Selected Medication Safety Risks That Can Easily Fall Off the Radar Screen—Part 2

Matthew Grissinger, RPh, FASCP

Mr. Grissinger, an editorial board member of P&T, is Director of Error Reporting Programs at the Institute for Safe Medication Practices (ISMP) in Horsham, Pennsylvania (www.ismp.org).

Some medication safety risks are painlessly apparent in an organization, while many others lie dormant in the system until an error or adverse event draws attention to them. We thought it would be useful to describe selected medication safety risks for organizations to manage that might otherwise fall off the radar screen. In Part 1, published in last month’s column, we described one risk for three of the Institute for Safe Medication Practices’ (ISMP’s) 10 Key Elements of the Medication Use System. These risks were related to:

1. **Patient information**: Placing orders on the wrong patient’s electronic health record;
2. **Drug information**: Nursing references that promote unnecessary dilution of intravenous (IV) push medications; and
3. **Communication about drug therapy**: In electronic records, confusing the available concentration as the patient’s dose.

Part 2 in this month’s column covers one risk in three key elements associated with manufacturer and practitioner labeling, patient education, and medication storage.

**4a. Key Element: Manufacturer Drug Labeling, Packaging, Nomenclature: Per-Liter Electrolyte Content on Various Sizes of Manufacturers’ IV Bags**

The way electrolyte concentrations are expressed on IV bags in volumes less than or greater than 1 L has tripped up many practitioners over the years. Concentrations are listed per liter, not per container volume. For example, a 250-mL 0.9% sodium chloride injection container label lists the sodium chloride content as 154 mEq/1,000 mL, rather than 38.5 mEq/250 mL. Commercially marketed parenteral nutrition products available in containers greater than 1 L also express the electrolyte ingredients “per liter.”

We recently described an error that occurred while a pharmacist was preparing a bag of 3% sodium chloride after the pharmacy unexpectedly ran out of the commercially available bags. The pharmacist mistakenly set the proportion as 154 mEq/0.9% = x/3% and calculated that he needed 513 mEq of sodium chloride, when he actually needed only 256–257 mEq of sodium chloride for a 500-mL bag (77 mEq/0.9% = x/3%).

Clearly, it’s time for the Food and Drug Administration and the U.S. Pharmacopeial Convention (USP) to rethink this electrolyte presentation with large-volume parenterals (LVPs) in volumes less than or greater than 1 L. For single- and multiple-dose injectables, USP requires the strength per total volume as the primary, prominent display on the label, followed by the strength per milliliter enclosed in parentheses. This should apply to LVPs as well. Until it does, pharmacists who calculate electrolyte quantities should seek out an independent double check. Sufficient quantities of commercially available products should be used whenever possible. For products that routinely require admixture, an instruction sheet should be available to guide the process.

**4b. Key Element: Practitioner Drug Labeling, Packaging, Nomenclature: Drawing More Than One Dose Into a Syringe**

Hospitals need to address a potentially common practice whereby an entire vial of medication is drawn into a syringe in anticipation of needing additional doses of the medication for the same patient, even though only a portion of the vial is needed for a single dose. In one case, a patient with pulmonary edema and possible pneumonia was about to be transferred from the emergency department to a medical intensive care unit when the patient’s condition began to deteriorate. According to press reports, doctors decided to intubate the patient and employ “mechanical ventilation because of respiratory distress/compromise.” Ketamine 100 mg was ordered, but the nurse drew up the total volume of 5 mL (500 mg) from a vial (100 mg/mL) of ketamine in case she needed additional incremental doses. She intended to administer just 1 mL (100 mg), but she inadvertently administered the entire 500 mg in the syringe. The patient arrested and could not be resuscitated.

The practice of withdrawing more than a single dose into a syringe was not supported in hospital policies. However, the nurse didn’t deviate from what was said to be a common at-risk behavior at the hospital (and no doubt in many other hospitals)—preparing a syringe containing an extra amount of a drug as a “just-in-case” measure if the physician wanted to order more of the drug later during the procedure. Similar practices often occur in post-anesthesia care units, where small, incremental doses of opioids are sometimes delivered, as nurses don’t want to waste and document the witnessed disposal of opioids.

This tragic incident signals a need to identify whether this practice is occurring in your institution, with the thought of addressing circumstances where the practice should be prohibited. Otherwise, there’s an increased risk of patient harm from overdoses as well as possible contamination of the medication remaining in the syringe. Wherever possible, prefilled pharmacy-prepared or commercially available syringes that contain the exact dose should be used.

**5. Key Element: Patient Education: Discharging Patients Who Do Not Understand Their Discharge Medications**

Despite the importance of teaching
patients about the medications to take after discharge, studies suggest that health care providers are not successfully preparing patients for the transition home. Between 30% and 70% of patients make a medication error in the immediate weeks following hospitalization.\textsuperscript{1-5} and the Centers for Medicare and Medicaid Services reports an average national hospital readmission rate of 17.5% to 19.5%.\textsuperscript{6} The discharge process is often rushed and interrupted, making it difficult to ensure that patients know what medications to take, the correct doses, and how to take them after discharge. The period immediately prior to discharge is not an ideal time for education either, as patients may be overwhelmed with the amount of information being provided at once. A recent study of patients with acute coronary syndrome or heart failure found that more than half of the hospitalized patients were either taking a previously prescribed medication that should have been discontinued (36%) or not taking a newly prescribed medication documented on the discharge medication list (27%).\textsuperscript{9} More than half (59%) of all discharged patients also misunderstood the indication, dose, or frequency of use of the prescribed medications.\textsuperscript{4}

Medication errors that occur during the first few weeks after discharge from the hospital can cause significant harm. In fact, one study showed that almost a quarter of all post-discharge errors were considered serious or life-threatening, and that most of these errors happened within the first 14 days after discharge.\textsuperscript{5} The highest predictors of post-discharge errors included low health literacy and low subjective numeracy (self-reported measure of the ability to perform mathematical tasks and the preference for numerical versus prose [words] information).\textsuperscript{4} Interestingly, numeracy was not specifically associated with misunderstandings in the numerical aspects of medications such as dose or frequency, but rather with taking a medication no longer prescribed, omitting a prescribed medication, or misunderstanding a medication’s indication. No association was found between errors and educational attainment, the number of medications being taken, medications changed during hospitalization, poor social support, or low pre-admission medication adherence. Perhaps this risk is best addressed with a redesigned discharge process that facilitates the most effective means of teaching patients about their medications, initiating education earlier in the hospital stay, and providing post-discharge support.

6. Key Element: Drug Storage, Standardization, and Distribution: Improper and Unsafe Vaccine Storage

The proper storage and handling of vaccines is vitally important because their stability and efficacy are dependent on these factors. To maintain stability, most vaccines must be stored in a refrigerator or freezer, and many also require protection from light. Excessive heat or cold—even a single exposure in some instances—can reduce vaccine potency. These temperature deviations are often due to inadequate refrigeration or freezer units, faulty thermostat controls, and refrigerator/freezer units with inadequate space to allow good air circulation and consistent temperatures.

Improper and unsafe storage can also lead to serious errors as a result of selecting the wrong vaccine, diluent, or other medication with a look-alike name and/or labeling and packaging. Unsegregated storage of vaccines has led to dispensing and administering the wrong vaccine or wrong form of vaccine (e.g., adult versus pediatric). Storing vaccines with other medications in a refrigerator or freezer has led to serious adverse outcomes, particularly when the mix-up has involved a vaccine and a high-alert medication. For example, vials of insulin have sometimes been mistaken for influenza vaccine, and various neuromuscular blocking agents have been used to reconstitute vaccines or were mistaken for hepatitis B or influenza vaccine.

ISMP recommends that vaccines be stored in stand-alone refrigerators or pharmacy grade/purpose-built refrigeration units (and freezers in the pharmacy), not in dormitory-style or combination units that both refrigerate and freeze. Regular temperature monitoring is necessary. Technology is available to enable continuous temperature-monitoring devices that can alert staff via electronic messages (e.g., email, text) and audible alarms if a unit is outside of the specified range. Vaccines should be separated into labeled bins or other containers according to vaccine type and formulation, keeping vaccines with their corresponding diluents. Never store different vaccines in the same bin/container. Do not store vaccines with similar labels, names, or abbreviations, or vaccines with overlapping components, immediately next to each other or on the same shelf. Separate the storage areas of pediatric and adult formulations of vaccines. Label the specific locations where vaccines are stored to facilitate correct, age-specific selection and to remind staff that some vaccines have two components in separate vials that need to be combined before administration.

Part 3 will appear in next month’s issue of P&T.

REFERENCES


The reports described here were received through ISMP’s Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on www.ismp.org or relayed directly to ISMP by calling 1-800-FAIL-SAFE or via email at ismpinfo@ismp.org.