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Educating the healthcare community about safe medication practices

Acute Care

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SafetyBriefs

Cross contamination with insulin pens. Facilities using insulin pens should bear in mind the possibility that an individual patient's pen might be used for another patient. In one report, a nurse told us that, rather than wait for an individual patient's pen to come from pharmacy, nurses at her hospital often borrowed a pen from another patient, put on a new disposable needle, and injected a dose of medication into the second patient using the first patient's pen. Apparently, the nurses failed to recognize that it's possible for biological contamination of the insulin solution to happen even if aspiration does not occur prior to injection. It is unclear whether these nurses felt pressured to engage in such an at-risk behavior because of system problems, such as lengthy turn-around time for delivery of new pen devices. Several studies suggest just how risky sharing pens among patients might be. Hemoglobin was detected in 6 out of 146 cartridges (4.1%) used by diabetic patients in one study (Sonoki K, et al. Regurgitation of blood into insulin cartridges in the pen-like injectors. *Diabetes Care* 2001; 24:603-04, available at: http://care.diabetesjournals.org/cgi/content/full/24/3/603). In another study of 120 patients, non-inert material, including squamous cells and other epithelial cells, was found in 58% of the cartridges (Le Floch JP, et al. Biological material in needles and cartridges after insulin injection with a pen in diabetic patients. *Diabetes Care* 1998; 21:1502-04, available at: http://care.diabetesjournals.org/cgi/reprint/21/9/1502.pdf). The authors noted that air bubbles could enter the cartridges after injection unless the needle is removed, suggesting that biological materials could do the same while the needle is in place. Pen manufacturers caution users to remove the needle immediately after injection so as not to leave a channel for entry of air into the cartridge, and they also warn against sharing the device between patients. Obviously, this

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There's more to the *60 Minutes* story on heparin errors

On March 17, 2008, CBS aired a *60 Minutes* segment featuring interviews with Dennis Quaid and his wife Kimberly Buffington who shared their thoughts about the medication errors that happened to their newborn twins in November 2007 (www.cbsnews.com/stories/2008/03/13/60minutes/main3936412.shtml). The errors involved the accidental administration of heparin withdrawn from vials (manufactured by Baxter) containing a concentration of 10,000 units/mL rather than the intended flush concentration of 10 units/mL. According to Mr. Quaid, the 1,000-fold overdoses caused bleeding in both twins, but fortunately, there are no signs of permanent harm.

Similar errors occurred in another hospital in 2006, which also attracted media coverage, particularly because three infants died as a result of the errors. (Visit www.ismp.org/Newsletters/acutecare/archives.asp for details about these errors in our September 21, 2006 and November 29, 2007 newsletters.) In response to the 2006 errors, ISMP, FDA, and Baxter issued nationwide safety alerts to healthcare providers, and Baxter redesigned the label and packaging of the 1 mL heparin vials containing 10,000 units/mL (as well as 1 mL vials of 5,000 units/mL and 1,000 units/mL strengths) to help distinguish them from vials containing lower concentrations of heparin flush solutions. However, heparin vials with the newer labels had not yet reached the hospital where the Quaid twins were being treated.

When describing the errors, the *60 Minutes* segment focused primarily on the similarity of the heparin vial labels and the nurses' failure to read the labels correctly. But these types of errors involved additional human factors and system failures that were never mentioned during the segment. While CBS investigators were traveling across the US to gather background information for the feature story, staff from ISMP and other patient safety organizations shared with the investigators how these factors contributed to the errors. A few examples follow.

CBS investigators heard how confirmation bias can cause any healthcare practitioner to overlook disconfirming evidence when reading a medication label, particularly a label that looks similar to a product label the practitioner believes he is reading. That is, if two products have similar labels, the practitioner tends to see only what he thinks he should see for the intended product, missing information that signals he has selected the wrong product. Confirmation bias is particularly prevalent in cases where the correct product or strength was previously available in a designated storage area hundreds of times before the event (as were the heparin flush vials when these errors happened). Yet, the *60 Minutes* segment most likely left viewers with the belief that the nurses simply didn't bother to read the labels on the heparin vials.

Next, it was emphasized to CBS investigators that safe and reliable healthcare cannot be achieved through human vigilance alone, and that sole reliance on practitioners to read medication labels and interpret the information correctly is ill advised. Perfect performance on any task is impossible as evidenced by the safety science of human factors engineering and our own personal experiences. We cannot expect practitioners—no matter how experienced and vigilant—to be infallible. Indeed, in both the 2006 and 2007 events, multiple nurses and pharmacy technicians all made the same human error when selecting the heparin vials. Instead, we stressed the need to anticipate human fallibility and thus establish reliable systems to *prevent* errors or *detect* errors before they reach patients. As a practical example, we suggested

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is something that requires ongoing education and oversight wherever insulin pens are used. Sharing of pens must be prohibited. While we are not aware of any cases of actual cross contamination, the risk remains. Many hospitals have employed pen technology successfully and safely, but it's important to guard against possible failure points with these devices. For more information on potential problems with pen devices, see our November 30, 2006 newsletter article, *PEN injectors: Technology is not without imPENding risks* (www.ismp.org/Newsletters/acutecare/articles/20061130.asp).

Pediatric Injectable Drugs 8th Edition (The Teddy Bear Book). ASHP informed purchasers of this book about typographical errors in the monographs for rocuronium bromide and sodium chloride. On page 394, rocuronium bromide "Dosage" section, 8th line: the dosage for infants should be 0.5 mg/kg. On page 402, sodium chloride "Brand Names" section, the first line should read as follows: 0.45% saline (1/2 NS) = 77 mEq/L. ASHP urges you to correct these errors immediately in all copies of the reference text and communicate the correction to all staff who may use the text. ASHP has also posted these corrections on its website.

Lantus and Apidra insulins confused. We've received several reports about confusion between **LANTUS** (insulin glargine) and **APIDRA** (insulin glulisine), both available from sanofi-aventis. Many patients use these products in conjunction with one another since one is basal insulin (Lantus) while the other is rapid-acting insulin. In the past, these vials looked strikingly similar because Lantus is packaged in an unusual (for the US) elongated vial with a purple cap while Apidra is packaged in a similar vial with a blue cap (see Figure 1 on page 3). Depending on lighting conditions, it is sometimes difficult to differentiate these colors. In addition, once the caps are removed, it is even more difficult to tell the vials apart. Most of the reports about container mix-ups were received prior to a recent Apidra label change. The new label has a band of diagonal stripes with alternating blue and green segments (see Figure 2 on

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point-of-care bar-coding systems, which we estimated could be implemented in every US hospital for less than $10 billion. But the *60 Minutes* segment missed a great opportunity to promote bar-coding and other systems that improve the robustness and reliability of the medication use process.

ISMP also suggested that healthcare providers should assess whether 10,000 units/mL strength heparin vials are really needed in their organizations. In many cases, this strength of heparin can be eliminated given other available strengths (e.g., 5,000 units/mL) that may be less likely to be confused with other heparin strengths or cause harm if used in error. The decision to dispense vials of heparin rather than commercially available or pharmacy-prepared unit-dose syringes of heparin flush solutions to the neonatal intensive care unit was another underlying factor that contributed to the near-tragic errors experienced by the Quaid twins.

Another missed opportunity during the *60 Minutes* segment was emphasizing the need for all healthcare providers to be proactive and learn from errors that have happened elsewhere. We provided newsletters to CBS in which mix-ups between the 10,000 units/mL and 10 units/mL vials of heparin had been described along with interventions to prevent similar events from happening in other organizations. We also shared the *ISMP Quarterly Action Agenda* and reviewed how the tool could be used to initiate changes *before* serious medication errors occurred in other facilities. With no regulatory or accrediting bodies requiring *proactive* risk-reduction activities in healthcare, we had hoped that *60 Minutes* would seize the opportunity to promote this as a fundamental responsibility for all healthcare providers and other key stakeholders—from FDA to the pharmaceutical industry. Unfortunately, this didn't happen.

ISMP supports an error-reduction strategy that the news segment did highlight throughout the broadcast: the need to consider a recall of products that pose a threat to patient safety. We can't say whether 1 mL vials of 10,000 units/mL heparin with the older labeling should have been withdrawn from the market. ISMP is not in a position to measure the impact of such a withdrawal (although a current shortage of this important product exists after a heparin recall due to manufacturing concerns). At the time of the event, the potential shortage of the product could have presented greater hazards to patient safety than leaving the vial on the market until an adequate supply of the vials with new labeling and packaging were available. And to give credit where credit is due, Baxter was responsive to the need to change the label, which in itself was a considerable undertaking, from design of the label to market testing and FDA approval. While there are a growing number of exceptions, too many pharmaceutical companies remain passive, sitting tight and suggesting that "reading the label is *Nursing 101*," or they believe that sending letters to healthcare practitioners to increase awareness of labeling problems suffices. Nevertheless, as we've said before, FDA and manufacturers should be required to conduct an assessment of the impact that withdrawing a problematic medication would have on patient safety, and take immediate action when safety calls for a withdrawal.

Media attention can often serve as a catalyst for change. Thus, we applaud *60 Minutes* for bringing attention to medication errors, although we hope a more complete and balanced picture will be presented in further segments on the topic. We also thank the Quaid family for sharing their story publicly, supporting the need for changes in healthcare to promote patient safety, and challenging healthcare providers to be more transparent in regards to medical error. Although the segment's tone implied otherwise, ISMP strongly believes that healthcare organizations are working hard to strengthen the many system weaknesses that have led to medication errors. As such, we hope the *60 Minutes* segment sparks realization that the same error could happen in other healthcare organizations where therapeutic heparin and heparin flushes are used, and that action must be taken now to prevent a similar error from happening again.

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page 3). Unfortunately, this simple cosmetic change has not achieved the desired outcome because, given the unusual elongated shape of the vials, they can still be confused, especially once the caps are removed. In a recent event, an insulin pump was accidentally filled with Lantus instead of Apidra, causing the patient to experience hypoglycemia. The mix-up happened in an outpatient setting while the patient was traveling. Although the patient did not typically use Lantus, she took a vial with her as backup in case the pump malfunctioned. The vials of Apidra and Lantus were put into the same bag to facilitate passage through airport security; the vials were subsequently mixed up. The reporter felt the manufacturer should change one of the vials so they are not the same size and shape. Other strategies besides separating the vials during use and storage would include using an alternate insulin delivery system such as a pen for either the long-acting or short-acting insulin and using a different rapid-acting brand of insulin. If insulin vials are stored in automated dispensing cabinets, placing each type of insulin in a separate pocket can also prevent mix-ups due to look-alike vials.

Figure 1. Capped vials before Apidra (L) label change.

Figure 2. Uncapped vials after Apidra (R) label change.

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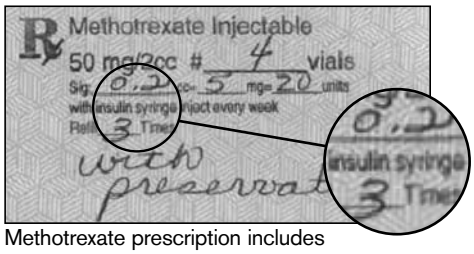
TB or not TB? Scale down dosing errors with methotrexate

Many patients who self-administer methotrexate injection to treat inflammatory conditions such as rheumatoid arthritis, Crohn's Disease, or psoriasis, have been instructed to use U-100 insulin syringes, which are readily available with an attached needle in community pharmacies. Tuberculin syringes with an attached needle can also be used, but they may not be as widely accessible as insulin syringes.

Health professionals who recommend using insulin syringes to measure doses of methotrexate (see photo), or *any* non-insulin product, should be aware of the potential for dose miscommunication by patients and staff during hospitalization. Patients may refer to the amount of medication they take using the scale for units on the insulin syringe. Staff have misinterpreted this dose as milligram or volume amounts. For example, with methotrexate injection (25 mg/mL), a patient may state they "take 50" (meaning they measure 50 units on the insulin syringe, which equals 12.5 mg); staff may misunderstand this as 50 mg.

With this immunosuppressant drug, such dosage errors can be particularly severe. In a case we published in our October 16, 2002 newsletter (*The right "route" to safety*), a patient's family provided inaccurate information that prompted a nurse practitioner to order "methotrexate injection 80 cc every Sunday." The patient, who told the nurse she'd been using 80 cc per dose, had actually been taking 0.8 mL of the injectable solution once weekly, with doses measured using a U-100 insulin syringe (80 units on the scale).

The risk of communicating methotrexate doses incorrectly is similar to problems when prescribing U-500 insulin. Since there is no available U-500 insulin syringe, patients are often told to use a U-100 insulin syringe. Because there is a 5-fold increase in concentration with U-500 insulin, patients preparing doses using a U-100 scale are taught to measure "40 units" for a dose of 200 units. When the patient states, "I take 40 units," he is sharing the U-100 syringe measurement marker, not an accurate dose. As mentioned, use of a tuberculin syringe with a volume scale would prevent such dose miscommunications.



Methotrexate prescription includes instructions for use of insulin syringe.

When recording methotrexate doses, be certain to ask patients what administration device they use to administer the drug. When insulin syringes are used, verify dosing information provided by patients and family, especially if the medication dose seems unusual or unexpected.

Special Announcements...

ISMP teleconference. Please join us for Part III in our series on high-alert medications, **Preventing errors with insulin: A multidisciplinary approach.** The teleconference, which will be held on **April 23** from 1:30 to 3:00 p.m. EDT, will explore current trends in insulin therapy, barriers to optimal therapy and safety, common types of errors with insulin, and measures that can be used to evaluate safety practices with insulin. To register, visit: www.ismp.org/sc?k=tc37.

ADC guidelines. In 2007, ISMP held a national forum with pharmacists, nurses, and vendors to develop a draft set of consensus-driven safe practices for automated dispensing cabinets (ADCs). We thank McKesson, Omnicell, and Cardinal Health for support of this project, and all the healthcare practitioners who submitted comments on the draft guidelines. The final guidance document is now available at: www.ismp.org/Tools/guidelines/ADC_Guidelines_Final.pdf.

***High-Alert Medications* list.** Please see page 4 for ISMP's updated List of High-Alert Medications (also available at: www.ismp.org). We added opium tincture to the list as well as a notation that colchicine injection will be removed from the list later in 2008 since the product is no longer manufactured. We plan to conduct a full survey again in 2009, but if you have any drugs you would like us to consider for addition to the list before then, please send a message to: ismpinfo@ismp.org.

ISMP's List of *High-Alert* Medications

High-alert medications are drugs that bear a heightened risk of causing significant patient harm when they are used in error. Although mistakes may or may not be more common with these drugs, the consequences of an error are clearly more devastating to patients. We hope you will use this list to determine which medications require special safeguards to reduce the risk of errors. This may include strategies like improving access to information about these drugs; limiting access to high-alert medications; using auxiliary labels and automated alerts; standardizing the ordering, storage, preparation, and administration of these products; and employing redundancies such as automated or independent double-checks when necessary. (Note: manual independent double-checks are not always the optimal error-reduction strategy and may not be practical for all of the medications on the list).

Classes/Categories of Medications
adrenergic agonists, IV (e.g., epinephrine, phenylephrine, norepinephrine)
adrenergic antagonists, IV (e.g., propranolol, metoprolol, labetalol)
anesthetic agents, general, inhaled and IV (e.g., propofol, ketamine)
antiarrhythmics, IV (e.g., lidocaine, amiodarone)
antithrombotic agents (anticoagulants), including warfarin, low-molecular-weight heparin, IV unfractionated heparin, Factor Xa inhibitors (fondaparinux), direct thrombin inhibitors (e.g., argatroban, lepirudin, bivalirudin), thrombolytics (e.g., alteplase, reteplase, tenecteplase), and glycoprotein IIb/IIIa inhibitors (e.g., eptifibatide)
cardioplegic solutions
chemotherapeutic agents, parenteral and oral
dextrose, hypertonic, 20% or greater
dialysis solutions, peritoneal and hemodialysis
epidural or intrathecal medications
hypoglycemics, oral
inotropic medications, IV (e.g., digoxin, milrinone)
liposomal forms of drugs (e.g., liposomal amphotericin B)
moderate sedation agents, IV (e.g., midazolam)
moderate sedation agents, oral, for children (e.g., chloral hydrate)
narcotics/opiates, IV, transdermal, and oral (including liquid concentrates, immediate and sustained-release formulations)
neuromuscular blocking agents (e.g., succinylcholine, rocuronium, vecuronium)
radiocontrast agents, IV
total parenteral nutrition solutions

Specific Medications
colchicine injection***
epoprostenol (Flolan), IV
insulin, subcutaneous and IV
magnesium sulfate injection
methotrexate, oral, non-oncologic use
opium tincture
oxytocin, IV
nitroprusside sodium for injection
potassium chloride for injection concentrate
potassium phosphates injection
promethazine, IV
sodium chloride for injection, hypertonic (greater than 0.9% concentration)
sterile water for injection, inhalation, and irrigation (excluding pour bottles) in containers of 100 mL or more

****Although colchicine injection should no longer be used, it will remain on the list until shipments of unapproved colchicine injection cease in August 2008. For details, please visit:* www.fda.gov/bbs/topics/NEWS/2008/NEW01791.html.

Background

Based on error reports submitted to the USP-ISMP Medication Errors Reporting Program, reports of harmful errors in the literature, and input from practitioners and safety experts, ISMP created and periodically updates a list of potential high-alert medications. During February-April 2007, 770 practitioners responded to an ISMP survey designed to identify which medications were most frequently considered high-alert drugs by individuals and organizations. Further, to assure relevance and completeness, the clinical staff at ISMP, members of our advisory board, and safety experts throughout the US were asked to review the potential list. This list of drugs and drug categories reflects the collective thinking of all who provided input.