

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; <pennyt2@chw.edu.au>).

## AUSTRALIAN INCIDENTS

### Incorrect administration route – what is the cue – prescribed route, labelled route or container appearance?

Atropine 1% eye drops are often used off-label for poor swallowing or hypersalivation in psychiatric patients. Recently, atropine eye drops were sent from the pharmacy department labelled, 'To be given'. But because they were in the original container and labelled as eye drops they were administered as eye drops and not given orally despite the oral route being prescribed. **Recommendation:** If the prescribed route is off-label and differs from the licensed route of administration, then the liquid should be decanted into a mixture bottle and re-labelled as Atropine Oral Solution with no reference to eyes. Hyoscine patches (Scopoderm) have been used successfully in palliative care and in psychiatric patients for hypersalivation and poor swallowing.

[Australian Incident 99, April 2009]

### Unsigned, undated or unnamed prescriptions – are you dispensing these?

It is tempting for busy hospital prescribers to pass off the legally required prescription details as unnecessary bureaucracy. It may also be tempting for them to have their clinic nurse or ward clerk complete these details. This bypasses the cognitive link between the prescriber's intention and the end result. How many of us have seen a well meaning ward clerk stick an incorrect patient label to a prescription or medication chart? Has anyone wondered why the prescriber must identify the patient by printing their name to verify accuracy when first prescribing on the National Inpatient Medication Chart? The prescription date is crucial to a patient's medical history and the authority for prescribing can only be accepted by a legally accountable prescriber. We not only leave ourselves open to forgery but also share legal accountability if we dispense an incomplete prescription.

[Australian Incident 100, April 2009]

### Mucomyst ampoules for inhalation



The labelling of Mucomyst ampoules for inhalation has contributed to numerous medication incidents where the dose for nebulisation has been incorrectly calculated. Each ampoule contains acetylcysteine 200 mg/mL and the total volume of the ampoule is 5 mL. This 5 mL volume is separately identified on the ampoule. On several occasions, the total volume has been mistaken to be 1 mL and the dose calculated in that way. Hence, a usual dose of 600 mg for nebulisation has been administered as 15 mL instead of 3 mL.

[Australian Incident 101, May 2009]

## US SAFETY BRIEFS

### Colour-coded syringes for anaesthetic drugs

Colour-coded syringes containing anaesthesia drugs are available from major repackaging companies. These syringes are in demand by anaesthesia providers who previously had to prepare and label all drug syringes themselves (Figure 1). The ISMP is concerned about risks



Figure 1. Colour-coded syringes containing anaesthetic drugs

associated with using these colour-coded syringes unless certain actions are taken to prevent mix-ups that could prove harmful to patients. For many years, rolls of colour-coded labels have been available to anaesthesia providers. The colours are based on an American Society for Testing and Materials standard for user-applied labels in the operating room. The colours are not used just to differentiate products, they are used to specify a drug class, e.g. blue labels for all opioids, fluorescent red labels for neuromuscular blockers, yellow labels for induction agents, orange labels for tranquillisers, violet labels for vasopressors and green labels for anticholinergics (Figure 2). The ISMP promoted this colour-coding system



Figure 2. Colour-coded syringes containing opiates

for user-applied labels among anaesthesia providers. The colour-coding system was not designed for commercial

product labels. The ISMP, American Society of Health-System Pharmacists and pharmaceutical company scientists oppose colour-coding of commercial pharmaceutical products. When anaesthesia providers prepare drugs in the operating room, they retrieve the medication from a cart, read the vial or ampoule label, draw up the medication and apply a colour-coded adhesive label to the syringe. In most cases, only a single agent within each drug class is needed. Each drug has its own colour and the anaesthesia providers know what is in each syringe since it was prepared by them. The commercially packaged colour-coded syringes also have different, easily recognisable colours for various pharmacological classes of anaesthesia drugs. But a serious risk exists as there are often multiple drugs within a class, each with very different properties. These drugs are all available in the same colour and perhaps the same size syringes. Unlike anaesthesia providers who typically use a single drug within each class, commercial systems used to the fullest extent will result in many different agents within a drug class that share the same colour syringes, risking drug selection errors. For example, it is possible to have three opioids – morphine, fentanyl and hydromorphone – each with significant potency variations, all in blue syringes in the same physical area. Mix-ups among these drugs could cause serious harm. This problem also exists with coloured syringes containing vasopressors, tranquillisers and neuromuscular blockers. Colour-coding strategies have led to repeated product mix-ups ever since the US Food and Drug Administration (FDA) allowed ophthalmologists and eye medication manufacturers to use a colour-code classification system for classes of ophthalmic medications. This is problematic when staff other than ophthalmologists dispense or administer these medications. While injuries may not be serious when a mix-up occurs between eye drops, mix-ups between potent parenteral anaesthesia drugs – mostly all high-alert medications – can prove fatal. The ISMP is concerned about mix-ups between anaesthesia drugs if the colour-coded syringes are available outside the operating room. Within the operating room, most patients are intubated, monitored and have immediate access to care in case of a serious mix-up. Outside the operating room, mix-ups may be more difficult to recognise and manage quickly. Mix-ups may also go unrecognised if syringes are accidentally returned to the wrong storage area or placed on a table with other syringes of drugs in the same class. There is evidence that people do not always read labels as they should. Instead they use a single variable, such as colour or shape/size of the container, when selecting a drug.

**Recommendations:** To reduce the risk of syringe mix-ups, we hope that commercial repackagers will label these products with warnings to encourage use by anaesthesia providers within operating rooms only. They should also consider modifying the American Society for Testing and Materials standard by including drug names along the borders and additional colours along the label edges to help differentiate products within each class. Bar-coding systems would likely prevent most mix-ups; there is a barcode on these commercially available syringes. Without significant label modifications by the companies, or bar-coding capabilities in health facilities, pharmacists purchasing these prefilled syringes should have a system in place to ensure they are not used outside the operating

room. We also encourage hospitals that have not implemented bar-coding systems to work with anaesthesia staff to limit the variety of medications within a class. For example, purchase prefilled syringes for one opioid that is most often used in the operating room, and require anaesthesia staff to prepare other opioids and affix user-applied labels.

*[ISMP Medication Safety Alert! 18 December 2008]*

### Colour-coded ophthalmic medications

Bausch and Lomb's cyclopentolate 1% and atropine sulphate 1% ophthalmic drops look identical and resulted in a drug selection error when an automated dispensing cabinet was filled (Figure 1). The American Academy of Ophthalmology endorsed a colour-code scheme in 1996, which was approved by FDA for voluntary use by manufacturers, believing it would help differentiate eye products. The scheme is based on therapeutic class, e.g. anti-infective ophthalmic containers and carton labels



**Figure 1. Colour-coded ophthalmic medications**

have a tan background; mydriatics and cycloplegics use red; miotics use green and beta-blockers use yellow or blue. Despite the Academy's intention to reduce errors, colour-coding products in this manner makes items within each therapeutic class much more difficult to differentiate. When similar highly stylised corporate logos, fonts, package sizes and colour combinations are factored in, what may work well in an ophthalmology office or patient's home may not work well in other clinical locations. Given that mix-ups between items within each drug class can be serious if the strength, onset, duration and mechanism of action are different, it is surprising that ophthalmologists continue to endorse the colour-coding system. Possibly the best way to prevent mix-ups is to avoid awarding contracts to one vendor for an entire product line, and to purchase drugs within a class from different manufacturers.

*[ISMP Medication Safety Alert! 12 February 2009]*

### '2day' gets '86ed'

The order for Slow-Mag (magnesium chloride) was misspelled as 'Slomag' 64 mg TID 2Day. The pharmacist questioned whether this meant to give the medication TID for 2 days (her initial thought) or give it just today (2Day). She called to clarify the order, and it turned out that 2Day was text messaging shorthand for today. The pharmacist asked the nurse to rewrite the verbal order

*Slomag 64mg TID 2Day*

and politely suggested that text messaging language was not appropriate for transcribing medical orders due to potential misinterpretation. Using text messaging abbreviations with medical orders is a new and evolving chapter in the dangerous abbreviations saga. [ISMP Medication Safety Alert! 26 February 2009]

### **Inattentional blindness: what captures your attention?**

1. Nurse pulls a vial of heparin from an automated dispensing cabinet. She reads the label, prepares the medication and administers it intravenously to an infant. The infant receives heparin 10 000 units/mL instead of 10 units/mL and dies.
2. Pharmacist enters a prescription for methotrexate daily into the pharmacy computer. A dose warning appears on the screen. The pharmacist reads the warning, bypasses it and dispenses the medication as entered. The patient receives an overdose of methotrexate and dies.
3. Nurse reaches in the refrigerator for a piggyback antibiotic for her patient. She reads the label, spikes the bag with IV tubing and administers the medication to her patient. The patient receives a neuromuscular blocker instead of the intended antibiotic and dies.
4. Pharmacy technician labels and delivers an IV infusion to the dialysis unit. The nurse reads the pharmacy label and hangs the bag while preparing her patient for dialysis. The patient receives sterile water for injection instead of sodium chloride 0.9% and dies.
5. Nurse picks out a prefilled syringe of pain medication for her patient. She reads the label and administers the medication intravenously. The patient receives hydromorphone instead of morphine and experiences a respiratory arrest.

All of these actual errors and many more have happened under similar circumstances, i.e. the person performing the task fails to see what should have been plainly visible, and later, they cannot explain the lapse. In many cases, the people involved in the errors have been labelled as careless and negligent. But these types of accidents are common, even with intelligent, vigilant and attentive people. The cause is usually rooted in inattentional blindness, a condition all people periodically exhibit.

### **How do we process information?**

Most mental processing occurs outside of conscious awareness. The amount of information that can be taken in by our senses is limitless but the brain has limited resources when it comes to attentiveness. Our senses receive much more information than can possibly be processed at one time. To combat information overload, the brain allows large amounts of information through almost entirely unassimilated, peeling off a few pieces of selected information for a closer look. In deciding what to focus on, the brain scans about 30 to 40 pieces of information (e.g. sights, sounds, smells) per second, until something captures its attention. Our attention filter selects a small amount of information to process and anything leftover gets short shrift. The rest of the information never reaches our consciousness—thus the term inattentional blindness. The brain is a master at filling in the gaps and compiling an integrated portrait of reality based on just a flickering view. Accidents happen when attention mistakenly filters away important information

and the brain fills in the gaps with what is aptly referred to as a ‘grand illusion’. Thus, in the examples above, the brains of the individuals involved in the errors filtered out important information on medication labels and computer screens and filled in the gaps with erroneous information that led them to believe they had the correct medication or had read the warning appropriately.

### **What captures your attention?**

Visual attentiveness or what captures your attention is shaped by four factors.

**Conspicuity.** The degree to which an object or piece of information jumps out to capture your attention falls into two categories: sensory conspicuity and cognitive conspicuity. *Sensory conspicuity* deals with the physical properties of information. For example, a high degree of contrast with the background is the most important feature in making information conspicuous. Luminance (brightness) contrast is more important than colour contrast for sensory conspicuity. Factors such as bright colours, movement and flicker do not ensure conspicuity. However, pre-attentive properties (the brain automatically processes the information without being aware), such as colour and shape have been used successfully on visual displays to call attention to specific items or categories. *Cognitive conspicuity* deals with the perceived relevance of the information. The ‘cocktail party’ effect is a classic portrayal of cognitive conspicuity, i.e. the phenomenon of being in a crowd, listening to a conversation and being able to hear your name mentioned across the room. Functioning somewhat like the volume control on a radio, you can turn down the volume of background noise at a cocktail party and turn up the volume as you listen attentively to one conversation at a time. While engaged in conversation, if someone behind you mentions your name, you are automatically attracted to the other conversation because it is meaningful to you. Meaningful visual information can also jump out at you automatically. For example, scanning the newspaper and finding your attention drawn to articles that include the first name of your child. Attention to something of relevance can also be purposeful. For example, scanning a luggage carousel for your black suitcase, looking purposefully for the broken wheel or red ribbon that distinguishes your suitcase from all the other black suitcases on the carousel. **Mental workload and task interference.** Inattentional blindness is more likely to occur if part of your attention is diverted to secondary tasks, like answering the phone while entering prescriptions into the computer or thinking about your dinner plans while transcribing an order. We all learn to function amazingly well while multi-tasking, but complicated tasks require our full attention. However, auditory tasks (listening to the radio) will interfere less with visual tasks (seeing a pedestrian crossing the road) than would a second visual task (focusing on a street sign). Low workload causes boredom and reduces the mental attention given to tasks, as does carrying out highly practised tasks, such as drawing medication out of a vial into a syringe. In fact, we spend a large majority of our waking life functioning with the equivalent of an automatic pilot, with occasional conscious checks to ensure tasks are being carried out properly. This makes us particularly prone to inattentional blindness. Reliance on technology has also lessened our ability to notice abnormalities.

**Expectation.** Expectation has a powerful effect on our ability to pay attention and notice information. If the medication we are looking for comes in a carton with a stylised label, we come to expect this presentation every time we look for the medication. If a new medication comes in a similar looking carton, our brain may not pay attention to information that disconfirms our belief that the new medication is the old one—a phenomenon called *confirmation bias* to which highly experienced practitioners are most prone. Our past experiences also teach us what is relevant. Errors occur when new or unusual circumstances happen in familiar situations. The nurse who picked up a vial of heparin in the wrong concentration had never experienced removing the wrong medication from an automatic dispensing cabinet. The pharmacist who did not notice important information on a computer warning had rarely encountered a clinically significant computer alert. The nurse who picked the wrong pain medication from the narcotics cabinet did not remember making such an error in the past. Each of these practitioners had subconsciously learned that there was nothing important to see when carrying out these tasks. Nothing had ever happened, so attention was automatically filtered away from the details to conserve mental processing.

**Capacity.** The capacity to pay attention is variable and influenced by age and mental aptitude. Attention is also variable within an individual due to influences such as distractions, alcohol, drugs and fatigue. It is difficult to reduce the risk of inattentive blindness, as it is an involuntary and unnoticed consequence of our adaptive ability to defend against information overload. Error-reduction strategies, such as education, training and rules are of little value. Instead, efforts should centre on increasing conspicuity of critical information and decreasing diversions of attention and secondary tasks when carrying out complex tasks.

*[ISMP Medication Safety Alert! 26 February 2009]*

### **Insulin pens and cartridges must not be shared**

The FDA has issued an alert reminding health professionals that single-patient insulin pens and insulin cartridges should not be used for multiple patients due to the potential risk of transmitting blood-borne viruses such as HIV and hepatitis. Insulin pens are injector devices that contain a disposable needle and either an insulin reservoir or an insulin cartridge. The devices typically contain enough insulin for a patient to self-administer several doses of insulin before the reservoir or cartridge is empty. All insulin pens are approved for single-patient use only (one device for one patient). The US FDA is aware of incidents at two undisclosed hospitals involving more than 2000 people in which the cartridge of the insulin pens were used to administer insulin to multiple patients, although the disposable needles were reportedly changed among patients. Patients exposed to shared insulin pens are being contacted by the two hospitals and are being offered testing for hepatitis and HIV. Some of the exposed patients have reportedly tested positive for the hepatitis C virus, although it is not known if the virus was spread as a result of sharing the insulin pen. The US FDA is working with the Centers for Disease Control and Prevention and professional organisations to address infection control issues related to insulin pens.

*[FDA Patient Safety News. 19 March 2009]*

### **Methotrexate overdose**

A 72-year-old female with a history of rheumatoid arthritis and multiple hospital admissions for pulmonary problems was started on oral methotrexate 10 mg once weekly. Three months into therapy, the methotrexate dose was increased to 10 mg BID once weekly on Mondays. One month after the dose adjustment, she was admitted to hospital for pulmonary infection and her medication reconciliation form correctly listed methotrexate 10 mg BID on Mondays. However, it was transcribed on the discharge medication list as 'methotrexate 10 mg BID'. She began to take the methotrexate as erroneously listed on her discharge medication list – 10 mg BID daily. After taking methotrexate 10 mg BID daily (using the tablets she had at home), she was seen by a visiting nurse who discovered the error after the patient complained of mucositis and diarrhoea. The patient was advised to cease the methotrexate and to go to the emergency department. On admission, she was found to be pancytopenic possibly due to methotrexate toxicity with a white blood cell count of 1000 cells/mm<sup>3</sup>, an absolute neutrophil count of 200 cells/mm<sup>3</sup> and haemoglobin of 8.2 g/dL. The patient was started on filgrastim and darbepoetin to support her white and red blood cell counts, respectively. Despite previous prescriptions for methotrexate, she had never been given clear instructions about sticking to a weekly dosage schedule and naming the day of the week for administration. Perhaps if the prescription had been written more clearly, such as 'morning and evening every Monday' the error would not have happened.

**Recommendation:** To ensure that patients on methotrexate understand the weekly dosing schedule, encourage follow-up phone calls. We also firmly believe that prescribing and dispensing methotrexate as a dose pack will help reinforce the weekly dosing schedule. The dose pack contains a one-month supply of methotrexate tablets in 4 weekly unit dose blister cards to help ensure that the proper dose is taken at the right time. Before discharging hospitalised patients, medications on the discharge list should be reconciled with the list provided on admission and discrepancies resolved. When the discharge medication list is given to the patient, a nurse, pharmacist or physician should review the medications and give patients an opportunity to ask questions about changes to medications and doses they were previously taking. Emphasis should be placed on the weekly dosing schedule for patients discharged on methotrexate.

*[ISMP Medication Safety Alert! 26 March 2009]*

### **Failed chemotherapy check system and pharmacist no contest plea for involuntary manslaughter**

The 19 April 2009, the *Cleveland Plain Dealer* covered another disconcerting report about a health professional who is facing criminal charges for his role in a fatal medication error. A former Ohio pharmacist will plead no contest next month to involuntary manslaughter of a 2-year-old child who died in 2006 as a result of a chemotherapy compounding error. The pharmacy board has revoked the pharmacist's license and a grand jury has indicted him on charges of reckless homicide and involuntary manslaughter. The pharmacist faces up to five years in prison. Prosecutors hold the pharmacist responsible for the toddler's death because he oversaw the preparation of her chemotherapy. The child had

undergone surgeries and four rounds of chemotherapy to treat a curable malignant tumour at the base of her spine. She was supposed to receive her last dose of chemotherapy on the day of the error. A pharmacy technician mistakenly prepared the infusion using too much sodium chloride 23.4%. The technician mentioned to the pharmacist that the final preparation did not seem right, but the error went unnoticed. The infusion was administered to the child, who died three days later. Although we cannot shed more light on the root causes of the error, our experiences strongly suggest that underlying system vulnerabilities played a role. Pharmacists either remove fluid from a bag when a large volume of medication needs to be added and then add additional fluid to the bag and titrate with sodium chloride 23.4% or they start with an empty bag and follow a similar process (compounding from scratch is error-prone). Such exactness of base solutions is often unnecessary from a clinical standpoint. Communication failures between technicians and pharmacists, IV compounding-related failures, inadequate documentation of the exact product and amounts of additives, and other system issues have contributed to numerous fatal errors. We have also seen compounding errors and subsequent failed double-checks due to adverse performance shaping factors such as poor lighting, clutter, noise and interruptions. In this case, news reports suggest that the pharmacist felt rushed, causing him to miss any flags that may have signalled an error. Without minimising the loss of life in this case, we continue to be deeply concerned about the criminalisation of human errors in health care. Mere human errors that randomly occur in well-meaning people are considered criminal in a number of circumstances where public safety is at issue. Safety experts advocate a fair and just path for individuals involved in adverse events, arguing that punishment simply because the patient was harmed does not serve the public interest. Its potential impact on patient safety is enormous, sending the wrong message to health professionals about the importance of reporting and analysing errors. It could also have a chilling effect on the recruitment and retention of an already depleted health workforce. All professionals are fallible human beings destined to make mistakes and drift away from safe behaviours as perceptions of risk fade when trying to do more in resource-strapped professions. If warranted, licensing boards can protect patients from reckless or incompetent actions of health practitioners by limiting or revoking licenses. While the law clearly allows for the criminal indictment of health professionals who make harmful errors, despite no intent to cause harm, it will long be debated whether this course of action is fair, required or even beneficial. The fact remains that the greater good is served by focusing on system issues that allow tragedies like this to happen. By focusing instead on those involved – the easy targets – one can easily avoid addressing the systems issues. Focus on the easy target in this case makes us wonder whether any regulatory or accreditation agency is assuring that all hospitals learn from this event and adjust their systems to prevent the same type of error. Some good has come from this tragic error. In Ohio, Senate Bill 203, called Emily's Law after the child that died, requires pharmacy technicians to be 18 years or older, possess a high-school diploma, pass a criminal background check, and pass a competency exam approved by the Ohio State Board of Pharmacy.

[ISMP Medication Safety Alert! 23 April 2009]

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## SHPA Research and Development Grants Program

### General Grants Information

Members considering applying for a grant are advised to consult the Research and Development Grants section of the SHPA web site, which includes grant flyers, information on how to apply, grant conditions and the necessary application forms. If members would like advice on the suitability of a proposal for a particular grant, they can contact the Federal Secretariat or any member of the Research and Development Grants Advisory Committee.

### Important Information for Members Applying for Research Grants

The Research Project Application Form has recently been updated and is available on the SHPA web site. The application form now includes a section for completing a brief CV for all study investigators. Please ensure that you use the updated form when applying for research grants. And a further reminder that two completed referee reports must be received by the Federal Secretariat by *no later than the closing date for the grant* for your application to be considered by the Research and Development Grants Advisory Committee.

### New Grant in 2009

Pharmatel Fresenius Kabi have launched a new grant in 2009 – the Pharmatel Fresenius Kabi Oncology Pharmacy Grant. The grant totals \$10 000 and is available as either one grant or two grants of \$5000 to enable successful applicants to undertake a preceptorship in oncology practice. The closing date for the new Pharmatel Fresenius Kabi grant is 31 August 2009.

### 35th SHPA National Conference RDGAC Pre-Conference Workshop

The Research and Development Grants Advisory Committee will be conducting a pre-conference workshop in Perth on 5 November 2009. The first session of the workshop will provide a practical approach to constructing a research application. Participants will work in groups to develop a grant application based on a research case scenario provided on the day. In the second part of the workshop, group discussion will focus around opportunities to foster research within your departments. Sponsors of the Research and Development Grants Advisory Committee's program will be invited to join the final session of the workshop. Members will have an opportunity to share ideas and provide feedback for our sponsoring companies. The workshop will be hosted by Dr Sepehr Shakib the eminent South Australian pharmacologist.

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