This series brings you up-to-date information about medication safety issues and strategies to prevent medication errors. It draws on Australian incidents and US experience, including (with permission) material from ISMP Medication Safety Alert! *a bulletin published by the US Institute for Safe Medication Practices <www.ismp.org>. This series is coordinated via the Committee of Specialty Practice in Medication Safety (Chair, Rosemary Burke, Director of Pharmacy, Concord Hospital, NSW). Australian incidents are collated and editorial recommendations made by Penny Thornton (Principal Advisor, Medication Safety, NSW Health; <medsafety@shpa.org.au>).*

AUSTRALIAN INCIDENTS

Jurnista again?

We are wondering if other sites are having issues with Jurnista (modified-release hydromorphone tablets 8 mg, 16 mg, 32 mg, 64 mg). They are marketed as a once daily tablet, and we have noted a few incidents of them being prescribed BD. A colleague noted that pharmacy staff were greatly concerned about the potential for error when Jurnista was approved for addition to the hospital formulary, so they printed alert stickers highlighting the once daily dosing. Potential errors have been identified either in pharmacy or by nurses when they removed packs for dosing and noticed the alert stickers.
[Australian Incident 102, November 2009]

US SAFETY BRIEFS

ISMP survey helps define near-miss and close-call

ISMP conducted a survey regarding the definition of a near-miss! ISMP agrees with the vast majority of respondents (88%) who defined a near-miss as an error that happened but did not reach the patient. These errors are captured and corrected before reaching the patient, either by chance or purposefully designed system controls that were in place. Thus, reporting near-misses can help to evaluate whether the capture opportunities are functioning poorly – if they are fortuitous – or functioning well – if they are part of the system design, consistently implemented, and routinely effective. Only 3% of respondents defined a near-miss as an error that reached the patient but did not result in harm. Yet, this is closer to how a near-miss is defined by some state reporting programs and the Agency for Healthcare Research and Quality <www.psnet.ahrq.gov/glossary.aspx>. According to the Agency, the definition of a near-miss is an 'event or situation that did not produce patient injury, but only because of chance'. The good fortune of not harming a patient might reflect how robust the patient is or how fortuitous a timely intervention by the provider may be. The problem with this definition is twofold:

- it does not clarify whether the harmless error that resulted in the 'event' or 'situation' reached the patient; and
- it fails to foster ongoing evaluation of system controls that can help capture errors or prevent patient harm once an error has reached the patient. Instead, it implies that patient harm was avoided purely by chance, giving little credence to capture and recovery opportunities that may be working well or in need of improvement.

Several respondents suggested that the term near-miss is a confusing misnomer, and that a near-miss is really a near 'hit' or near 'error.' A near 'miss' is more applicable when trying to 'hit' something, not avoid something. They suggested 'close-call' as a better term, and we agree. Although near-miss appears to be well entrenched in healthcare terminology, we will try to refer to near-misses as close-calls when feasible to prevent confusion (Box 1).

Box 1. Definition of a close-call (near miss)

An event, situation, or error that took place but was captured before reaching the patient, e.g. penicillin was ordered for a patient allergic to the drug, however, the pharmacist was alerted to the allergy during computer order entry, called the prescriber, and the penicillin was not dispensed or administered to the patient, or the wrong drug was dispensed by pharmacy, and a nurse caught the error before it was administered to the patient.

[Medication Safety Alert! 24 September 2009]

Caution regarding once-weekly levothyroxine

A recent article in *Hospital Pharmacy* (2009; 44: 748-50.) discussed once-weekly administration of levothyroxine, which has a half-life of about 7 days. The article noted that initial data appear to show the regimen is as effective as daily dosing and may be useful in combating poor adherence to a daily regimen, although the exact dose has not been clearly established. We have published similar reports in which prescribing or dispensing errors with methotrexate led to instructing patients to take the medication daily instead of weekly. There is every reason to believe the same will happen with once-weekly levothyroxine. Dosing errors may be more difficult for pharmacists and nurses to detect since daily levothyroxine is the norm and doses vary dramatically between patients; a weekly regimen may be hard to identify since the same dose may be given daily for some patients. Physicians contemplating weekly administration should consider the potential for an error and alert patients accordingly.
[Medication Safety Alert! 24 September 2009]

FDA and manufacturers take note!

Mix-ups between drug strengths that differ by a factor of 10 are a common type of dosing error. For example, ISMP learned about four errors in which Abilify (aripiprazole) 20 mg was accidentally dispensed to several patients instead of 2 mg. In one case, a 7-year-old child took 68 doses that were 10 times higher than the prescribed dose. The child became withdrawn, cried frequently and 'seemed depressed in a zombie-like state'. Over the years, pharmaceutical companies have trialled and marketed numerous dosage forms that have a 10-fold difference in strength, sometimes leading to harmful errors. For example, how many children have received Stelazine (prochlorperazine) 25 mg suppositories instead of the 2.5 mg strength? (Expressing the 2.5 mg dose as 21/2 helps differentiate it from 25 mg.) How many asthma patients have been given predniSONE 50 mg instead of 5 mg? The risk of 10-fold overdoses is further increased by

health professionals who use trailing zeros (e.g. 2.0 mg, which can be misread as 20 mg) or do not use leading zeros (e.g. .5 mg, which can be misread as 5 mg). We wish FDA and companies would do more to avoid dosage strengths in exact 10-fold multiples as they greatly increase the risk of 10-fold dosing errors. All too often, blame is cast on pharmacists, doctors, and nurses for prescribing or dispensing errors when many of these would not have occurred if companies took a far safer approach of testing and marketing medications with strengths that are above or below the exact 10-fold difference. We have seen an attempt to do this in recent years when fentaNYL transdermal was marketed in a 12.5 microgram/hour dosage form. The US manufacturer, Ortho-McNeil labelled it Duragesic-12 in an attempt to prevent mix-ups between Duragesic 12.5 mcg/hour and Duragesic 125 mcg/hour, which may be an acceptable dose for chronic pain patients. We hope that manufacturers and the Food and Drug Administration will take note as they contemplate drug approvals, especially for high-alert medication categories.

Australian note: Janssen-Cilag's Durogesic patches provide FentaNYL in 12, 25, 50, 75, 100 microgram/hr strengths. This may avoid similar mix-ups in Australia but regardless, the Therapeutic Goods Administration should take note for future reference in forthcoming product registrations.

[Medication Safety Alert! 8 October 2009]

Safe post-op opioid administration and monitoring

The Anesthesia Patient Safety Foundation has published an editorial regarding the continuing problem of opioid-induced respiratory depression. They identified inadequate monitoring of oxygenation and/or ventilation, in addition to failure to consider patient-specific characteristics, as causes for the continued occurrence of opioid-induced respiratory depression. According to the Foundation, the following should be addressed in all patients receiving postoperative opioids:

- individualise each patient's dose based on their history and physical status;
- make pulse oximetry routine;
- assess each patient's need for supplemental oxygen; and
- consider capnography to monitor ventilation, particularly for patients receiving oxygen and/or at high risk for opioid-induced respiratory depression.

[Medication Safety Alert! 8 October 2009]

Oral syringes: crucial and economical risk-reduction strategy

ISMP has repeatedly stressed the importance of never using parenteral syringes to prepare or administer small volumes of oral/enteral products. Over the years, this important advice has appeared in more than 60 issues of our newsletters and in countless presentations. Yet, we continue to visit organisations where this simple but critical safety measure is not followed. Using parenteral syringes (one with a Luer lock that can be attached to a needle-less IV system) to administer oral/enteral liquids presents a serious danger of misadministration. After filling a parenteral syringe with an oral/enteral medication, it takes a momentary mental lapse to connect it to an intravenous line and inject it. To prevent this, oral syringes have specially engineered hubs that cannot be easily or securely connected to standard IV lines and cannot accommodate a needle attachment. While some health professionals may believe this type of error would never happen to them, most events occur when knowledgeable staff, intending to administer the product orally/enterally, inadvertently administer it via the wrong route or access port, or when staff mistake the contents of a syringe (often unlabelled) as a parenteral product. Such errors continue to occur far too often, for example recently a new graduate nurse prepared yogurt in a parenteral syringe and then accidentally administered it to an adult patient intravenously through a PICC line. The nurse then flushed the line with water. The yogurt was intended to be given via an enteral tube to help treat diarrhoea. The distal ends of the enteral and PICC lines (all unlabelled) looked very similar. We have written about similar errors that fortunately were not all fatal:

Example 1: A pharmacy dispensed niMODipine capsules to nursing units, unaware that these were being used for patients who could not swallow. In one instance, a nurse softened the gelatin capsule in hot water and withdrew the medication into a parenteral syringe. In the chaos of the day, the dose was administered intravenously instead of via the feeding tube. The nurse immediately noticed the error and tried unsuccessfully to withdraw the drug from the IV tubing. The patient decompensated immediately and subsequently died. A boxed warning has been added to the niMODipine labelling to caution about this type of medication administration error with this product.

Example 2: Midazolam syrup (15 mg) and paracetamol liquid (650 mg) were withdrawn into a parenteral syringe and administered intravenously to an 11-year-old child being prepared for surgery. A nurse and fourth-year student nurse had prepared the doses, but the nurse was called away. While she was gone, the student nurse administered the drugs intravenously, believing the child was nothing-by-mouth before surgery. The child remained unconscious for 50 minutes and required several days of antibiotics and he recovered fully.

Example 3: An uncooperative patient was sedated for an MRI with 500 mg of chloral hydrate syrup. The patient would not drink from the pharmacy-dispensed unit-dose cup, so a nurse withdrew the medication into a parenteral syringe and administered it orally. A physician accompanied the patient to the radiology department. Once there, the patient required additional sedation, so the physician called the nurse to send another dose of chloral hydrate to radiology. Again, the nurse withdrew the dose into a parenteral syringe. She felt uncomfortable sending it to radiology in a parenteral syringe, but oral syringes were not available. So, she left the syringe uncapped (and without a needle), and included the tear-off label from the unit dose cup for reference. The physician did not notice the label and began to administer the medication intravenously. When the patient started yelling, further administration was halted. The patient received very little of the medication and was not injured.

Example 4: A nurse floated to the neurology floor, where she was instructed to give a 19-year-old man recovering from a frontal craniotomy a dose of Dilantin (phenytoin) oral elixir through the feeding tube. The nurse mistakenly gave the drug through the triple lumen catheter. The patient coded within seconds, resulting in a severe non-recoverable anoxic brain injury.

Recommendations: The consistent use of oral syringes for preparation and administration of all small volume oral/enteral liquids is an effective and economical risk-reduction strategy that should be employed in all healthcare settings. Patients are subjected to a substantial and unjustifiable risk of harm when oral/enteral products are prepared and administered in parenteral syringes. It is time to make the use of oral syringes a standard of practice in every healthcare organisation.
[Medication Safety Alert! 22 October 2009]

Inaccurate insulin dosing if withdrawn from a pen cartridge

A pharmacist received a call from a nurse who was concerned that a patient's insulin pen did not deliver the correct dose. To identify the problem, the nurse took a standard insulin syringe, dialled the pen to 10 units, and injected the insulin into the syringe to measure how much would reach the patient. She found that the insulin syringe only contained 5 units. This was repeated twice with the same results. The pharmacist went to the nursing unit, repeated the experiment, and also got 5 units. When laying the pen down on the table, the pharmacist noticed that an air bubble was visible. Knowing how that could affect insulin delivery from the pen, he obtained a new pen and repeated the previous experiment. This time 10 units were measured in the syringe. The problem was traced to nurses using the pen cartridges as 'mini' insulin vials by drawing the dose out of the pen cartridge with an insulin syringe. It is a practice we have warned against because it leads to inaccurate dose measurement <www.ismp.org/Newsletters/acutecare/articles/20080508.asp>. When nurses are not sure how to use a pen, or encounter problems when using it, they may remove the pen cartridge and use it as a vial. This can accidentally introduce air into the cartridge. Once any amount of insulin is withdrawn from the cartridge, it may no longer deliver the amount of insulin listed on the dispensing dial. In this instance, the patient was subjected to several injections and less effective blood glucose control because the pen was used in an unintended manner.
[Medication Safety Alert! 19 November 2009]

Don't be a borrower or lender!

The phrase, '*Neither a borrower nor a lender be',* originated from Shakespeare's famous play, *Hamlet* (1603), during which Lord Polonius gives this advice to his son who is heading back to school. Because our world is different today, you may believe this advice is outdated and irrelevant. But when it comes to medication safety, Shakespeare's advice is timeless – medications should never be borrowed from or lent to others. His advice is simple enough to follow, but practitioners can be tempted to borrow a 'missing medication' (a dose that should have been available) or the first dose of a new medication from another patient's cassette, a discharged patient's unused medications or from another patient care unit. Borrowing medications as a workaround to speed the process of administering medications due to inherent or excessive wait times associated with the pharmacy dispensing process increases the risk of an error. Lest you believe that profiled automated dispensing cabinets (ADCs) and unit dose dispensing have sufficiently curtailed the practice of borrowing medications, a survey originally conducted in 2002 and repeated in 2008 found that almost half of the 1296 nurses who participated in the 2008 survey still borrowed medications when doses for their patients appeared to be missing on the unit. A few of the errors that have been reported to ISMP as a result of borrowing medications (which can be similar to errors associated with removing medications from floor stock or ADCs before pharmacy review of the orders) are presented in Table 2.

Table 2. Examples of errors associated with borrowing medications

A patient received two doses of Seroquel (QUEtiapine) 100 mg instead of the prescribed dose of Serzone (nefazodone) 200 mg. When the nurse could not find the patient's dose of Serzone, she thought pharmacy had forgotten to dispense it. Instead of calling the pharmacy, she asked another nurse to borrow the medication from a close-by unit. This nurse misheard the request for Serzone as SEROquel and borrowed two 100 mg doses of the wrong medication. The patient experienced significant somnolence and sedation after receiving 200 mg of SEROquel.
A physician prescribed IV Zosyn (piperacillin and tazobactam) for a patient with pneumonia. The nurse wanted to start the antibiotic right away, so instead of waiting for pharmacy to dispense the drug, she borrowed an unused dose from a patient who had recently died. The patient had a known penicillin allergy and experienced an anaphylactic reaction. Fortunately, the patient survived. The pharmacy had not dispensed the medication because they were awaiting clarification of the order.
When a nurse found that she could not obtain a dose of Toradol (ketorolac) from the unit's automated dispensing cabinet via the override feature, she borrowed a dose from another patient and administered it to an aspirin-allergic patient. The patient did not experience a life-threatening reaction. The pharmacy had not released the medication because they were awaiting clarification of the order.
A woman with atrial fibrillation, hypertension, lethargy and constipation died while receiving concurrent enoxaparin and heparin. A cardiologist initially prescribed enoxaparin and warfarin. When a gastroenterologist recommended a colonoscopy, warfarin was discontinued and a heparin infusion was ordered. Enoxaparin administration continued every 12 hours and the heparin order was never faxed to the pharmacy. To administer the bolus and begin the infusion, the nurse borrowed a vial of heparin and a premixed solution that the pharmacy had dispensed for another patient. Several hours later, the patient's aPTT was above 90 seconds. The heparin infusion was decreased, but by morning, the patient exhibited signs of internal bleeding and her aPTT was still elevated. Heparin and enoxaparin were discontinued, but the patient died despite aggressive treatment.

As there are many opportunities for error, the ideal medication administration system is one in which there is more than one practitioner between the drug and the patient. For example, while screening orders, a pharmacist may detect a prescribing error such as an inappropriate dose, a drug allergy, or a drug-drug interaction. While checking medications before administration, a nurse may detect a pharmacy dispensing error. While reviewing the patient's medication administration record, a physician may detect the inadvertent discontinuation of a drug. Most pharmacies have a system of checks before medications are dispensed. Computer software helps screen the order for appropriateness and safety, and multiple staff aid in preparing the medications and check them against the order before they are dispensed. However, this safety system is bypassed when doses are borrowed from other patients or obtained from an ADC before a pharmacist has screened the order.

Therefore, with borrowed medications, the system will not provide adequate checks to capture errors before they reach the patient.

Recommendations: Borrowing medications is not just a nursing problem; it is a complex, interdisciplinary issue that requires ongoing teamwork and excellent communication among nurses, pharmacists and other practitioners. Begin by assuming that borrowing medications occurs in your hospital and consider the following four-pronged approach to address this issue.

1. Remedy the reasons for borrowing. Prohibition against borrowing medications via policy is not enough to ensure patient safety, as the reasons for this behaviour are often rooted in system deficiencies. Learn why nurses and other practitioners may borrow medications from unauthorised sources and address these issues in a collaborative manner. If turnaround time for dispensing medications (or review of orders to allow access to medications) is perceived to be an issue, set up measures to identify the scope of the problem, address vulnerabilities, and gain consensus among nurses, pharmacists, physicians, and hospital leadership regarding acceptable time frames for drug delivery or order review. Uncover and address misconceptions about the clinical significance of providing therapy within the acceptable time frame for starting new drug therapy. If awaiting order clarification, pharmacists should contact the nurse to communicate the reason for a delay.

2. Decrease staff tolerance. Ensure nurses and other practitioners understand the risks and consequences of borrowing medications, and ensure pharmacists understand the risks and consequences of delayed order review and dispensing of medications. Encourage reporting of conditions that contribute to delayed order review and dispensing, which may encourage and reward the practice of borrowing medications. Use this information to improve the medication-use system.

3. Reasons for missing medications. Missing doses are an inconvenience and could be related to system problems with restocking of ADCs, or delivery to patient care units. However, a medication can be missing or not available for other reasons, such as:

- medication was given but not documented on the medication administration record;
- dose was given on another patient care unit;
- medication time or frequency was scheduled incorrectly and is being reviewed;
- order was incorrectly interpreted or mistranscribed onto the medication administration record;
- medication was not dispensed by pharmacy because of a safety problem;
- an additional dose in the 24-hour cart fill was used to replace a previously dropped dose or a dose that had been vomited;
- drug was misplaced (e.g. removed from the tube and left at the station);
- pharmacy never received the order; and
- discontinued drug is still on the medication administration record.

4. Eliminate unauthorised access to drugs. Discourage the accumulation of discontinued or unused medications in patient care units. Provide a secure container or ADC compartment for staff to place medications from discharged or expired patients as well as other discontinued or unused medications. Conduct frequent pharmacy rounds to collect these medications (including refrigerated items). Use profiled ADCs and establish stringent criteria for removal of medications. Monitor override reports for appropriateness.

[Medication Safety Alert! 19 November 2009]

Kids harmed from hypotonic IV fluids

ISMP Canada has published a report of two paediatric deaths from acute hyponatraemia <www.ismp-canada.org/download/safetyBulletins/ISMPCSB2009-7-HospitalAcquiredAcuteHyponatremia.pdf>. One of the children had been admitted for a tonsillectomy and the other child was receiving treatment for vomiting and diarrhoea in an emergency department. The deaths were caused by IV administration of hypotonic solutions. The children received IV fluids of 3.3% dextrose with 0.3% sodium chloride, which contains 51 mmol/L (51 mEq/L) of sodium. Outside of the body, the osmolarity of the solution is 269 mOsmol/L (sodium and dextrose combined). Once the solution is infused, however, the dextrose is rapidly metabolised, which leaves two-thirds of the solution (667 mL) as extremely hypotonic, electrolyte-free water. These cases are similar to the paediatric deaths we published in August 2009 <www.ismp.org/Newsletters/acutecare/articles/20090813.asp>. The UK National Patient Safety Agency has also identified hospital-acquired hyponatraemia in children as a major patient safety issue and issued an alert in March 2007 <www.nrls.npsa.nhs.uk/EasySiteWeb/getresource.axd?AssetID=60073&type=full&servicetype=Attachment>. Keep in mind that hypotonic solutions have also caused life-threatening and fatal fluid and electrolyte imbalances in adults.

[Medication Safety Alert! 19 November 2009]