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

Label oral liquid pharmaceuticals with strength and dose?

A child was admitted to hospital with increasing seizures. She had been prescribed phenobarbitone syrup 1.5 mL twice daily. On investigation by a pharmacist, it was discovered that on recent discharge from another hospital, a Pharmaceutical Benefits Scheme prescription had been written for phenobarbitone 1.5 mL twice daily. As there is only one strength of phenobarbitone (15 mg/5 mL) liquid readily available in community pharmacy, this strength had been dispensed and a dose of 1.5 mL had been given. The increasing seizures had resulted from under-dosing. The pharmacist also discovered that prior to discharge, the child had been taking a dose of phenobarbitone 15 mg twice daily using the syrup manufactured by the hospital, i.e. 1.5 mL twice daily of a 10 mg/mL syrup. There has been debate over whether pharmacists should label dispensed oral liquid preparations with dose instructions in … mL and (… mg). It was noted that this may be too confusing for some patients and carers as the strength is clearly present in the product title in the header and they can always back calculate their dose. However, incidents like this show that when there are different strengths of liquids available, prescribing and labelling doses in mL is hazardous. Perhaps an answer is to give both dose instructions, in …mL *and* in (… mg) with the volume in bold type. Obviously we should also ensure that the patient has consumer medicines information and a marked/calibrated oral dose delivery syringe unless a volume easily measured in a medicine cup is to be given. *[Australian Incident 100, May 2009]*

Tamiflu – another oral syringe safety concern?

An unusual problem with oral syringes is prescription labelling. With the recent urgent dispensing of oseltamivir, problems have been noticed with the oral syringe included in the box (Figure 1). Although the strength of the reconstituted oral suspension is clearly marked on the box as 12 mg/mL, when the oral syringe is used to measure the dose, one is confronted with calibrations in 15 mg increments (30 mg, 45 mg, 60 mg with no interim divisions). These calibrations are aligned with recommended dose increments and in most cases the correct dose is easily measured. However, pharmacists are used to expressing the dispensed item strengths in mg/mL and giving patients a dose in mL to take with an oral syringe calibrated in mL increments. Perhaps in this case we need to change our practice and give a dose in mg for regular doses. However, there are no calibrations below a 30 mg dose. What if doses are to be given to a child who is three and a half months old (6 kg = 12 mg dose)? Will parents be able to estimate a dose of 12 mg from a syringe where the nearest measure is 30 mg? We have decided to include a calibrated 5 mL oral syringe for very young patients to whom we dispense or for whom we supply a pre-labelled bottle for nurse dispensing with directions: *Take ... mL TWICE a day for 5 days*.
[Australian Incident 101, May 2009]

Figure 1. Oral syringe included with the Tamiflu suspension

US SAFETY BRIEFS

Your organisation's LASA drug name lists

Pharmaceutical manufacturers and regulatory authorities have been taking measures to determine if there are unacceptable similarities between proposed names and products on the market. Although some improvement has occurred, factors such as handwritten and verbal prescriptions, which can easily be mistaken as look-alike or sound-alike (LASA) drug names and the vast number of products on the market have impeded resolution of the problem. In March 2009, we distributed a subscriber survey to learn how healthcare providers are dealing with LASA drug names. This safety concern has been the focus of one of the Joint Commission's National Patient Safety Goals since 2005. The National Patient Safety Goals requires accredited organisations to maintain and annually review a list of at least ten LASA drug name pairs and to take action to prevent the interchange of these products. Our survey found that more than a quarter of responding nurses did not know whether their organisations maintained a list of LASA drug names.

LASA drug name pairs. About 80% of respondents reported that their organisation maintains a list of LASA drug name pairs that could be confused with each other. Uncertainty about whether their organisation maintains such a list was higher among nurses (27%) than pharmacists (3%). A quarter (26%) of respondents felt they could name most of the drug name pairs on their organisation's list; 5% could not name any drugs on their LASA list. Half of the respondents' LASA list contained more than 15 name pairs; 30% contained 11 to 15 name pairs; 14% 10 name pairs; and 6% less than 10 name

pairs. Thirty-nine per cent of nurses and 16% of pharmacists had no idea where the LASA list originated. Half of the respondents (54%) reported adding new drug name pairs to their organisation's initial list, but almost a third (29%) were uncertain whether any drug name pairs had ever been added.

Risk-reduction steps. Among respondents with a list of LASA drug name pairs, 87% reported that their organisations had identified risk-reduction steps to reduce confusion between these drugs. Of those, half felt their organisation had implemented all the identified risk-reduction steps. About 11% of respondents were uncertain whether their organisation had identified and/or implemented risk-reduction steps; 2% said no steps have been identified or implemented. The most common resources used to identify risk-reduction steps included best-practice recommendations in the literature (41%), ISMP resources (38%) and analysis of internal medication use systems (37%). Most frequently addressed risk-reduction steps included drug dispensing (91%), drug storage (89%) and drug administration (80%). Least frequently addressed steps included drug procurement (57%), transcription of drug orders (60%) and prescribing (65%). The most frequently implemented risk-reduction steps involved limiting access to drugs on the LASA list, particularly avoiding unit stock and dispensing the prescribed products from the pharmacy in unit doses. Displaying the entire drug name on computer screens when stems are used for mnemonics, and requiring prescribers to include the dosage form, strength and instructions also ranked among the top risk-reduction steps. Risk-reduction steps that involved patients, such as investigating their concerns about drug appearance, were the least used strategies, as were redundancies, prescribing by brand and generic names, bar-coding and daily physician review of prescribed drugs. Including the drug's indication when prescribing also scored low, with only a few respondents using this strategy. Not listed as a choice on our survey, automated dispensing cabinets were mentioned by some as a way of decreasing mix-ups if the LASA drugs are stored in separate drawers that open only when selected, and if the LASA drug names are easily distinguishable on the screen.

Effectiveness of risk-reduction steps. On average, 82% of respondents believed their organisation's risk-reduction strategies had been effective – pharmacists (86%) were more likely to believe this than nurses (76%). Three-quarters of nurses (76%) and pharmacists (78%) agreed that the strategies taken by their organisations to guard against confusion had prevented them from making a mistake with the targeted LASA drugs.

Conclusion. Our survey suggests that more can be done to reduce the risk of errors with LASA drugs. The first point of business: all staff involved in medication use, particularly frontline nurses, pharmacists, physicians, unit secretaries and technicians, need to be aware of their organisation's LASA list, how it was selected and is updated, what it means, why it is important to patient safety, and the steps laid out to reduce mix-ups. Keeping the list manageable is also crucial. A manageable number of drug name pairs on the list should not prevent you from taking steps – bar-coding technology to the use of tall man letters – to reduce mix-ups among different products with LASA names. Your organisation's LASA list should serve to draw attention to a finite number of products that can cause great harm if confused, and to promote knowledge of and compliance with drug-specific risk-reduction strategies. Further, when adding a new name pair to the list, an awareness campaign is needed. In addition, do not forget to employ risk-reduction strategies that target the procurement, transcription and prescribing of the drug name pairs on your LASA list, and to expand the patient's role to help ensure a mix-up does not happen.

[ISMP Medication Safety Alert! 21 May 2009]

Too much HYDROmorphone

A 40-year-old healthy man visited an emergency department for severe throat pain. At the hospital, he was given hydromorphone (Dilaudid) 2 mg IV at 8 am. He was then transferred to a nursing unit where he was given two additional doses of hydromorphone 2 mg IV prior to 5 pm. The patient rarely took opioids except Vicodin (acetaminophen + hydrocodone), which he had not tolerated well. The patient's wife mentioned this and it was noted in his chart. The patient suffered a respiratory arrest and was resuscitated but sustained permanent central nervous system impairment and died. The death was attributed to the hydromorphone dosing. Even if hydromorphone was an appropriate analgesic for throat pain, patients should not receive high initial doses of opiates, hydromorphone 2 mg IV is equivalent to morphine 12 to 14 mg IV, an extremely large dose for anyone who has not been on opiates in the past. Another analgesic, even non-narcotic, may have been a safer choice and adequate to relieve the patient's throat pain.

[ISMP Medication Safety Alert! 4 June 2009]

Volume control set safety

Hospitals that use Buretrol or Soluset volume control sets should examine how they are being used to deliver IV medications in patient care units. Of concern is the lack of identifying the drug placed in the volume control sets – particularly in an emergency – as well as the potential for chemical inactivation or precipitation that may occur in the volume control sets or IV tubing when multiple medications are administered using the same set. If volume control sets are used, ensure that staff label the chamber when medications are added, check incompatibilities with pharmacy before adding the drug and maintain sterile technique.

[ISMP Medication Safety Alert! 4 June 2009]

Australian comment: Also ensure added drugs are fully mixed with diluents prior to commencing infusion, as concentrated drug (e.g. potassium) administration may result if not fully mixed.

Intrathecal injection warrants mask worn during procedure

Two women who had given birth to healthy babies developed bacterial meningitis following intrathecal injections of anaesthetics by the same anaesthetist. One of the mothers died within days of acquiring the infection, while the other mother is still recovering. Cultures identified *Streptococcus salivarius*, a common organism found in the mouth and respiratory tract, as the bacteria that caused the meningitis in both women. The department of health investigated the adverse events, collecting patient, drug and equipment samples and

reviewed the practices associated with the delivery of spinal or epidural anaesthesia during labour. The health department identified infection control problems as well as inadequate patient monitoring post spinal anaesthesia as contributory to the events. In particular, the health department determined that the events may have been linked to the anaesthetist's failure to wear a mask during the administration of spinal medications. At the hospital where the events occurred, anaesthesiology teams did not routinely wear surgical masks during spinal/epidural procedures, although they do now. Wearing a mask during these procedures may seem a reasonable precaution, even though bacterial meningitis or infections such as epidural abscesses are rare sequelae of spinal anaesthesia. The issue has been widely debated, and literature on this topic can be found in support of both wearing and not wearing a mask. Proponents of wearing a mask cite common sense and well-established evidence proving the effectiveness of universal precautions as adequate to convince anaesthetists to wear a mask during administration of spinal/epidural anaesthesia. However, if more evidence is needed, proponents point to multiple studies that link bacterial meningitis and epidural abscesses to *Streptococcus* pathogens cultured from the nose or throat of clinical staff. Moreover, laboratory evidence corroborates the clinical value of surgical masks in preventing the transmission of organisms from the upper airway and limiting bacterial contamination of a surface. Opponents of wearing a mask during spinal/epidural anaesthesia suggest there are more case reports and studies in the literature that describe the occurrence of bacterial meningitis and epidural abscesses despite the anaesthetist wearing a face mask than there are implicating the anaesthetist when no mask was worn. They acknowledge that case reports often implicate nose and throat flora of the anaesthetist, but suggest that the studies do not prove the anaesthetist caused the infection. Some studies of iatrogenic bacterial meningitis and epidural abscesses also fail to mention whether or not a mask was worn during the procedure, making it difficult to draw conclusions on the subject. While one study showed that masks decreased growth in agar plates placed 30 cm in front of anaesthetists who talked for several minutes, the same study showed increased bacterial growth once the masks had been worn for 15 minutes when compared to not wearing a mask. Since anaesthetists rarely change their masks during a procedure and may use the same mask for the entire day, the mask may increase the risk of transmitting a bacterial infection. The need to wear a mask during spinal/epidural procedures is also questioned on the basis of evidence that masks do not actually decrease the rate of surgical wound infections. The Centers for Disease Control and Prevention recommends wearing a mask when carrying out these procedures, including myelograms and lumbar punctures. The recommendation is categorised on the basis of existing scientific data as: 1B: Strongly recommended for implementation and supported by some experimental, clinical, or epidemiologic studies and a strong theoretical rationale. The decision by the Centers for Disease Control and Prevention to recommend wearing a mask was based in large part on evidence that face masks are effective in limiting the dispersal of oropharyngeal droplets and are recommended as an evidence-based practice for the placement of central venous catheters. Although the absence of a mask during initiation of spinal/epidural anaesthesia may not necessarily cause the patient to develop an infection, most evidence points to the fact that it makes the procedure a safer one. It would appear that not wearing a mask is hard to justify when identical organisms have been grown from patient cultures and nasal swabs from anaesthetists who did not wear a mask.
[ISMP Medication Safety Alert! 18 June 2009]

Smoking cessation drug update
FDA has issued a public health advisory <www.fda.gov/Drugs/DrugSafety/PublicHealthAdvisories/ucm169988.htm> stating that manufacturers of the smoking cessation aids varenicline (Chantix) and bupropion (Zyban) are required to add new boxed warnings and develop patient medication guides highlighting the risk of serious neuropsychiatric symptoms in patients using these products. The boxed warning for varenicline now warns about changes in behaviour, hostility, agitation, depressed mood, suicidal thoughts and behaviour, and attempted suicide. The new label also mentions serious skin disorders and accidental injuries as adverse effects.
[ISMP Medication Safety Alert! 16 July 2009]

Insulin errors
For emergency treatment of hyperkalaemia, 10 to 15 units of regular IV insulin along with 50 mL of 50% glucose (to prevent hypoglycaemia) is often given, causing potassium ions to shift into cells. A renal transplant recipient developed cardiopulmonary instability while receiving insulin as part of this regimen. While searching for the cause, the physician discovered that the patient had accidentally received 100 units rather than 10 units of regular IV insulin. During investigation of the event, it was determined that an anaesthetic resident drew 1 mL of U-100 insulin into a 10 mL syringe, added 9 mL of saline, and injected the entire contents. Undiluted U-100 insulin does not provide enough volume for injection via IV tubing. They also identified that hospital orientation and training of anaesthetic residents in medication preparation was inadequate. At the hospital where the error occurred, development of a medication preparation course and preceptor program is being considered for new residents and anaesthesia, operating room and pharmacy staff. In hospitals with operating room pharmacy satellites, insulin dilution and dose preparation should occur in the satellites. Some hospitals use an insulin minibag system (prediluted to 1 unit/mL). However, insulin adherence to plastic IV equipment makes it difficult to estimate exactly how much insulin is reaching patients.
[ISMP Medication Safety Alert! 16 July 2009]

Provera, Prozac or Proscar?
An order was written for Provera (medroxyprogesterone) 10 mg po daily. During order entry, the pharmacist misinterpreted the order as Prozac (fluoxetine) 10 mg po daily. The nurse did not detect the error when verifying the order in the electronic medication administration record. The patient received one dose of Prozac. The

physician discovered the error the next day while he was reviewing the patient's medication list (highly recommended form of redundancy that has detected many errors). The handwritten order was shown to several nurses, pharmacists and physicians. Most read the order as Provera but one physician thought it was Prozac. One nurse guessed it was Provera but also said it could be Proscar (finasteride). Poor handwriting was a contributing factor, as was the fact that Provera is infrequently prescribed while Prozac is a commonly prescribed drug, perhaps biasing the reader's interpretation as Prozac on the handwritten prescription. *[ISMP Medication Safety Alert! 30 July 2009]*

Fatal sound-alike

A pharmacist from Ireland told us about a patient who in the course of treatment was given parenteral morphine. The patient was sensitive to the drug and developed respiratory depression. The physician telephoned in an order for an ampoule of NaLoxone to be administered. A dose was prepared from unit stock and given but there was no response. A repeat order for a second ampoule of naloxone was also given and again the patient showed no improvement. The nurse then questioned the physician, 'How much of this LaNoxin do you want me to give?' This type of error is considered a metathesis, or transposition of speech sounds or syllables, like saying 'tragedy' instead of 'tragedy'. Instead of NaLoxone, the nurse heard LaNoxin. The patient subsequently died. Contributing to the error, the nurse had not read back (or at least repeated back) the telephone order to the physician, and the physician had prescribed an ampoule of the drug rather than a metric weight dose. The nurse accepted the incomplete order and administered an ampoule of LaNoxin (digoxin) both times.
[ISMP Medication Safety Alert! 30 July 2009]

Investigate and clarify requests for missing doses

A pharmacist received a faxed missing medication request from a nursing unit for vitamin K1 20 mg IV for a patient with an elevated INR of 3.8. The patient, who was being treated for deep vein thrombosis and a pulmonary embolism, had been started on heparin and was recently transitioned to warfarin. The physician determined that an INR of 3.8 was too high and ordered and IV dose of vitamin K1 to be given. Although IV vitamin K1 was in an automated dispensing cabinet, it could not be removed until a pharmacist verified the order. When the drug failed to become available in the automated dispensing cabinet within the usual time it took a pharmacist to review the order, the nurse had sent the message about the missing medication in case pharmacy had overlooked this specific order. Before dispensing the drug, the pharmacist decided to check the dose with the physician, as she read the prescribed dose as 2 mg, and the nurse had requested 20 mg. When questioned, the physician responded that he had prescribed 2 mg. The pharmacist had recognised that the dose of vitamin K1 was considerably higher than it should be for an INR of 3.8. Although the nurse told the pharmacist that the physician was on the unit and wanted the dose given immediately, had the pharmacist not insisted on verifying the dose, the patient could have experienced an adverse outcome. At best, if a 20 mg dose of IV vitamin K1 had been administered, the patient could have been at risk for attenuating the effect of warfarin for weeks; at worst, the patient could have experienced a fatal allergic reaction. Health professionals have a responsibility to question therapy that does not agree with their knowledge or experience. Even though there may be a rational explanation for a variation from established treatment, it is better to question the variation and learn something new than to acquiesce and dispense or administer what might be a harmful dose. It is also reasonable to expect nurses who administer anticoagulants to be familiar with the typical doses of antagonists. Such information should be included in nursing orientation and annual competency evaluations. Additionally, nurses should have easy access to drug references or anticoagulation protocols to verify prescribed doses of antagonists before administration. *[ISMP Medication Safety Alert! 30 July 2009]*

Nurse accidentally kills premature child

There was a wave of indignation after the death of a premature baby born to a young immigrant who was the first person in Spain to die of swine flu. The baby died 14 days after his 20-year-old mother died, because a milk solution that should have been fed into his stomach via a tube was attached instead to a drip into a vein. Hospital authorities immediately admitted a ghastly error. The error was blamed on an inexperienced nurse on her first shifts in the intensive care unit of a major maternity hospital. The maternity unit's nursing supervisor had been absent when the mistake was made. It was not spotted for an hour, by which time enough of the milk fluid had been pumped into the child's vein to provoke a deadly embolism. The baby had been born by caesarean in an emergency operation hours before his mother died of swine flu. The baby was 12 weeks premature but had been progressing well in the intensive care unit and was not suffering from swine flu. Experts said the milk solution would have been clearly marked and it would have been difficult to confuse it with an intravenous drip. It should have been attached to a tube inserted in the baby's nose. *[<guardian.co.uk>, 13 July 2009]*