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, Concord, NSW). The Australian incidents are collated and editorial recommendations made by Penny Thornton (Federal Councillor, SHPA, and Pharmacy Services Manager, The Children's Hospital, Westmead NSW; e-mail: pennyt2@chw.edu.au).

AUSTRALIAN INCIDENTS

Aza–Azi similarity—generic name confusion

Azathioprine, an immunosuppressant comes in 25 mg and 50 mg tablets. Azithromycin, an antibiotic (predominantly used at this paediatric institution for cystic fibrosis) comes in 500 mg tablets. An order was written for azithromycin 250 mg but the patient was given 5 tablets of azathioprine 50 mg (250 mg). The patient refused to take more than one tablet. The error was picked up when the mother went to pharmacy requesting an increased tablet strength so the patient would not have to take so many tablets. If you need to give a child more than 2 tablets for a dose—re-check that you have the right drug and/or dose prior to administration!
[Australian Incident 57, May 2007]

Diazepam/Ditropan handwritten confusion in a brand generic name mixture

Diazepam, a benzodiazepine, is used as a muscle relaxant, anticonvulsant or anxiolytic. Ditropan (oxybutynin) is used to treat bladder spasm. Due to misinterpretation of the written drug name in the medical notes, the patient was ordered and given diazepam 2.5 mg instead of Ditropan for 3 days before the error was noticed. Both of these drugs come in 5 mg tablets. This is one instance where ensuring consistent generic drug name prescribing would have prevented misinterpretation. While not a watertight rule, in general there are less combinations of generic drug names which can be mistaken than brand names.
[Australian Incident 58, May 2007]

Non-use of premixed potassium and electrolyte confusion

A nurse on checking her paediatric patient's fluids against what was charted found he was being administered N/2 saline with 20 mmol of sodium bicarbonate. He had been ordered N/2 saline with 10 mmol KCl and this order had been signed as started. 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 he had been charted for 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 leave patients vulnerable from both infection and mis-selection. If this is compounded with a lack of clear prescribing the patient is vulnerable. If the order had been clear, the previous nurse would not have had to second-guess the prescriber and she would have been able to take a bag of pre-mixed potassium fluid for use without need for additive. We must all be aware of the first national alert of the Safety & Quality Council of Australia which recommends pre-mixed potassium fluid wherever possible.
[Australian Incident 60, May 2007]

US SAFETY BRIEFS

Draft guidelines for safe e-communication of drug orders

ISMP has published draft guidelines for 'Safe electronic communication of medication orders' and are seeking comments <www.ismp.org/Newsletters/acutecare/articles/2003 0220.asp ?ptr=y>.
[ISMP Medication Safety Alert! 27 March 2007]

NHS takes action on tubing misconnection issue

The UK National Patient Safety Agency (NPSA) has done something that should set an example to all regulatory authorities. They have set deadlines for NHS entities in England and Wales to adopt enteral feeding catheters that do not contain ports with female luer connectors. Ports with female luer connectors need parenteral syringes to administer oral liquid medicines. Many enteral catheters manufactured in the US feature ports that accept parenteral syringes. Even if a liquid medicine is prepared in an oral syringe, the medicine must be transferred to a parenteral syringe for administration via an enteral catheter, risking the accidental administration of the drug via a parenteral line. The NPSA directive also requires enteral catheters to have end connectors that are unable to connect to IV or other parenteral lines. Ports and connectors on the enteral feeding catheter must feature a male luer catheter tip or other non-female luer design, e.g. administration sets will have a female luer connector to fit a male luer on the nasogastric tube (reverse luer connection). The NPSA has held meetings with medical device industry representatives to inform them of their design recommendations, and it is anticipated that the recommendations will be incorporated into catheters and administration sets within 12 months. The design is similar to an error mentioned previously in which an infant accidentally received breast milk IV instead of via a nasogastric tube <www.ismp.org/Newsletters/acutecare/articles/20060615.asp>. The March 2007, NPSA *Patient Safety Alert* also announced that when a spoon or graduated measure cannot be used, measurement and administration of oral liquid drug doses must use labelled oral syringes that cannot be connected to IV catheters or ports. The measures being undertaken also prohibit three-way taps or syringe tip adapters, as these connecting devices bypass safeguards. Oral syringes must be in use in clinical areas by 30 September 2007, with remaining recommendations in place by 31 March 2008. Special training of health professionals must occur and policies must be in place by the 2008 deadline. NPSA is a special health authority created within NHS to coordinate the safety efforts of all those involved in health care, and more importantly, to learn from adverse events occurring in the NHS. There is no equivalent organisation in the US although the Joint Commission has served a similar role as an accreditation organisation. A Joint Commission 2008 National Patient Safety Goal to prevent tubing misconnections was not approved after field review earlier this year. Representatives from the US FDA, American Hospital Association, ISMP, and several other organisations have formed an ad hoc committee that is expected to publish a white paper in 2007 on the issue of catheter misconnections <www.npsa.nhs.uk/health/alerts>.
[ISMP Medication Safety Alert! 3 May 2007]

Action needed to prevent heparin-insulin confusion

The New Jersey Department of Health and Senior Services' Patient Safety Initiative recently issued an alert to hospitals after learning of an incident involving a bag of TPN that contained insulin instead of heparin. A blood glucose level of 17 mg/dL was reported for a premature baby in the NICU, 6 hours after a TPN infusion had been started. Despite multiple bolus doses of dextrose and an infusion of dextrose 20% in NaCl 0.45%,

the hypoglycaemia did not resolve until discontinuing the TPN. The neonatologist asked that the remaining TPN be sent for analysis, which showed that it contained insulin, not heparin. This hospital receives TPN from a national vendor and an investigation into the event is under way. ISMP has received multiple reports of similar events of mix-ups between heparin and insulin occurring, some examples include:

- Cases of severe hypoglycaemia after a pharmacist added 200 units of insulin instead of heparin to TPN, and another added 1000 units of insulin instead of heparin to TPN.
- Two patients, neither of whom was diabetic, died after being injected with insulin instead of heparin during a vascular catheter flush procedure.
- A central line catheter was flushed by a nurse with insulin instead of heparin.
- A nurse erroneously transcribed a verbal order to resume an insulin drip as 'resume heparin drip'.
- A pharmacist entered an order for heparin 500 units into the computer as 'regular insulin 500 units'.
- A non-diabetic patient received 50 units of insulin (0.5 mL) SC instead of heparin 5000 units (0.5 mL).

The commonest factors associated with these mix-ups seems to be: similar packaging of insulin and heparin in 10 mL vials; placement of insulin and heparin vials next to each other on counters, drug carts, or under a pharmacy IV admixture hoods; and mental slips leading to confusion between heparin and insulin, especially as both drugs are dosed in units. Perhaps the risk of a mental slip is growing, as insulin infusions are now more commonly used. In cases of unexpected, unexplained hypoglycaemia, consider the possibility of a medication error and take the following steps: discontinue all infusions and hang new solutions, treat patients as necessary with dextrose, and check for unintended additives by sending the infusion bags for analysis. Hypoglycaemia may also be caused by the erroneous administration of an oral hypoglycaemic to a non-diabetic patient. Early identification and treatment of iatrogenically induced hypoglycaemia can mitigate harm.

Recommendations: Do not keep insulin and heparin vials next to each other on counters, drug carts, or under pharmacy IV admixture hoods. Many organisations do not allow insulin near where TPN is being prepared, as they administer all insulin separately. Consider providing insulin to patient care units in pen devices rather than vials. When insulin is needed for an IV, it should be retrieved and added separately from other ingredients and returned to the appropriate storage area immediately after use. Adding insulin to any IV solution should occur in the pharmacy. Require an independent double-check of IV insulin and IV heparin doses/infusions before dispensing. Require an independent double-check of all TPN solutions, including an initial independent check of the vials gathered for additives that must be added manually, another check of the vials and the syringes pulled back to the volumes of drug actually added to the solution, and an independent check of the finished solution comparing the label and the original order. This double-check process should occur even if the TPN is prepared by a pharmacist. Finally, consider eliminating heparin as a TPN additive or as part of a vascular catheter flush procedure, thus removing the potential for confusion with insulin. The addition of heparin to peripheral and central parenteral nutrition solutions for thromboprophylaxis is a matter of debate, as effectiveness has not been shown. Also have the pharmacy and therapeutics committees and neonatologists determine whether heparin is absolutely necessary in infant TPN solutions, or establish criteria for when its use is indicated. A systematic review concluded that heparin infusions are effective in improving umbilical arterial catheter patency in neonates with no statistically significant evidence of adverse outcomes <www.nichd.nih.gov/ochraneShah4/SHAH.htm#Barrington%202000>. The effectiveness of heparin to prevent thrombosis in neonates with peripheral central catheters has not been systematically evaluated. At present, there is no evidence to support its use. More research is needed to identify the benefits and risks of using heparin in neonates.

Australian comment: We believe there is sufficiently different packaging and storage in Australia to avoid confusion, however the risk of a mental slip is real.

[ISMP Medication Safety Alert! 3 May 2007]

Failure to clearly link brand products to paracetamol poses threat to drug safety

ISMP has noticed a lack of any mention of paracetamol as the active ingredient in several products (single and multiple ingredient) in advertising (billboards and web sites). Paracetamol is well known to the public as a generic OTC analgesic. It has also received significant public attention as a leading cause of acute liver failure when taken in conjunction with alcohol, as an intentional overdose, and as unintentional overdoses when exceeding recommended amounts. Consumers need to link brand names with paracetamol so that these products are not taken concurrently or with other prescription and OTC products that contain paracetamol. Review by the FDA of numerous cases of unintentional overdose and associated hepatotoxicity identified four contributory factors.

- Failure by consumers to recognise the ingredients contained in OTC drug products and/or the potential for harm due to exceeding the recommended dose.
- Variety and availability of both OTC and prescription products that contain paracetamol (e.g. single ingredient, combinations, multiple formulations)
- Lack of consumer awareness of the potential to develop serious adverse effects from taking two or more different products containing paracetamol concomitantly.
- Failure of prescription container labels to list paracetamol as an ingredient.

Contributing factors for the latter point include size limitations of inventory fields in pharmacy computers, and 'real estate' issues on pharmacy labels, which often results in omissions or the use of abbreviations on labels that are difficult for consumers to understand. In addition, many pharmacies have turned off the duplicate checking function for drugs in the same therapeutic class because of excessive alerts, thus reducing the ability to ward staff about excessive paracetamol doses.

Australian comment: In Australia, ingredients must be listed, however until the Trans-Tasman labelling order is in operation, there is no mandate as to font size of the listing. It is often hard to locate and decipher ingredient listings on OTC products and we wonder how often the public recognise differing products containing paracetamol as many of these are purchased outside of pharmacies without the safety net of pharmacy staff alerting them to the dangers.

[ISMP Medication Safety Alert! 5 April 2007]

ISMP 2007 survey on HIGH-ALERT medications

High-alert medications are those that bear a heightened risk of causing significant 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.

Practitioners' views. Drugs based on ISMP's current list of high-alert medications and 3 new drugs for consideration, were most frequently and least frequently considered high-alert medications by survey respondents (Tables 1, 2). These findings were similar to responses received during ISMP's 2003 survey on high-alert drugs <www.ismp.org/Newsletters/acutecare/articles/20031016.asp>, with a few exceptions: epidural and

intrathecal drugs, added to ISMP's high-alert drug list *after* the 2003 survey, joined the top 10 drugs that practitioners felt should be considered high-alert in the 2007 survey. Three additional drugs added *after* the 2003 survey—colchicine injection, IV radiocontrast media, oral methotrexate for non-oncological use—are among the drugs least frequently considered high-alert; however, close to half the respondents considered them to be high-alert drugs in the 2007 survey. The three new drugs added to the 2007 survey for consideration—epoprostenol, oxytocin, promethazine IV—are among the least frequently considered high-alert; however, more than half the respondents felt they should be high-alert drugs. There was a sizeable increase in the frequency with which respondents felt general anaesthetics should be considered high-alert (77% in 2003 to 86% in 2007). There were sizable decreases in the frequency with which respondents believed hypertonic sodium chloride (91% in 2003 to 83% in 2007) and warfarin (73% in 2003 to 60% in 2007) should be considered high-alert. It is interesting that risk/quality/safety managers who responded to the survey placed both hypertonic sodium chloride and warfarin among the top 10 drugs that they felt should be considered high-alert. Perhaps these differences can be explained by the knowledge that risk/quality/safety managers often have regarding the drugs that have caused patient harm. Practitioners may not be privy to these data, which often stems from internal and external error reporting databases, reports of malpractice claims and judgments, patient complaints, and publications about sentinel events involving drugs. **Practice site adoption.** Respondents also reported whether their practice sites treated each drug on the survey as high-alert, with special precautions in place to prevent errors and harm. Tables 1 and 2 provide information on these findings, showing the differences between practitioners' beliefs that the drug should be considered high-alert, and practice site adoption of safety precautions for the drug. The most common drugs/drug categories considered high-alert in practice sites included: parenteral chemotherapy (90%); IV insulin (88%); KCl for injection concentrate (86%); IV unfractionated heparin (80%); epidural/intrathecal drugs (79%); neuromuscular blockers (78%); potassium phosphate injection (77%). The least common drugs/drug categories considered high-alert included: oral hypoglycaemics (21%); colchicine injection (29%); epoprostenol (39%); dialysis solutions, peritoneal and haemodialysis (40%); IV adrenergic antagonists (41%); IV radiocontrast drugs (43%); liposomal forms of drugs (44%). Although the gap was sometimes fairly large between respondents' beliefs and practice site designation as a high-alert drug, the adoption of safety precautions for many of the specific drugs/drug classes generally increased between 2003 and 2007. **Differing views.** Some interesting differences emerged between nurses' and pharmacists' perceptions on which drugs they considered high-alert. With only two exceptions—concentrated NaCl and SC insulin—nurses more frequently identified the drugs listed in the survey as high-alert than did pharmacists (Table 4). For certain drugs, including two of the new drugs added in the 2007 survey, the differences were large: 65% of nurses reported that IV radiocontrast drugs should be considered high-alert, compared to 34% of pharmacists. Seventy-three per cent of nurses believed that oxytocin should be a high-alert drug but only 38% of pharmacists agreed. Sixty-eight per cent of nurses felt that epoprostenol should be a high-alert drug, compared to 45% of pharmacists. **Using the survey findings.** ISMP will be compiling an updated list of high-alert drugs based on these findings, along with evidence from various medication error reporting programs to which ISMP has access, and the opinions of safety experts throughout the US <www.ismp.org/survey/Survey2007 02W.asp>. Discussions on nursing and pharmacy perspectives may prove to be worthwhile, including exploration of the differences in opinion about which drugs should be considered high-alert. Differences between practitioners' beliefs that a drug should be high-alert and practice site adoption of safety precautions for the drug might also be useful.

Table 1. Medications **MOST FREQUENTLY** considered high-alert (N=770)

		Medications considered high-alert at practice sites
Chemotherapeutic agents, parenteral	97%	90%
Neuromuscular blocking agents	94%	78%
IV insulin	93%	88%
Epidural/intrathecal drugs	93%	79%
Potassium chloride for injection concentrate	93%	86%
Potassium phosphates injection	87%	77%
Anesthetic agents	86%	68%
IV unfractionated heparin	85%	80%
IV adrenergic agonists	83%	63%
Thrombolytics/fibrinolytics	83%	70%
Sodium chloride injection, more than 0.9% strength	83%	71%
Narcotics and opiates, IV, transdermal, oral	79%	68%
Moderate sedation agents, oral, for children	78%	62%
Chemotherapeutic agents, oral	78%	66%
Subcutaneous insulin	76%	73%

Table 2. Medications **LEAST FREQUENTLY** considered high-alert (N=770)

		Medications considered high-alert at practice sites
Hypoglycemics, oral	30%	21%
Colchicine injection	47%	29%
IV radiocontrast agents	54%	43%
Methotrexate, oral, non-oncologic use	56%	45%
Total parenteral nutrition	55%	50%
Liposomal forms of drugs	56%	44%
IV adrenergic antagonists	56%	41%
Dialysis solutions, peritoneal/hemodialysis	57%	40%
Epoprostenol (Flolan)*	58%	39%
Oxytocin*	58%	42%
IV promethazine injection*	60%	43%
Heparin, low molecular weight	60%	53%
Glycoprotein IIb, IIIa inhibitors	64%	52%
Inotropic medications, IV (e.g., digoxin, milrinone)	67%	50%
Warfarin	67%	54%

*New in 2007

Table 4. Differences between pharmacists [RPh] (=210) and nurses (n=363)

	RPh	Nurses
Oxytocin*	38%	73%
IV radiocontrast agents	34%	65%
IV adrenergic antagonists	38%	65%
Dialysis solutions, peritoneal/hemodialysis	41%	68%
Epoprostenol (Flolan)*	45%	68%
Nitroprusside, sodium, injection	60%	83%
IV moderate sedation agents	57%	79%
Liposomal forms of drugs	45%	64%
Anesthetic agents	74%	93%
IV amiodarone	59%	77%
Dextrose, 20% or greater	58%	76%
IV lidocaine	58%	76%
Cardioplegic solutions	66%	83%
Moderate sedation agents, oral, for children	69%	84%
Sodium chloride injection, more than 0.9% strength	91%	77%
Subcutaneous insulin	84%	76%

*New in 2007