

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 (Pharmacy Services Manager, The Children's Hospital, NSW; e-mail: pennyt2@chw.edu.au).

AUSTRALIAN INCIDENTS

Which heparin?

A child in ICU was given IV heparin 5000 units/5 mL instead of heparin saline 50 units/5 mL on two occasions involving different staff members. A femoral arterial line was being rewired and a 'hepsal' flush was ordered to flush the line. Heparin 5000 units/5 mL was retrieved from the treatment room by nursing staff and the doctor administered approximately 1 mL. About 2 hours later the central line was blocked and approximately 3 mL of heparin 5000 units/5 mL was again administered instead of 'hepsal' 50 units/5 mL. Shortly afterwards it was noticed that blood was oozing from the site of the central venous line insertion and the error was recognised. Protamine was given, coagulation studies were performed and the parents informed. An ultrasound of the head did not indicate any intracerebral bleeding. There was a slight drop in haemoglobin and a blood transfusion was needed, but no serious consequences followed. Even small doses of heparin in a sick child can cause life-threatening complications. The heparin preparations were from two different manufacturers, but both were in 5 mL plastic vials and labelled with brown writing. Care must be taken to store and label different concentrations of heparin safely.

[Australian Incident 64, August 2007]

Non-use of premixed potassium and electrolyte confusion

When a nurse came on shift in a paediatric hospital, she was checking her patient's fluids against what was charted when she found the patient being administered N/2 saline with 20 mmol sodium bicarbonate added. The patient had been ordered N/2 saline with 10 mmol potassium chloride and this order had been signed as commenced. Thinking that this might have been a bag left over from the day before, she checked to see what the patient had been ordered on the previous day and found that the patient had been charted N/2 saline with 10 mmol of (blank). The patient's blood returned a high bicarbonate level and a low potassium level, however, there were no adverse consequences once the correction had been made. Preparation of electrolyte infusions in clinical areas leaves patients vulnerable from microbiological contamination and product mis-selection. If this is compounded with a lack of clear prescribing as in this case the patient is vulnerable. If the order had been clear, the nurse would not have had to second-guess the prescriber (she should not have done in any case) and she would have been able to select a bag of pre-mixed potassium fluid for use without need for additive. Be aware of the first National Alert of the Safety and Quality Council of Australia which recommends use of pre-mixed potassium infusions wherever possible.

[Australian Incident 67, August 2007]

Wife takes husband's cytotoxic

A patient was prescribed melphalan 10 mg on days 1 to 14. His wife was prescribed thyroxine daily. The husband usually organised their medication. He went to the pharmacy and had their prescriptions dispensed. They obtained a whole pack of melphalan (25 tabs) and 14 days worth of thyroxine from their community pharmacy. The husband took thyroxine for 14 days

and his wife took the melphalan continuously. He claimed he became confused between verbal and written advice. Encourage community pharmacists to dispense the exact prescribed quantity despite PBS quantities being paid for. It may be in the patients' interest to only receive sufficient for a course duration.

[Australian Incident 68, April 2007]

Brand name sound-alikes?

A patient was admitted with a high blood pressure and unexplained bleeding with an INR >10. On undertaking medication reconciliation, the pharmacist found that the patient had been taking warfarin 5 mg which had been labelled by the dispensing pharmacy as perindopril 5 mg. It is thought this confusion could have arisen due to Coumadin and Coversyl being co-located on the pharmacy dispensing shelf.

[Australian Incident 69, February 2007]

Are pharmaceutical companies doing all they can for labelling?

Brand labelling is often mistaken as products look very similar, even if colour coding is used as a distinguisher. It seems that pharmaceutical companies are trying to address our concerns as some are now prepared to maximise the generic drug name as a distinguisher. Some readers are concerned about the look-alike nature of packaging, however, we must put ourselves in the company's shoes—what type of labelling choices are there for them if we, as users, are not going to carefully read a generic drug name and strength? Most companies are trying to assist us in our endeavours to promote patient knowledge of the actual drug name. When we have machine readable coding on each product and the software to make it usable, even look-alike products should not be a concern.

[Australian Incident 70, November 2007]

US SAFETY BRIEFS

Preventing mix-ups between various formulations of amphotericin B

The UK National Patient Safety Agency issued a medication alert warning health professionals of the risk of confusion between different formulations of IV amphotericin used to treat serious fungal infections. Alerts issued by ISMP since 1997 and by ISMP Canada since 2002 have called attention to mix-ups between the lipid-based and conventional formulations of amphotericin. Mix-ups have led to overdoses or underdoses resulting in subtherapeutic treatment. Two recent deaths in the UK prompted a call for the country's hospitals to take action, such as the following suggestions: 1) Conventional amphotericin B deoxycholate doses should not exceed 1.5 mg/kg daily. 2) Encourage prescribers to communicate orders using both the proprietary name and the complete generic name: Fungizone (amphotericin B desoxycholate), Ambisome (amphotericin B liposomal), Abelcet (amphotericin B lipid complex), and Amphotec (amphotericin B cholesteryl sulfate complex). List both the generic and brand names on protocols, preprinted orders, pharmacy labels, and medication administration records. 3) Include the patient's weight in kg and dose calculations as part of the prescription. 4) Verify the dose if you are unfamiliar

with the drug and/or usual dose prior to prescribing, dispensing, and/or administering the drug. 5) Ensure that detailed, technical drug information is easily and readily accessible in clinical areas that use amphotericin products. 6) Add a warning statement to all IV administration guidelines or drug charts produced by the hospital specifically describing the risks associated with these products. 7) Restrict the preparation and dispensing of amphotericin products to the pharmacy. 8) Differentiate or separate the storage of different formulations of amphotericin within the pharmacy (and in other areas where the drugs might be stored). Use cautionary labels to remind staff about the differences between the products. Add these statements to MARs. 9) Require an independent double-check before administering amphotericin products. 10) Include liposomal

forms of drugs on your organisation's list of high-alert medications; such products are included on ISMP's list <www.ismp.org/Tools/highalertmedications.pdf>. [ISMP Medication Safety Alert! 6 September 2007]

Lack of standard dosing contributes to IV errors

A large variety of IV drug dosing methods exist in hospitals. For example, the same drug might be administered within the same facility using the dosing methods of µg/kg, µg/kg/min, or µg/kg/hr concentrations. Lack of standardisation makes recognition of dosing errors difficult, even when using smart pumps. Define and standardise adult (and if applicable, paediatric) dosing methods to be used for each drug administered IV in your organisation. Employ smart pumps and

Table 1. Conditions that Promote Student Nurse-Related Medication Errors

Error-Prone Conditions	Examples of Errors	Recommendations
Nonstandard Times Medications scheduled for administration during nonstandard or less commonly used times, including early in the morning, are prone to student dose omissions.	<ul style="list-style-type: none"> ■ A student omitted an antibiotic ordered as a one-time dose at 1100. ■ A patient did not receive his morning dose of insulin because the student assigned to the patient had not arrived on the unit in time to administer the drug. 	<ul style="list-style-type: none"> ■ Staff nurses should develop a proactive plan with students that clarifies the details and responsibility for administration of each ordered medication and how new medication orders received during the shift will be handled. ■ Staff nurses and nursing instructors should monitor patient's MARs and review potential omissions with students.
Documentation Issues With both staff nurses and students administering medications to the same patients, dose omissions or extra doses have been administered because students or staff nurses have not properly documented drug administration or reviewed prior documentation of drug administration.	<ul style="list-style-type: none"> ■ A student documented that he gave the patient his morning medications at 0830; these medications were still in the patient's drawer at 1700. ■ A student administered heparin to a patient and left the unit for a conference before documenting it; a staff nurse gave the patient another dose. ■ A student gave a dose of Lopressor to a post-op patient who had already received the medication in the PACU, which was documented on the PACU record. 	<ul style="list-style-type: none"> ■ Students and staff nurses should be using the same MAR. ■ Students and staff nurses should bring the patient's MAR to the bedside and document drug administration immediately after the patient has taken the medications. ■ Encourage students to review all sources of documented drug administration, particularly when patients are transferred from a different level of care or unit. ■ When possible, include students in verbal reports about their patients (e.g., PACU report upon transfer to the unit).
MARs Unavailable or not Referenced Students may not consistently use the patient's MAR to guide the preparation of medications, and may not bring the patient's MAR consistently to the bedside for reference when administering medications.	<ul style="list-style-type: none"> ■ A staff nurse had given a patient a dose of methadone at 0730; although this was documented, the student also gave the patient a dose at 0830. The student was using a worksheet she had created, not the MAR. ■ A student gave the wrong patient a dose of digoxin and warfarin; the student did not bring the MAR into the room to assist with patient verification. 	<ul style="list-style-type: none"> ■ MARs should be available to students when preparing and administering medications; worksheets should not be used. ■ Students should prepare medications using only the original MAR and should bring the MAR to the patient's bedside for verification before administering drugs. ■ Teach students the organization's process to identify patients using two unique identifiers before drug administration.
Partial Drug Administration Students may not be administering all of the prescribed medications to assigned patients, particularly IV medications that they may not be permitted to administer.	<ul style="list-style-type: none"> ■ A patient did not receive an IV antibiotic for 3 days; staff nurses were unaware that the students assigned to this patient were not allowed to give IV medications. ■ A student nurse did not administer a respiratory medication to her patient; she thought a respiratory therapist would administer it. 	<ul style="list-style-type: none"> ■ Nursing instructors should provide a daily report to each unit that hosts students regarding the types of medications that the students will and will not be administering. ■ Encourage students to confirm this information with the staff nurse assigned to their patient, and to report drugs that are not given when due.
Held or Discontinued Medications Students have not known or understood the organization's processes for holding and discontinuing medications and have administered drugs that have been placed on hold or discontinued.	<ul style="list-style-type: none"> ■ A student gave a dose of Lovenox that was noted to be held on the MAR. ■ A student did not know the meaning of a yellowed-out section on the MAR and gave the patient an IV dose of potassium chloride that had been discontinued. 	<ul style="list-style-type: none"> ■ The organization should review its procedures for holding medications and make any necessary revisions to ensure that the procedure is clear and reliable. ■ Share the organization's procedures for holding and discontinuing medications with nursing instructors and students.
Monitoring Issues Students may not be aware that vital signs and/or lab values should be checked before administering certain medications.	<ul style="list-style-type: none"> ■ A student gave a patient with an INR of 2.33 a dose of Lovenox, which was noted to be discontinued on the MAR when the INR reached 2 (patient was also on warfarin). ■ A student administered a dose of Epogen to a patient with a hemoglobin of 15.5; the dose was listed on the MAR to be held if the patient's hemoglobin exceeded 12. 	<ul style="list-style-type: none"> ■ Be sure students and nursing instructors know how to access the most recent lab results and are able to obtain them. ■ Work with students to help them identify vital signs and lab data that may alter medication therapy.
Non-Specific Doses Dispensed Student nurses have administered excessive doses when they expected the drug to be provided in a patient-specific dose, but pharmacy had dispensed a larger dose or quantity.	<ul style="list-style-type: none"> ■ A student gave the patient a 4 mg tablet of dexamethasone as dispensed, but 2 mg (½ tablet) had been prescribed. ■ A student administered the full amount of Dilantin suspension dispensed in a bottle intended to be used for several doses. 	<ul style="list-style-type: none"> ■ Pharmacy should dispense medications in ready-to-use, patient-specific doses whenever possible; otherwise provide further instructions on the MAR and the dose itself, if possible. ■ On MARs, list the patient-specific dose first (before the available dosage strength dispensed, if applicable), as in the following example: "Lopressor 25 mg," followed by "25 mg = ½ of a 50 mg tab."
Oral Liquids in Parenteral Syringes Preparation of oral or enteral solutions in parenteral syringes has led to students accidentally administering these products by the IV route.	<ul style="list-style-type: none"> ■ A student gave the patient an oral liquid dose of vancomycin by the IV route. ■ A student prepared an oral liquid narcotic in a parenteral syringe; while the instructor's back was to the patient, the student began to administer the drug via an IV saline lock. ■ A student gave a patient an oral liquid dose of furosemide IV, which was intended for gastric tube administration. 	<ul style="list-style-type: none"> ■ Pharmacists should dispense all oral liquid products in oral syringes. ■ Medication areas should be stocked with oral syringes. ■ Students should be advised that oral syringes must be used when preparing oral solutions and apprised of the dangers of not doing so. ■ Discontinue IV routes as soon as possible, if appropriate.
Preparing Drugs for Multiple Patients Student nurses have given medications to the wrong patient, particularly when they prepared more than one patient's medications at a time and brought medications for two or more patients into a room.	<ul style="list-style-type: none"> ■ A student gave the patient in bed A his medications along with a dose of warfarin 5 mg intended for the patient in bed B. ■ An instructor put medications intended for the patient in bed B on a table while observing a student administer medications to the patient in bed A; the student picked up the wrong medications and gave them to the patient. 	<ul style="list-style-type: none"> ■ Teach students by example to prepare one patient's medications at a time and administer those medications before preparing another patient's medications. Stress the risks associated with handling more than one patient's medications at a time. ■ Teach students the organization's process to identify patients using two unique identifiers before drug administration.

program them using the endorsed dosing method. The dose on the prescriber's order, the MAR, and the drug label should match the dosing method required to program the infusion pump [ISMP Medication Safety Alert! 4 October 2007]

Fatal 1000-fold overdose of zinc in TPN due to confusion between mcg and mg

A fatal 1000-fold overdose of zinc sulfate contained in a TPN solution was administered to a preterm neonate. A calculation was made to convert zinc, prescribed in mcg/100 mL, to mcg/kg, which was required for the automated compounder software. The calculation was correct, but it was entered incorrectly into the pharmacy computer as mg, not mcg. Several system failures contributed to the error, including nonstandard ways of prescribing electrolyte additives in TPN and inadequate check systems. Standardise the way zinc sulfate (and other electrolytes) is prescribed. Ensure that the prescribed dosing method matches the dosing method required for order entry into pharmacy software. Add low-volume trace elements to TPN admixtures manually. Build and heed dose warnings in automated compounders and pharmacy software. Develop comprehensive education modules and validate the competency of individuals involved in TPN. See the full article with additional recommendations from <www.ismp.org/Newsletters/acutecare/articles/20070906.asp>.

[ISMP Medication Safety Alert! 4 October 2007]

WHO: Dilute vincristine in a minibag

WHO published a drug alert following the death of a 21-year-old woman who received vincristine via the intrathecal route. At least 55 other cases have been reported worldwide, and death is a near-certain outcome when vincristine is administered to the CNS instead of IV. Dilute vincristine and other vinca alkaloids in a minibag rather than a syringe so it looks dissimilar to drugs that are given intrathecally. For more on preventing fatal vincristine errors, view the free FDA Patient Safety Video <www.access.data.fda.gov/psn/transcript.cfm?show=68#7>.

[ISMP Medication Safety Alert! 4 October 2007]

IV fluorouracil infused in 4 hours instead of 4 days

A patient undergoing treatment for advanced carcinoma received a fatal dose of fluorouracil, given over 4 hours instead of 4 days. Two nurses miscalculated the infusion rate, forgetting to divide the daily dose by 24 hours. The pharmacy label listed the mL/24 hour rate of infusion first, then the mL/hour rate. The nurses saw the mL/24 hour infusion rate and thought their erroneous calculations were correct. Failed double-check systems and pump design flaws also contributed to the error. Display information needed to program infusion pumps in a standard way. The mL/hour rate, not the mL/24 hour rate, should be prominent. Minimise the need for calculations at the bedside. Use checklists to structure task workflow. Use chemotherapy certification processes to validate that staff possess and maintain an appropriate level of skills, knowledge, and abilities before working independently <www.ismp.org/Newsletters/acutecare/archives/Sep07.asp#20>.

[ISMP Medication Safety Alert! 4 October 2007]

New Rocephin (ceftriaxone) warning

FDA and Roche published an advisory about a potential problem when Rocephin is used concomitantly with calcium or calcium containing products within 48 hours, especially in neonates. A second advisory <www.fda.gov/medwatch/safety/2007/Rocephin_HCP_august2007.pdf> stresses that Rocephin and calcium-containing solutions, including parenteral nutrition, should not be mixed or co-administered within 48 hours, even

via different infusion lines at different sites. Computer alerts or smart pumps can help warn clinicians about such conditions.

[ISMP Medication Safety Alert! 4 October 2007]

Conditions that lead to student nurse-related errors

If your organisation provides a site for clinical rotations of student nurses, you may be aware that students can be involved in medication errors despite close supervision by their instructors. When analysing errors involving student nurses reported to the USP-ISMP Medication Errors Reporting Program and the PA Patient Safety Reporting System, it appears that many of the errors arise from a distinct set of error-prone conditions or medications. Some student-related errors are similar in origin to those that seasoned licensed health professionals make, such as misinterpreting abbreviations, misidentifying drugs due to look-alike labels and packages, misprogramming a pump due to a design flaw, or making a mental slip when distracted. Other errors stem from system problems and practice issues that are rather unique to environments where students and hospital staff are caring for patients. The duality of patient assignments is a prime example. Patients who are assigned to student nurses are also assigned to staff nurses. While dual assignments are necessary, communication breakdowns regarding who will administer medications to patients, what medications have been administered, and which medications should be held, have resulted in dose omissions and the administration of extra doses. Thus, the communication between students, nursing instructors, and staff needs to be planned carefully to ensure a model that considers the safety issues associated with dual assignments. Data from the reporting programs also show that insulin is among the most frequent drugs involved in student nurse-related errors, particularly with omitting prescribed doses, selecting the wrong type of insulin, administering the wrong sliding-scale insulin coverage, and administering insulin to the wrong patient. Student nurses may not make proportionately more errors with insulin than staff nurses. However, like staff nurses, students and nursing instructors must treat insulin as a high-alert medication and observe the robust safeguards in place to prevent errors. This should include an independent double-check of all insulin doses by a staff nurse before administration. Additionally, organisations should share their list of high-alert drugs and associated error-reduction strategies with nursing instructors to ensure the same level of attention to safe systems and practices occurs when students administer these drugs. Table 1 (p. 131) is a list of additional error-prone conditions identified through analysis of student nurse-related errors. The list is not intended to be critical of student nurses or their instructors, nor is it intended to discourage organisations from providing a clinical rotation site for students. Indeed, student nurses often enrich the patient's experience during hospitalisation, and they should be welcomed as part of the patient care team. Rather, the information in Table 1 should be used to stimulate system improvements to reduce the risk of medication errors. Each practice site that hosts student nurses should meet with the instructors who will be supervising students. The organisation's medication administration procedures and specific error-prone conditions that may exist during clinical rotations should be reviewed, along with system-level safety nets that have been designed to reduce these risks, and safety practices that students and faculty should adopt to further enhance patient safety. In addition to the examples in Table 1, instructors may be able to describe other error-prone conditions that they have observed, which can be addressed. Nursing instructors should be invited to attend any orientation programs that cover the organisation's safety goals so they can reinforce related safe practices during clinical rotations.

[ISMP Medication Safety Alert! 18 October 2007]

Sound-alike names

A community pharmacist misheard a telephone prescription for Prozac (fluoxetine) 10 mg daily as Prograf (tacrolimus) 10 mg daily. When the patient arrived to pick up the prescription, the pharmacist discussed the use of the medication with her and subsequently recognised that an error had occurred. Although the two names sound alike when spoken, this is the first time we have received a report of a mix-up. We thought you would like to know so you can take steps to make sure similar mix-ups do not occur at your practice site. In this case, communication between the pharmacist and patient allowed for the correction of the initial mistake before the patient received the drug. Given the potential for increased susceptibility to infection due to the immunosuppressant properties of Prograf, severe harm could have occurred had the error not been recognised prior to the patient leaving the pharmacy. ISMP's recommendations for preventing sound-alike mix-ups are included with the Joint Commission National Patient Safety's look-alike/sound-alike medications, and can be found on <www.jointcommission.org>.

[ISMP Medication Safety Alert! 29 November 2007]

Another heparin error

It has been headline news for the past week: three infants at a reputable hospital received 1000 times more heparin than intended when vials containing 10 000 units/mL instead of 10 units/mL were used in error to flush vascular access lines. No doubt the intense media attention given to these errors is related to the fact that two of the infants are the newborn twins of Hollywood celebrities Dennis and Kimberly Quaid. Fortunately, according to news reports, none of the infants suffered lasting adverse effects from the error. These events are similar to a case in Indiana last year, where three babies died after receiving overdoses of heparin while flushing their vascular access lines. According to news reports, in both these cases, pharmacy technicians accidentally placed vials containing more concentrated heparin (10 000 units/mL) in locations in patient care areas designated for less concentrated heparin vials (10 units/mL). Vials containing the different strengths of heparin looked similar. Thus, the nurses who were accustomed to finding only the 10 units/mL concentration of heparin in stock, did not notice the error until after the wrong concentration had been used to flush the infants' access lines. In response to the most recent error, the hospital no longer stocks heparin 10 units/mL vials in paediatric units and uses saline to flush all neonatal, paediatric, and adult peripheral lines. No information was shared about flushing practices for central line catheters, including umbilical lines and PICC lines. In the pharmacy, heparin 10 000 units/mL vials have been separated from vials containing other strengths.

[ISMP Medication Safety Alert! 29 November 2007]

Learning from mistakes so we don't repeat them

A deep analysis of these heparin errors underscores two fundamental problems that continue to threaten patient safety: failure to fully adopt a learning culture; failure to be truly mindful about safety. **Learning culture.** When viewed from the aggregate perspective of all health care provided to all patients, harmful errors might seem to occur frequently. In individual organisations, however, they occur infrequently. Therefore, the only way to make significant safety improvements and remain consistently mindful of patient safety is to seek out and learn from information about risk and errors from within the organisation and externally. Unfortunately, many organisations do not use external safety information from sources such as

FDA and USP advisories, and other reliable publications, to inform internal improvement efforts. It is rare for healthcare organisations to systematically and effectively learn from the failures of others. In 2000 and 2004, ISMP distributed a medication safety self-assessment tool for hospitals. When asked if an interdisciplinary team uses published error experiences to improve medication safety, only 50% of more than 1600 participating hospitals in 2004 (and 29% in 2000) said they consistently perform this important function. *Australia released our version of the MSSA in Feb 2007 and it is now referenced in EQUIP 4 standards from the Australian Council on Healthcare Standards.* Because organisations want to be safe, they tend to look for evidence of safety, not hazards, and may not recognise the valuable gift that colleagues offer by sharing their stories of error and risk. Regulatory and accrediting agencies have tacitly endorsed this behaviour by failing to require organisations to seek out and learn from the failures of others as a condition of accreditation or licensure. Of all the elements of a culture of safety, a learning culture is probably the easiest to engineer and the hardest to make work. In a learning culture, workers must possess the willingness and competence to draw responsible conclusions from robust internal and external safety information systems and make substantial changes when necessary. Too often, practitioners read published reports about harmful errors but do not truly believe the events could happen to them. Absent shared learning, the same heparin error will likely occur in other hospitals. **Mindfulness.** The health industry has not sufficiently developed a healthy preoccupation with system failures to counteract the usual sense of comfort that stems from success. Instead of harbouring a chronic worry about system failure, health workers have become complacent and are not always thinking critically about patient safety. Prime examples include the misguided 'no news is good news' viewpoint in organisations that have not yet experienced a tragic medical error, and discourses that simply chastise organisations when an error happens, without offering a thoughtful analysis of the event and practical recommendations to prevent recurrence. Each organisation needs to proactively identify risks, appreciate how susceptible its systems are to the same errors that have happened in other organisations, and acknowledge that the absence of similar errors is not necessarily evidence of success. Challenge the status quo, and inspire and encourage staff to track down bad news (internally and externally), learn from it, and use it to improve patient safety. Help shatter assumptions that systems are safe until proven dangerous by a tragic event. And do not let the heparin errors described happen in your organisation, or a needless death from mistakenly administering a neuromuscular blocker found among other vials of medication in the refrigerator, or accidentally administering vincristine by the intrathecal route, or... It has been said that those who do not learn from mistakes are destined to repeat them.

[ISMP Medication Safety Alert! 29 November 2007]

T1D or TID?

T1D (letter T, number 1, letter D) is a potentially dangerous abbreviation for 'type 1 diabetes' that appears occasionally in the literature. If it is used when writing orders for patients, we envision that the abbreviation will eventually be mistaken for 'three times daily', so avoid its use.

[ISMP Medication Safety Alert! 29 November 2007]