e.g., 2 or 3 liters) rather than 1-liter bags that could be mistaken as infusions. When central supply purchases an alternative item during drug shortages, the pharmacy must be notified and should then conduct a review to identify potential risks with the product's design, including look-alike labeling and packaging. If risks are identified, consider purchasing the product (or one product of a problematic pair) from a different manufacturer. Store look-alike products separately, and consider the use of signage or other warnings on the bags and in storage locations.

Welcome 2025-2026 Fellow

Kara Jensen, PharmD, BCPS is the 2025-2026 ***ISMP Safe Medication Management Fellow***, supported by the US Army. Kara is an active-duty US Army Officer and most recently worked as the Deputy Commander for Nursing at Wiesbaden Army Health Clinic in Germany. She received her Doctor of Pharmacy Degree from Virginia Commonwealth University/ Medical College of Virginia in Richmond, VA. In her previous positions, Kara has actively contributed to medication safety through participation on various safety committees where she gained an interest in medication safety. In July, Kara returned to the United States to begin her Fellowship. Throughout the year, she is looking forward to learning more about medication safety which will further equip her to promote and implement best practices within the Army Pharmacy system. Please join us in welcoming Kara to our team.

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Create an escalation plan. Develop a policy and procedure outlining action to take if a step in the process or system fails. Consider whether it is due to a pump issue or an interoperability issue (e.g., Wi-Fi, system downtime) to engage the appropriate stakeholders (e.g., biomedical engineering, IT). Consider instances where the system should prompt the nurse to obtain a double check before bypassing an alert to ensure the action is appropriate, or whether a hard stop should be built.

Learn from errors. Review internally reported interoperability-related errors as well as published external events. Encourage staff to report both close calls and errors that have reached the patient. Share impactful stories and recognize staff for good catches. Watch for trends and highlight the opportunities identified with direct communication to units involved, or if more widespread, consider broad communication via a flyer or safety bulletin.

Next steps. Nebraska Medicine is planning to continue to refine compliance dashboards for procedural holding areas. The team is also working on more comprehensive education on recognizing and understanding alerts in the workflow, pulling data from the pump to EHR, recognizing physical set-up hazards (e.g., IV poles safety, line labeling), and implementing IV pump interoperability in their clinic-based infusion center.

We want to thank Stacie J. Ethington, MSN, RN, and Sloane Hoefer, PharmD, BCPS, from Nebraska Medicine, for sharing how their health-system optimized interoperability as well as helping to write this article.

Free activities from ASHP

As sterile compounding standards continue to evolve, ensuring your team is aligned with USP <797> requirements is more important than ever. The American Society of Health-System Pharmacists (ASHP) is offering four (4) **FREE** on-demand educational sessions designed to strengthen your compliance and improve patient safety.

- **Navigating the Life Cycle of Viable Air and Surface Samples:** Understand the latest best practices in sampling and monitoring to ensure a clean compounding environment.
- **USP <797> and Parenteral Nutrition: What's New on the Menu:** Explore updates impacting PN preparation and administration – and what they mean for compliance.
- **Achieving Your Personnel Best: Training Personnel in USP Chapter <797> and Opportunities for Quality Assessment Plans:** Learn how to train staff and assess competency through real-world quality plans.
- **IV Been There Too: Safely and Effectively Incorporating Technology and a Designated Person in USP <797> Compliance:** Discover how leveraging technology and leadership roles supports safe, effective implementation of USP <797>.

All programs offer continuing education (CE) for pharmacists and pharmacy technicians. For more information and to view the activity, please click on the program titles.

Special Announcements

Work for ISMP

Help spread medication error prevention recommendations to the entire healthcare community! ISMP is looking for a ***Medication Safety Specialist-Education*** who will be responsible for the coordination and implementation of our educational programming. Med Safety Board (MSB), an ISMP company powered by ECRI, is accepting applications for a full-time ***Director***. For more details on both positions and to apply, visit: *Job Opportunities*.

Apply for new Fellowship

Applications are being accepted for the first ***Ochsner Children's & ISMP Safe Medication Management Fellowship***! This unique one-year program for pharmacists offers the opportunity to learn from and work with top experts in medication safety while supporting error prevention strategies in pediatrics at Ochsner Health. **The fellowship requires working onsite at Ochsner Health in New Orleans, LA**, and remotely with ISMP. For more information and to apply, please visit: *Safe Medication Management Fellowships*.

Apply for a JUST CULTURE scholarship

Applications are now being accepted for the ***Judy Smetzer Just Culture Champion Scholarships***. Qualifications to apply include the following: currently working in the healthcare field, having at least 5 years of full-time postgraduate experience, and a commitment from executive leadership within your organization. Achieving Just Culture certification helps advance fair accountability and system improvements. The deadline to apply is **September 30, 2025**. For more information and to submit an application, click here.

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