Updating a medication system
Avoiding insulin errors in hospitals
Improving I.V. infusion safety
Testing a TPN management system
Q. I’m responsible for the actions—and errors—of the pharmacy technicians I supervise. How can I best protect myself from the risks this responsibility entails?

A. You have two tools: Education and supervision. The most reliable educational safeguard is hiring only pharmacy technicians who are certified by the Pharmacy Technician Certification Board (http://www.ptcb.org). Unfortunately, this certification is largely voluntary, although some state boards of pharmacy are now beginning to require it. If yours doesn’t and you have technicians on staff who aren’t certified, encourage them to pursue certification.

Use on-the-job training to upgrade your technicians’ skills, even those who are certified. Give them a written policy and procedures manual, which can reduce the risk of miscommunication. Monitor all technicians to be sure they abide by procedural protocols. Do periodic checkups on crucial details to establish what training is still necessary.

Encourage your technicians to learn everything about patient safety and risk reduction by taking advantage of educational opportunities, joining professional organizations, such as the American Association of Pharmacy Technicians (http://www.pharmacytechnicians.com), and abiding by professional codes of ethics.

Q. What’s the difference between occurrence and claims-made insurance policies?

A. An occurrence policy covers you for any incident that occurs during the term policy, regardless of when the claim is filed. As long as the incident occurred when the policy was active, regardless of when you were named in a lawsuit, you’re covered. A claims-made policy also provides coverage for an incident that occurs during an active policy period, but only if the claim is filed during that period.

What’s key with a claims-made policy is that you run the risk of not being covered for a claim discovered after the policy has expired. Therefore, if you decide to terminate a claims-made policy, you’ll need to purchase tail coverage to continue to protect yourself. This will extend the time that a claim can be reported, although the incident must happen while the policy is active or you won’t be covered.

Also, a claims-made policy can typically cost less than an occurrence policy for the first 3 to 6 years (the premium can increase up to 30% a year). That may seem like a big difference in price, but by purchasing a claims-made policy and tail coverage, you can end up spending as much as or more than you would if you purchased an occurrence policy.

LAST YEAR, THE STAFF at The Medical Center in Bowling Green, Ky., reached a crossroads with our medication-use system. We had ambitious plans to advance medication safety and improve patient care—including the use of bar-coded medications at the point of care. But we realized that we couldn’t attain our goals using the same systems and processes that we’d relied upon for the past decade.

We had two main problems. First, we simply didn’t have a foundation for the comprehensive use of bar-coded medications, processes, and the associated technology. Second, all medication-dispensing processes for both pharmacy and nursing were manual. Filling—and dispensing from—multiple unit-based cabinets consumed a lot of time. Clearly, a change was needed.

Today, we have a much-improved bar-coding system and we’ve changed the way we dispense and move medications from the central pharmacy. Our process for transforming the medication-use system is ongoing. The transitions haven’t always been easy and they haven’t come cheap—at least on the front end. But the payback has been immediate and inspiring:

- Adverse drug events (ADEs) are down 10%. The largest area of improvement has been seen with the near-misses, especially errors from mistakes in refilling the unit-based cabinets.

- Staff pharmacists are spending twice as much time on clinical activities.

- Pharmacy technician productivity is up 33%.

We also were fortunate to have a before-and-after system benefits analysis conducted by Shack & Tulloch, Inc., an economic consulting firm from Rochester, N.Y. This quantitative, independent research validated our strategy and results.

**Processes past their prime**

For most of the previous decade, our facility had used a fully decentralized medication-dispensing system with unit-based cabinets as the focal point. Nurses could count on having up to 90% of the medications they needed in the cabinets on their units. In pharmacy, our job was to make sure the cabinets were always well stocked. This type of a profile system from the unit-based cabinets requires the pharmacist to verify a patient’s medication orders in the computer before these medications are available for nurses to administer. Although this system for administering medications seems convenient for nurses because it gives them quick access to medications once a pharmacist reviews the orders, it can slow down the medication administration process. Nurses administered nearly 190,000 doses per month from cabinets, creating traffic jams around the cabinets during “normal” med passes. Waiting in line to get medications wasted nurses’ time, delayed patient care, and prevented nurses from doing other patient care activities.

Meanwhile, our pharmacists were spending 90% of their time on repetitious order entry and on manual dispensing, checking, and distribution activities for multiple
units throughout the hospitals. This left precious little time for clinical activities on the nursing units.

Decentralized control also created other burdens for both nurses and pharmacists—for example, an increased risk of potential medication errors due to misfills. The number of expedited orders—and the time we spent tracking down orders—was growing due to medication “stock outs” (when the needed medication wasn’t available). Tracking and eliminating expired medications was increasingly problematic. And storing medications in cabinets led to overstocking some drugs, which was costing us money.

Clearly, the decentralized model had not only run its course at our facility, but it was also inhibiting our progress.

Our makeover begins

Ultimately, our challenge was to give nurses ready access to medications while regaining control of medication-administration workflow and inventory. After a thorough self-examination, we decided that we needed to automate critical processes for both safety and productivity reasons.

Reengineering our processes required executive sponsorship, a strong commitment to change management, and a total team effort involving pharmacists, nurses, physicians, finance personnel, and the information technology staff. The result of several months of discussion, discovery, and planning was an aggressive yet realistic business case with reasonable execution parameters.

Our plans called for replacing the decentralized dispensing system in favor of a hybrid medication distribution system. This meant centralizing medication control in the pharmacy and limiting dependence on our unit-based cabinets as “be-all and end-all” dispensing devices. Another requirement: The solution had to support our new bar-code scanning strategy and seamlessly integrate all pharmacy and clinical systems.

Ultimately, after reviewing different systems, we aligned our medication-use processes on central pharmacy technology featuring the McKesson ROBOT-Rx system and MedCarousel technology. These solutions automate the storage, dispensing, returning, restocking, and inventory control of bar-coded, unit-dose medications. To ensure that a continuous supply of bar-coded medications is available in unit-dose form, we turned to McKesson’s Pak-Plus-Rx packaging service.

Now, about 60% of the most commonly prescribed bar-coded medications are dispensed automatically from the ROBOT-Rx system in white envelopes. Medications not inventoried in ROBOT-Rx, such as topicals or certain injectable drugs, are dispensed from the MedCarousel. Pharmacy personnel transport the envelopes to the respective nursing units and refill the unit-based cabinets.

The next phase of our transformation will involve using ROBOT-Rx to dispense patient-specific medications into the envelopes, and then transport the envelopes directly to nursing units. This will be a big timesaver for nurses, because they won’t have to administer each dose from the unit-based cabinets. Everything nurses need for each patient will be in the envelope.

Four key goals

At the outset, we established four main goals: enhance medication and patient safety; boost productivity and efficiency; reduce medication inventory; and improve financial performance. Here’s how we fared against our stated goals, as measured by Shack & Tulloch’s quantitative study:

1. Enhance medication and patient safety. From the start, we wanted to establish a bar-code-based foundation for future automated medication administration. We also wanted to increase pharmacist-patient interventions on the nursing units.

Freed from time-consuming, manual tasks, 1.5 pharmacist full-time equivalents (FTEs) were redeployed from distribution to clinical activities—a 200% increase. This is leading to more effective and less costly patient care, with projected annual savings of more than $200,000 for the hospital.

Furthermore, with more pharmacist time available for patient care, we conservatively project a 10% decrease in ADEs—a savings valued at $112,000 a year.

2. Boost productivity and efficiency. Using the ROBOT-Rx and MedCarousel automated technologies and the Pak-Plus-Rx service dramatically improved productivity among both our pharmacists and pharmacy technicians.

Previously, pharmacists spent 90% of their time com-
pleting manual order entry and performing dispensing functions. Now, ROBOT-Rx and MedCarousel dispense 90% of all medications. The amount of time our pharmacists devote to clinical activities has doubled, and the time that pharmacy technicians spend in manual activities associated with refilling unit-based cabinets has decreased 33%. And with the PakPlus-Rx service accounting for bar-coded, unit-dose medication packaging requirements, we redepolyed 0.4 pharmacists and 1.4 FTE technicians to other critical areas in the pharmacy.

The nursing staff is happy with the changes in the medication-use process so far. There are fewer errors found from refills in the unit-based cabinets and fewer stock outs. The new bar-coded medication label from Pak-Plus-Rx is much easier to read than many manufacturers’ labels and labels the pharmacy previously used for repackaging medications. Early measurements of the system have shown time-efficiency improvements, as well as fewer medication errors. We’re continuing to measure these results.

3. Reduce medication inventory. Our new systems and processes have paid us back with substantially improved medication inventory management systems. This has resulted in much lower costs and better patient care. For instance, we:
- reduced inventory by 20% at each medication cabinet, saving $121,000 a year.
- buy medications in bulk, reducing our overall drug spending by 30%, saving $39,000 a year.
- cut the number of expired medications by 90%, saving $13,500 annually.
- anticipate a reduction of the overall number of unit-based cabinets within 2 years, saving $125,000 a year.

4. Improve financial performance. Although the focus of our project was enhancing patient safety, overall, we’ve seen some impressive numbers and a favorable financial outlook. The financial analysis was based on potential savings and the costs associated with the Robot-Rx, MedCarousel, and PakPlus-Rx. These figures don’t include any renovation of the pharmacy department. We’ve:
- gained a net economic benefit of $691,000.
- achieved a 59% return on investment for the life of the 5-year project. (Estimating that the cost of capital for a community medical center ranges between 6% and 10%, Shack & Tulloch characterized our results as “outstanding.”)
- projected a payback period of 1.8 years.
- reduced our financial risk from a major medication error—essential for a health system like ours, which is self-insured.

Furthermore, the pharmacy project will help us meet our goal of going to a 100% bar-coded system for automated medication administration.

**Happier workforce, safer patients**

Overall, the internal and external analyses—and the real-world, day-to-day experiences of both our nurses and pharmacists—demonstrate that our medication-use makeover has had an immediate impact and will have a lasting impact on our facility. By automating what previously was redundant—manual labor—we’ve made the first important steps in enhancing the safety of the medication process. Patients expect that they’ll get the correct medication, and automating the dispensing function helps to achieve this expectation. This project has made pharmacists’ and technicians’ jobs more efficient and freed nurses’ time for patient care, which has also had a positive impact on patient safety.

The entire process also has energized us, and we’re studying ways to make further improvements, such as reworking med stations to maximize efficiency, monitoring medication trends to improve patient safety, and incorporating new metrics to measure and quantify time and monetary savings.

But the bottom line is that our patients are safer, our workforce is happier, and our cost savings are enabling future initiatives. By any standard, that’s quite a makeover.

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Source: Adapted with permission from “Case Study: Measuring the Benefits of a Hybrid Medication-Use System” by M Joyce, PharmD, FACHE, FAPhA. Pharmacy Purchasing and Products. 34:24, May 2006.
Just what the pharmacist ordered

Putting a new TPN management system to the test.

By Rich Monty, RPH

EACH DAY, PHARMACY technicians, pharmacists, and pharmacy managers face the same challenge: increasing efficiency within the pharmacy without compromising safe patient care. Compounding requires speed, strict attention to aseptic technique, and a high degree of accuracy. Yet most pharmacists would agree that compounding demands have far outpaced the technology on which they rely. For example, the total parenteral nutrition (TPN) compounding technology found in most intravenous (I.V.) admixture pharmacies was developed more than two decades ago. So we welcomed the opportunity to serve as a beta site for a new TPN management system that promises more functionality than traditional compounders.

As beta-site participants, staff members were trained on the system’s hardware and software components. The pharmacists and I.V. mix technicians closely monitored and documented the system’s functionality.

Many ways to “save time”
Most admixture pharmacies are ramping up to comply with the new USP <797> regulations,* and time has become a crucial factor in the busy compounding environment. Being pressed for time impacts more than just technician workload—it can also cause errors related to compounding sterile products. So our technicians were pleased to discover the new compounding system helped save them time on several levels, outperforming our current commercially available compounder by about 33%. In high-volume or time-sensitive environments such as hospitals and home care, a faster system enhances patient care.

Saving time, however, doesn’t make a compounder “superior”—it must be safe, accurate, and easy to operate as well. TPN formulations can be complex, requiring numerous time-consuming calculations for a single order. Checks and balances minimize the chance of mechanical or human error. To address this concern, the new compounder has a management system designed to reduce errors and help ensure the safety of prepared TPN solutions, including bar-code confirmation—technology the Institute for Safe Medications Practice recognizes as a positive factor in reducing medication errors.

The system also provides an easy step-by-step comprehensive tutorial for both pharmacists and pharmacy technicians. The tutorial guided our staff through an easy 40-minute teaching session. Our I.V. mix technicians were eager for the hands-on experience, and the comfort level between them and the compounder seemed instantaneous.

To assist staff on the job, a real-time help feature was available to clarify error codes and offer corrective actions to resolve them. Personnel could even pick up where they left off in the compounding process if an error occurred—another way in which the system increased our technicians’

Technology details
Preferred Homecare participated in beta-site testing for the Pinnacle TPN Management System from B. Braun Medical, planned for introduction in January 2007. Pinnacle is the first Windows-based TPN system to incorporate Trissel’s Ca/P Check Software, providing automated TPN calculations for nutritional assessment, aluminum calculations/warning, and calcium/phosphate checks, along with bar-coding technology, automatic quality checks throughout the TPN process, and a compounding speed of 1 liter in less than a minute.

*USP <797> provides standards of care for sterile pharmaceutical compounding. Its schedule for implementation is January 1, 2008. Based on USP <797> guidance on automated compounding devices for parenteral nutrition, the system discussed in this article helps improve USP <797> compliance. It lets us monitor and improve quality control with multiple quality control checks, and offers documented compounding operations and accuracy, validated equipment, customizable daily checklists requiring completion of standard operating procedures that ensure proper environmental monitoring of the compounding hood, and automatic calibration, which is required before any compounding begins.
efficiency. Pharmacy I.V. mix technicians reported the hardware and software components to be “user friendly,” featuring Windows-based drop-down menus, a recall feature for batch compounding, and a training module built directly into the software that provides training and user assessment for new users. The context-sensitive help feature proved especially valuable, and when we had questions that the computer program couldn’t answer, we contacted our vendor.

As a beta site, of course, we helped to work out any bugs in the program before its pending release. We did run into a few glitches, but none of them affected the safety of our I.V. production and all were quickly addressed with software updates.

**Safety from compounder to patient**

At every stage of the compounding process, multiple features help ensure accuracy and patient safety. For example, the system offers integrated access to Trissel’s Ca/P Check Safety Software, which provides an online reference to make informed decisions about potential calcium phosphate precipitate.

Bar codes are located directly on the solution bags, so when TPN solutions reach the confirmation process, pharmacists can scan them—a valuable double-check before initiating compounding. The step-by-step confirmation process was easy to use, with built-in hard stops for incorrectly hung solutions. These checks help ensure our pharmacists would use the correct solution when compounding for specific patients, particularly important for neonatal and pediatric patients. The system also provided extensive compounding reports, such as specific user productivity, pharmacist confirmation, and quantity of solutions used.

Secure access was ensured as each pharmacy technician and pharmacist was assigned his own ID number, which was associated with different security access and authorization levels. Pharmacists could enter their password into the software or use their bar-coded ID badge for TPN confirmation.

The system’s software also has customizable order templates and patient profiles for prescriber order entry and pharmacist review/approval, allowing direct electronic communication between prescribers and pharmacists. This helps ensure the right patient gets the right dose of the right drug.

In the end, it was the checks and balances provided at every level for each individual touching the compounding process that inspired our whole staff’s confidence that we could use this system to both help save time and improve patient safety.

Rich Monty is pharmacy manager, Preferred Homecare, Mesa, Ariz.
INSULIN WAS ONE of the most important and beneficial drug discoveries of the 20th century. Its therapeutic benefits are undeniable when health care processes are designed with appropriate safeguards. However, preventable patient harm associated with errors involving insulin use continues to be a problem in many hospitals. Despite the substantial attention to medication safety in general, and insulin safety specifically, evidence over the past 10 years suggests that patient injuries are still occurring. Insulin consistently appears as a top offender, leading to the most harmful and severe adverse events on the list of high-alert drugs published by the United States Pharmacopeia (USP) and the Institute for Safe Medication Practices (ISMP).

The American Society of Health-System Pharmacists (ASHP) issued a report, Professional Practice Recommendations for the Safe Use of Insulin in Hospitals, which is designed to help health care organizations and practitioners improve the safety and effectiveness of insulin use in hospitalized patients. It offered a comprehensive set of recommendations incorporating and citing numerous and diverse resources, including those specifically for pharmacists, discussed in this article. The list of best practices characteristics was adapted by the ISMP, which has successfully assisted organizations in medication-safety assessments and guided improvements. Each of the recommendations includes its own set of references, which you can use as sources of additional information and specific details that will be necessary for effective implementation of safer insulin practices within health care organizations.

Background and statement
Among patients discharged from hospitals, 12% have a diabetes diagnosis, and up to 25% of all hospitalized patients meet the criteria for the diagnosis of diabetes. Factors such as medications and stress cause many nondiabetic patients to develop hyperglycemia while hospitalized. Insulin is used in both of these populations to manage hyperglycemia. With such frequent use of insulin comes the risk of error and subsequent patient harm. Types of insulin-use errors include:
• administration of a wrong dose
• administration to the wrong patient
• use of the wrong insulin type
• administration via the wrong route
• wrong timing of doses
• omission of doses
• failure to properly adjust insulin therapy
• improper monitoring, timing, and assessment of blood glucose (BG) results.

Pharmacy practices related to insulin therapy play a central role in safe insulin therapy for hospitalized patients. Critical components include access controls, such as limitations on stocked items, safe storage, and restricted access to insulins and pharmacy-based insulin product preparation practices. Due to the variable nature of insulin therapy in hospitalized patients, traditional safety-based control practices, such as unit dosing, aren’t always possible. Implementation of other safety strategies is required.

Pharmacists’ review of insulin orders and therapy is often limited because of inadequate access to patient-specific information. They may also be hampered by inefficient processes. Improving both access to information and training in appropriate data assessment will help pharmacists improve insulin safety. Use the following chart as a guide to ensuring best practices for the safe use of insulin in your facility.
Order review, distribution, preparation, and dispensing

The pharmacy should routinely stock only those insulin products approved by the Pharmacy and Therapeutics Committee or other responsible body. The organization should use a single “brand” source for each insulin type. Product safety should be considered in the approval process.

Pharmacists should have the therapeutic skills and knowledge of organization-specific practices to competently review insulin therapy–related orders and to prepare and dispense insulin products.

The pharmacy should establish a standard process for pharmacist review of insulin orders.

The pharmacy computer should include appropriate alerts and decision support elements to reduce error risk.

Pharmacy technicians involved in distribution and preparation of insulin products should be educated regarding the high-alert status of insulin, appropriate safety practices, and consequences of error.

All orders for insulin should be reviewed by a pharmacist before administration except in an emergency when the drug is under the direct supervision of a licensed independent practitioner.

Insulin order review should include:

1. positive patient identification using two identifiers.
2. completeness of order.
3. appropriate regimen for specific insulin products.
4. appropriateness of doses and dose regimens.
5. timing of doses in relation to meals.
6. monitoring of BG has been ordered.
7. appropriateness of dosage adjustments.
8. potential drug interactions.
9. potential for error and confusion.
10. presence of orders for treatment of hypoglycemia.

The following information is readily available to the pharmacist reviewing insulin orders:

1. indication for use of insulin
2. insulin-dependent status (that is, whether patient is insulin-deficient)
3. goals of insulin therapy
4. patient comorbidities
5. concurrent medications
6. prior insulin use and response
7. patient age, weight, and height.

Required actions when insulin orders are incomplete, ambiguous, or raise any concerns should be clearly defined.

Archived information regarding a patient’s medication use for past hospitalizations is readily available.

Pharmacists should independently check weight-based dose calculations for all insulin doses ordered for patients weighing less than 50 kg, or those ordered using a weight-based dose equation.

The pharmacy computer should alert the pharmacist when orders for insulin fall outside predetermined dose limits based on total amount of insulin or based on a unit-per-kilogram basis. A limit using unit per kilogram should be used for all patients weighing less than 50 kg.

References/resources*

ASHP, ISMP, JCAHO

ASHP, Fajtova, ISMP, JCAHO, Kowiatek, Smith

ISMP, JCAHO

ISMP

ISMP

ISMP, JCAHO

ASHP, Clement, ISMP, JCAHO, Kowiatek, Smith, USP

Baldwin a, Fajtova, Clement, Grissinger 2003a, ISMP, JCAHO

ISMP, JCAHO

ISMP

ISMP, JCAHO

*See list at the end of the document for full citations. (Note: References printed in italics include sample order sets/protocols.)
<table>
<thead>
<tr>
<th>Order review, distribution, preparation, and dispensing (con’t)</th>
<th>References/resources*</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pharmacy computer should be directly linked to the laboratory computer, or the reviewing pharmacist should have real-time access to the laboratory computer.</td>
<td>ISMP, JCAHO</td>
</tr>
<tr>
<td>The pharmacy should have easy access to point-of-care (bedside) BG monitoring results.</td>
<td>JCAHO, ISMP</td>
</tr>
<tr>
<td>The pharmacy should be informed when insulin-deficient patients are admitted or identified. The pharmacy should contact prescribers when insulin is not ordered or is discontinued for identified insulin-deficient patients.</td>
<td>Clement, JCAHO</td>
</tr>
<tr>
<td>Insulins should be purchased, obtained, and stored in the pharmacy in such a manner as to reduce the chance of wrong product selection.</td>
<td>ASHP, ISMP</td>
</tr>
<tr>
<td>1. Look-alike/sound-alike products should be separated within storage areas (refrigerators).</td>
<td>ASHP, ISMP, JCAHO, Smith, Santell, USP</td>
</tr>
<tr>
<td>2. Only regular insulin (lispro and aspart if subcutaneous insulin pumps are also prepared) should be stored in the parenteral products area.</td>
<td>ASHP, ISMP, JCAHO, Smith, Santell, USP</td>
</tr>
<tr>
<td>3. Appropriate labels/signs and separation should be used to differentiate insulin products and reduce risk of wrong product selection.</td>
<td>ASHP, ISMP, JCAHO, Smith, Santell, USP</td>
</tr>
<tr>
<td>4. TALLman lettering should be used in labeling of insulin storage areas.</td>
<td>ASHP, ISMP, JCAHO, Smith, Santell, USP</td>
</tr>
<tr>
<td>Pharmacists should be specifically trained to enter insulin orders into the pharmacy computer system so as to produce organization-established labels, warnings, medication administration records, and patient profiles.</td>
<td>ASHP, ISMP, JCAHO, Smith, Santell, USP</td>
</tr>
<tr>
<td>The pharmacy computer should include appropriate alerts to reduce the risk of error in prescribing. Pharmacy computer systems should alert pharmacists to unsafe orders, appropriateness of dose regimens, drug-dietary interactions, prompt use of organization-specific protocols, and orders for BG monitoring. Pharmacy computer systems should include proper formatting, structure, and alerts to reduce risk of error from confusion related to various insulin products.</td>
<td>ISMP</td>
</tr>
<tr>
<td>If computerized prescriber order entry is available, the system should interface with the pharmacy system.</td>
<td>ISMP</td>
</tr>
<tr>
<td>An independent double check (properly documented) or machine-readable verification should be required whenever insulin products are dispensed from the pharmacy or placed in unit-based medication dispensing cabinets.</td>
<td>ISMP</td>
</tr>
<tr>
<td>The pharmacy should dispense individual supplies of insulin products labeled with specific patient name and second identifier (insulin products should not be shared among different patients). If doses of insulin are included on the label, they are listed as &quot;units&quot; or &quot;units = ml!&quot;, but not &quot;ml&quot; alone.</td>
<td>ISMP</td>
</tr>
<tr>
<td>The pharmacy should prepare individual patient-scheduled doses of intermediate (NPH) or long-acting insulins (glargine, detemir) unless these products are provided as individual patient insulin devices (insulin pens) or given mixed with short-acting agents (NPH).</td>
<td>ISMP</td>
</tr>
<tr>
<td>Insulin administration devices (Innolets) should be labeled on the device itself, not the removable cover.</td>
<td>—</td>
</tr>
<tr>
<td>The pharmacy should use appropriate auxiliary labels to alert and differentiate insulin products when appropriate.</td>
<td>ISMP</td>
</tr>
<tr>
<td>Floor stocks of insulins should be minimized or eliminated. If floor stocks of insulin are available, only regular insulin should be available as a stock item on patient care units. Access to the floor stock supply should be limited and controlled. Removal from floor stock should require an independent second check prior to administration. Specific clinical situations requiring access to floor stock insulin (e.g., severe hyperkalemia) should be defined and monitored. In such emergencies, an independent double check by two professionals should occur.</td>
<td>ISMP, JCAHO, Smetzer, USP</td>
</tr>
<tr>
<td>Order review, distribution, preparation, and dispensing (con’t)</td>
<td>References/resources*</td>
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<td>---------------------------------------------------------------</td>
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<tr>
<td>Insulin should not be available to be removed from unit-based medication dispensing cabinets without review of insulin orders by a pharmacist. If override of controls is allowed (and must be defined by the organization) in emergencies, an independent double check by two professionals should occur and an explanation for override provided. When removed, insulin products should be properly labeled with the patient’s name and second identifier, as well as expiration date.</td>
<td>ISMP, JCAHO</td>
</tr>
<tr>
<td>Insulin should not be available to be removed from unit-based medication dispensing cabinets without review of insulin orders by a pharmacist. If override of controls is allowed (and must be defined by the organization) in emergencies, an independent double check by two professionals should occur and an explanation for override provided. When removed, insulin products should be properly labeled with the patient’s name and second identifier, as well as expiration date.</td>
<td>ISMP, JCAHO</td>
</tr>
<tr>
<td>Insulin products should be maintained in a secure manner at all times.</td>
<td>ISMP, JCAHO</td>
</tr>
<tr>
<td>All insulin infusions and diluted insulins should be prepared in the pharmacy.</td>
<td>ASHP, ISMP, JCAHO, USP</td>
</tr>
<tr>
<td>A limited number of standard concentrations are used for insulin infusions. All insulin infusions will undergo an independent double check prior to dispensing.</td>
<td>JCAHO, ISMP</td>
</tr>
<tr>
<td>A limited number of standard insulin dilutions should be prepared using appropriate diluting solution. All insulin dilutions should undergo an independent double check prior to dispensing. Special warnings and labels should be considered for placement on the diluted insulin to alert caregivers.</td>
<td>Clement, ISMP, JCAHO</td>
</tr>
<tr>
<td>All insulin products should be measured using appropriately sized insulin syringes marked in “units.” Tuberculin and other syringes should not be used unless preparing I.V. solutions requiring doses greater than 100 units.</td>
<td>ADA 2005a, Clement, ISMP</td>
</tr>
<tr>
<td>All pharmacy-prepared parenteral insulin products should be prepared in compliance with USP Chapter 797 standards.</td>
<td>USP, ASHP</td>
</tr>
<tr>
<td>Institutional procedures should be established regarding potential insulin dose delivery variability due to binding to I.V. bags and tubing. Procedures should be established to minimize dose variability when I.V. tubing is changed. Considerations should include insulin concentration, infusion flow rates, clinical application, and patient characteristics.</td>
<td>Ling, USP</td>
</tr>
<tr>
<td>The dextrose content of I.V. drug solutions used in insulin therapy patients should be assessed and communicated to other patient caregivers.</td>
<td>Krajicek</td>
</tr>
<tr>
<td>Pharmacy-generated medication administration records (MARs) should include specific administration times or time prior to meals for all standing insulin doses.</td>
<td>Clement, ISMP, Gilman, Manning, Smith</td>
</tr>
<tr>
<td>Pharmacy-generated MARs should include appropriate warnings and alerts related to insulin therapy.</td>
<td>ISMP</td>
</tr>
<tr>
<td>When a patient is prescribed more than one type of insulin, pharmacy-generated MARs should clearly discriminate between insulin types.</td>
<td>ISMP, JCAHO, Smetzer</td>
</tr>
<tr>
<td>The pharmacy should routinely inspect patient care areas for unauthorized, unlabeled, and nonsecure insulin products and actively remove any unauthorized insulin products from patient care units.</td>
<td>ASHP, ISMP, JCAHO</td>
</tr>
<tr>
<td>Insulin should never be borrowed from or shared with another patient.</td>
<td>ISMP, JCAHO</td>
</tr>
<tr>
<td>Insulin should not be stored at the bedside unless secure and under the control of the nurse, even when patients are performing self-management. When insulin is needed, the insulin should be obtained and provided to the patient for observed administration, then returned to the secure storage area.</td>
<td>JCAHO</td>
</tr>
<tr>
<td>Use of a patient’s own insulin supply is allowed only as defined by organizational policies. If the patient’s own insulin is allowed, independent verification of the product by pharmacist, nurse, or prescriber is performed and documented.</td>
<td>—</td>
</tr>
</tbody>
</table>
Order review, distribution, preparation, and dispensing (con’t)

Nonformulary insulin products should be obtained and dispensed according to institutional policies and procedures. Prior to dispensing a nonformulary insulin product, appropriate communication, staff education, and safety measures should be implemented.

The pharmacy should establish a process for ongoing review of changes in insulin orders, and pharmacists should routinely review patient responses to ordered insulin therapy and make suggestions for changes when appropriate.

Pharmacists should communicate with prescribers, nurses, dietitians, patients, and others to coordinate insulin therapy.

Pharmacists with special training or knowledge/experience in the management of insulin therapy in hospitalized patients should be available for consultation.

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American Society of Health-System Pharmacists (ASHP) http://www.ashp.org
Joint Commission on Accreditation of Healthcare Organizations (JCAHO) http://www.jcaho.org

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Optimize I.V. infusion safety with a comprehensive approach

To improve vascular therapy and best comply with JCAHO’s 2006 National Patient Safety Goals, evaluate key recommendations as part of a well-rounded safety protocol.

By Mike Brown, RN, CRNI, BA

THE PRICE OF MEDICATION ERRORS is staggering, whether calculated in health care dollars due to extended stays, reduced quality of life due to adverse events, or damaged reputations of health care institutions due to patient deaths. Consider the following:

- Adverse drug events cause more than 770,000 injuries or deaths each year and cost up to $5.6 million per hospital.¹
- Patients who suffer unintended drug events remain in the hospital an average of 8 to 12 days longer than patients who don’t experience such mistakes. This means their hospital stays cost $16,000 to $24,000 more.¹
- Financial issues add to the burden of adverse events. One study found that all adverse events assessed were associated with increased costs—for example, the cost of care for patients who developed pneumonia while in the hospital rose by 84%. Treating pneumonia raised total treatment costs per patient from $22,390 to $28,505, while the length of stay increased from 5.1 to 5.4 days and the probability of death climbed from 4.67% to 5.5%.²

Pharmacy automation

Intravenous (I.V.) medication safety begins in the pharmacy, and computerized pharmacy information systems are essential for any hospital-based pharmacy to maintain patient safety while realizing optimal efficiency. Computerized systems help eliminate transcription errors, while preprogrammed dose limits provide an additional layer of security.

New integrated I.V. medication safety systems extend the reach of pharmacy information systems onto the patient-care units. Instead of generating a printed infusion order, pharmacists can generate a bar-code label that contains all the infusion parameters—and patient information—for each I.V. solution. It’s almost as if pharmacists are on the floor with clinicians.

Standardized sets and line tagging

Intravenous set standardization can eliminate costs, reduce confusion, and help minimize infection risk. Many hospitals stock literally dozens of I.V. sets with different drop factors for various infusion devices and needs. In some cases, using the wrong I.V. set can increase costs, and using dual injection-site sets may increase infection risk. The use of multiple sets may result in mismatches, such as wrong size roller clamps, which are difficult to regulate and may increase the likelihood of overinfusion. Agreeing on a single infusion device with standard and specialized sets may help eliminate the confusion and reduce costs that excess stocking can cause.

As patients move from unit to unit—and I.V. sets are changed and new I.V. solutions added—careful and consistent tagging of I.V. lines across the hospital continuum becomes critical. To ensure patient safety, clinicians should establish house-wide tagging standards, including the use of color coding to distinguish among the various types of lines in use, standardized labeling to avoid cross-unit con-
fusio n, and incorporation of the date and time of first use on each set.

**Updated devices, centralized distribution**

Eventually every technology reaches the end of its usable life. Hospitals may save money by not investing in new infusion pumps, but patient-care costs can easily outweigh the savings. Older technologies are more prone to failure—batteries can be unreliable, displays can malfunction, and devices may become inaccurate. Moreover, errors can negatively impact patient outcomes and increase hospital stay and risk—all of which translates into increased costs.

In addition, older technology may cause excessive nuisance alarms. Dissatisfied with equipment, clinicians may either silence alarms, which could result in missed sentinel

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**Beyond pumps: Smarter infusion systems**

I.V. medication safety systems avert high-risk-of-harm errors and provide actionable data.

By Sharon K. Steingass, RN, AOCN, MSN

When seeking to improve patient safety, your goal is to change the system, making it easier to do the right thing; build high-reliability organizations; and prevent individuals from committing errors or doing harm. Technology proves essential to reducing risk in medication delivery.

Prioritizing technology investments should focus first on the phase of medication delivery most vulnerable to error—administration. Then, consider this: High-risk medication infusion errors are most likely to cause harm.

Medication delivery technologies include computerized prescriber order entry (CPOE), bar-code technology, and “smart” I.V. medication safety systems. Compared to the other technologies, an I.V. medication safety system is associated with lower costs and more rapid implementation, and it provides the most immediate positive bedside impact. The Institute for Safe Medication Practices and the Emergency Care Research Institute recognize I.V. medication safety systems as vital to reducing medication-related errors.

In the past, I.V. infusion systems didn’t include dosing limits. Traditional I.V. pumps let nurse’s program infusions anywhere from 0.1 to 999 mL/hr. But the newest I.V. medication safety systems alert clinicians if a programmed dose exceeds institution-established limits before infusion begins, reducing the risk of over- or under-infusing critical medications. Smart I.V. medication safety systems allow for software customization to achieve the greatest impact on optimizing I.V. medication administration. Software customization requires a team approach. Nurses, pharmacists, and prescribers should review and evaluate current organizational I.V. practices and establish best-practice standards for the delivery of I.V. medications. An infusion system becomes “smart” when the customized data set is incorporated into the software that guides nurses at the point of administration. Modular-based smart infusion systems guide nurses through various types of I.V. administration (large volume, syringe, and patient-controlled analgesia) off a single platform.

More than “just a pump” or “smart pump,” an I.V. medication safety system becomes an information technology component that impacts care delivery hospital-wide and reports back to a central server. View selection and implementation of I.V. medication safety technology as a long-term decision. I.V. medication safety systems also provide previously unavailable data on the numbers and types of averted errors (“near misses”); for example, peak times for errors in administrating high-risk medications such as potassium, or sedation overuse in the ICU. Data analysis can help an organization reevaluate workflow, adjust high-risk medication delivery, and revise policy to reflect evidence-based best practices. Recently introduced networking capabilities allow real-time data collection and monitoring.

Conventional error reporting through convenience samples or case reports usually doesn’t clearly identify risk reduction opportunities. The ability to continuously collect data throughout the organization is what truly differentiates an I.V. medication safety system from a pump or smart pump. Computerized infusion systems become a repository of ongoing quality data about I.V.-related practices, which lets organizations easily identify and implement strategies to reduce high-risk-of-harm errors.

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events, or bypass the infusion pump altogether when administering secondary medications, using full-length tubing at much higher costs. Nuisance alarms may also increase the need for unscheduled restarts due to catheters cloting off or infiltration; these restarts are one of the most common causes of needle-stick injuries.³

Malfunctioning devices may be shoved into a corner rather than taken out of service for repair or replacement. Any malfunctioning device on a patient care floor presents a clear and present danger to patient safety.

Infusion devices are a hot commodity in the unit, but clinicians spend precious time locating infusion devices—time better spent providing hands-on patient care. As a result, hoarding, hiding, and stockpiling infusion devices on a floor have become an all-too-common practice in many institutions.

This causes multiple problems for biomedical engineers charged with maintaining and updating equipment and could pose serious patient-safety issues, especially in pumps with preprogrammed drug libraries. With hundreds of pumps in circulation, finding, finding, and troubleshooting them can quickly become a mammoth task. However, through a centralized distribution system, biomedical engineers can bring order to chaos, maintain optimal operation of infusion pumps, and help ensure patient safety.

Avoiding manual programming

Manual programming of infusion devices is one of the most common causes of medication errors in hospitals. A missed key or misplaced decimal can have dramatic consequences. Some manufacturers have tried to address this problem through onboard drug libraries, with limited results.

For example, these libraries can accommodate only a limited number of the most common medications, while hospital pharmacists prepare hundreds of admixtures every day. Additionally, onboard libraries must be continuously updated. As the previous example demonstrated, simply locating all the infusion pumps in a hospital can be a monumental task. Wireless systems that can update pump libraries from a central location are promising but limited because all the pumps must be turned on and functioning to be updated. With pumps hidden in closets or stockpiled in hallways, a biomedical engineer still may need to manually confirm that each pump has been updated.

A new generation of infusion devices that are automatically programmed based on bar-code data generated in the pharmacy and affixed to the I.V. medication bag may provide a solution to such medication errors. One available infusion safety system generates titration instructions from the pharmacy rather than an onboard drug library. Biomedical engineers no longer need to update on-pump libraries with new drugs or titration instructions, and users don’t have to manually program pumps on the floor.

Going needle-free

For nearly 20 years, medical device manufacturers have recognized the need for safety devices to prevent sharps injuries. In fact, from 1984 to 1996, more than 1,000 patents were issued for safety devices designed to prevent needle sticks. Devices now available enable the injection, aspiration, or infusion of fluids or medications—including blood, blood products, lipids, or total parenteral nutrition—through a completely needle-free system.

Many hospitals have instituted sweeping needle-safety protocols and programs in accordance with new federal regulations. Efforts like these should reduce not only medication errors, but also the costs associated with them. For more information concerning medication errors or patient safety, tap into professional associations’ Web sites. (See Selected Web sites.)

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Mike Brown is branch director for Gentiva Health Services in East Stroudsburg, Pa. He has over 15 years of clinical and managerial experience in infusion therapy practice and is an active member of the Infusion Nurses Society, serving on the society’s journal review board.

Source: Excerpted and adapted from Optimizing I.V. infusion safety with a comprehensive approach, IT Solutions, M Brown, October 2005.
Name pair confusion

A 71-year-old man with a history of chronic liver disease and hepatic encephalopathy was admitted to a teaching hospital for lethargy. Several days after his admission, a gastroenterology fellow ordered “rifaximin 400 mg per nasogastric tube t.i.d.” The drug, a nonabsorbable antibiotic approved for traveler's diarrhea caused by noninvasive strains of *Escherichia coli*, is also used to prevent episodes of hepatic encephalopathy in patients with liver cirrhosis.

Rifaximin (Xifaxan) wasn’t on the hospital’s formulary and the pharmacist who received the order wasn’t familiar with it. He misread the order as a more familiar drug, rifampin. Because the dose was to be given via a nasogastric tube, he dispensed a suspension for the 400 mg t.i.d. dose. The next day, the patient’s nurse asked a different pharmacist for information about rifaximin. This pharmacist sent the information to the nurse and, because it was a nonformulary item, followed up to see if the drug had been delivered yet. The nurse then noticed that the order had already been entered and dispensed incorrectly as rifampin. The patient had received three doses but hadn’t been harmed. The usual dose of rifampin, which is available as 200 mg tablets, is 600 mg daily to treat tuberculosis, and 300 mg P.O. every 8 hours to act with other agents for treatment of bacterial endocarditis.

Perhaps the unusual dosing of 400 mg every 8 hours and the lack of a diagnosis or indication for rifampin should have prompted the pharmacist to investigate further. Requiring the prescriber to provide the drug’s indication when ordering a nonformulary product might have helped prevent this error. The generic names rifaximin and rifampin are close enough that additional reports of mix-ups wouldn’t be surprising.

Sight and sound confusion

Omacor (omega-3-acid ethyl esters), a new drug distributed by Reliant Pharmaceuticals, is indicated as a dietary adjunct to reduce triglyceride levels of 500 mg/dL or more in adult patients. The drug is also being studied as adjuvant therapy to help prevent further myocardial infarctions in patients who’ve already survived at least one. It’s available in 1 gram capsules, and the recommended dose is 4 grams (four capsules) daily or 2 grams b.i.d. Prescriptions for Omacor have just begun to arrive in pharmacies, but a name-related safety issue already has occurred.

A community pharmacist reported an error in which a telephone order for Omacor 1 gram b.i.d. was misheard as Amicar (aminocaproic acid) 1 gram b.i.d. Fortunately, the patient read the drug information sheet before taking the medication and called the pharmacy to tell the pharmacist he was expecting a drug to reduce his triglyceride levels.

An actual mix-up between Omacor and Amicar would place certain patients at risk. Amicar, an antifibrinolytic agent, is used to enhance hemostasis when fibrinolysis contributes to bleeding. Both Amicar and Omacor are available in a 1 gram oral dosage strength. For use in acute bleeding due to elevated fibrinolytic activity, Amicar is given in higher oral doses than Omacor, but confusion could still occur. In most settings, Amicar isn’t used often, so pharmacists and nurses may not realize the labeled dose is 5 grams orally during the first hour of treatment, followed by a continuing dose of 1 gram/hour. The drug is also available for intravenous use. If patients receive Amicar instead of Omacor, the risk of thrombosis would be increased, as would a host of adverse reactions associated with the drug.

Substituting Omacor for patients who truly need Amicar may be even more significant, potentially leading to serious bleeding. The name similarity is so striking when handwritten or pronounced—and the potential for serious errors so high—that the product name, Omacor, should be changed. Meanwhile, set an alert in the CPOE system, match the drug’s indication to the patient’s diagnosis before dispensing either drug, and consider using tall-man letters when expressing the drugs—OMacOR and AMicAR—if both medications are available in your facility’s inventory. ■