Institute for Safe Medication Practices

Preventing narcotic adverse events in critical care units

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The recently published Canadian Adverse Events Study found that 7.5% of patients admitted to hospital had experienced an adverse event, 36.9% of adverse events were considered to be "highly preventable" and 23.6% of all adverse events were "drug- or fluid-related" (Baker et al., 2004). The researchers defined an adverse event "as an unintended injury or complication that results in disability at the time of discharge, death or prolonged hospital stay and that is caused by health care management rather than by the patient's underlying disease process" (Baker et al., 2004, p.1679). This is the largest study in Canada on adverse events, reviewing 3,745 charts in the fiscal year 2000 from a total of 20 acute care hospitals across five provinces. Health care is a complex and high-risk industry, and a 92.5% rate of doing things right might be perceived by some as acceptable and as an indicator of a relatively safe system. However, in other high-risk areas, such as the airline industry, this rate would be unacceptable. For instance, it has been calculated that a 99.9% accuracy rate would mean two unsafe plane landings per day at Chicago's O'Hare airport (Baker, 2001). Improved safety in the health care system can occur with small steps and incremental improvements. Focusing on high-alert drugs, such as narcotics, is an area where health care professionals can influence change.

Critical care units have a unique combination of high-risk patients and the need for administration of high-alert medications. Whether mistakes may or may not be more common with high-alert drugs, their consequences are more severe (ISMP Medication Safety Alert!, December 18, 2003). Examples of high-alert medications include narcotics, anticoagulants, insulin, and concentrated electrolytes. The critical care environment also requires quick decision-making, an ability to be attentive to multiple stimuli (e.g., monitors and alarms), and ongoing communication among the patient care team members. All of these factors create many opportunities for system failure.

A study of the adverse events involving 1,047 patients admitted to two intensive care units (ICUs) and one surgical unit identified 45.8% of patients as having an adverse event resulting from a "situation in which an inappropriate decision was made when, at the time, an appropriate alternative could have been chosen" (Andrews et al., 1997, p.310). Of those patients, 17.7% experienced an adverse event resulting in disability or death (Andrews et al., 1997). Cullen et al. (1997) found that adverse medication events were almost twice more likely to occur in the ICU than in a medical or surgical ward due to the absolute number of medications administered in critical care. Although no differences were found once these numbers were adjusted, it is noteworthy that adverse drug events in the ICU caused sentinel events 26% of the time versus 11% in non-ICUs (Cullen et al., 1997).

In 2001, an analysis of mortality associated with medication errors identified opiates as the largest category of drugs causing error-related death (Phillips et al., 2001). The annual report from USP's MedMARx, analyzing data from July 2002 to June 2003, found five opioid medications in the top 50 drugs associated with medication errors: *morphine, meperidine, fentanyl, hydromorphone and oxycodone* (USP, 2003). Such data, combined with the frequent use of narcotic medications in critical care to achieve the universal goal of "Maintaining an optimal level of comfort and safety for critically ill patients" (Jacobi et al., 2002, p.119) cannot be ignored.

Recently, a narcotic adverse event resulting in a fatal outcome was published in an **ISMP Canada Safety**

Awards Available to CACCN members

Criteria for awards available to members of the Canadian Association of Critical Care Nurses are published on pages 30-32 of this issue of Dynamics.

Bulletin as well as in the Canadian news media (ISMP Canada Safety Bulletin, June 2004). A patient presented to a Canadian hospital emergency department with a chest injury. The patient was ordered morphine 10 mg IM prior to discharge, but received hydromorphone 10 mg IM instead. Hydromorphone is approximately six times more potent than morphine (ISMP Canada Safety Bulletin, June 2004). Despite the fact that the error was discovered after a scheduled narcotic shift count and attempts were made to communicate the error, the patient, whose condition had already deteriorated at another hospital, could not be revived. Mix-ups between morphine and hydromorphone have been identified in the past (Cohen, 1994; USP, February, 1995).

The "most effective remedies to medication errors often lie outside the direct control of individual practitioners" (ISMP Medication Safety Alert!, March 7, 2001). Making it easier for health care practitioners to do the right thing and more difficult to do the wrong thing is based on human factors engineering (HFE) principles. Vicente (2003), an expert in HFE, refers to this discipline as the science of ensuring that the technology fits the user rather than the user fitting the technology. He notes that the use of HFE principles to design safe systems has been successful in a number of high-risk industries (Vicente, 2003). HFE anticipates that individuals will make errors, and designs systems that reduce over-reliance in areas of human limitation, such as memory. In the health care arena, anesthesiologists have taken lead initiatives with this approach over the last few decades (e.g., making oxygen and anesthetic gas lines incompatible), and have made strides in patient safety and in the prevention of recurring errors (Baker, 2001). In the example of the hydromorphone event described earlier, patient safety experts applying HFE principles believe that a risk exists in every facility and every unit where morphine and hydromorphone are stored together. Issues such as look-alike names and confusion between the variety of generic and trade names, as well as the variety of drug concentrations, can increase the risk of substitution errors (ISMP Canada Safety Bulletin, June 2004).

Efforts to enhance system safety with narcotic medications must take into account the human factors' perspective, but must also combine these principles with high leverage strategies that are applied throughout the medication use process: for example, *packaging*, *labelling*, *storage*, *prescribing*, *dispensing and administration*. Table One outlines various strategies critical care teams can employ (ISMP Medication Safety Alert!, June 2, 1999). Within the table, examples related to narcotics are provided, some of which can be implemented easily and quickly. Strategies that are longer term, such as the implementation of computerization, are included in order to stimulate strategic planning for changes and benefits that can be realized for all high-alert medications. (For a more exhaustive list of strategies, readers are encouraged to read the cited references.)

Bedside critical care nurses can play a key role in leading the implementation of these strategies. In addition, by recognizing and embracing the cultural shift towards incorporating safety principles into narcotic and other high-alert medication processes, every critical care nurse can have a positive impact on patient safety. This can be accomplished by including the following examples into daily practice:

- Ensure that all double checks, whether required or requested, are performed *'independently'*. (The nurse preparing the therapy and the nurse performing the double check must NOT discuss or influence each other in any way regarding their perception of the information – physician's order, drug, dosage, any calculations and equipment set-up. Once each has completed their role, prior to administration, the data check is compared. If the data check is 100% congruent, then the probability of an error reaching the patient is substantially reduced.)
- Be familiar with dangerous abbreviations and symbols, for example, use "mcg" instead of "µg" to avoid interpretation as "mg" (JCAHO, 2004). Request hospital administration to eliminate their use.
- Always read back telephone orders and repeat back verbal orders received. When verbalizing dosages such as 15 mg, state "one five milligrams" to prevent interpretation as "50 mg".
- Request narcotic references at the point of care (as mentioned in Table One).
- Return non-stock narcotic items to pharmacy when no longer required.
- Familiarize yourself with analgesic critical care practice guidelines (Jacobi et al., 2002).
- Take the time to investigate any patient safety concern brought forth by any team member including the patient or family. Practitioners involved in adverse events causing serious patient harm can often retrospectively identify a missed opportunity to prevent an error and these opportunities often point to areas for system improvements.
- Model a culture of safety so that errors and near misses are seen as a system weakness and identify opportunities for a change in process rather than in performance.
- Report medication errors and near misses. Share information from publicized errors. In addition, consider reporting errors to the Institute for Safe Medication Practices (ISMP) Canada in order to provide alerts and promote learning among colleagues nationally (see box at end of article).

The key to lowering the incidence of adverse drug events with high-alert medications such as narcotics is to focus efforts on prevention. Although critical care units are readily equipped and able to deal with the treatment sequelae of narcotic adverse drug events, these events can nonetheless lead to unnecessary risks, such as hypotension not readily responsive to a fluid challenge or cardiac arrhythmias related to opioid reversal in the

Table One: Enhancing narcotic safety	
High leverage to lower leverage strategies, in rank order (ISMP Medication Safety Alert!, June 2, 1999)	**Examples Related to Enhancing Narcotic Safety**
Forcing functions and constraints	• Restrict stock of high potency narcotics to pharmacy (ISMP Canada Safety Bulletin, June 2004) • Eliminate infrequently used narcotics from stock • Use only IV pumps with set-based anti-free-flow mechanisms – tubing is automatically clamped when removed from infusion pump and practitioner must conscientiously unclamp tubing to initiate fluid-flow by gravity (Health Canada, April 16, 2004; ISMP Canada Safety Bulletin, April 2004; ISMP Medication Safety Alert!, April 22, 1998). • Use tubing without injection ports for all epidural infusions (ISMP Canada Safety Bulletin, January 2003).
Automation and computerization	• Implement computerized physician order entry (CPOE) (ISMP Medication Safety Alert!, May 15, 2001). • Implement bar coding (ISMP Medication Safety Alert!, July 25, 2001). • Consider the purchase of *smart* pumps that utilize dose maximums/minimums and can provide special alerts (Health Canada, April 16, 2004; ISMP Medication Safety Alert!, April 22, 1998). • Consider the use of automated dispensing cabinets which can provide an automatic narcotic count, alerts and pertinent drug/dose information.
Simplification and standardization	• Use standardized solutions for infusions such as intravenous (IV), patient-controlled analgesia (PCA) and epidural (Cohen & Kilo, 1999; ISMP Medication Safety Alert!, July 10, 2003). • Use commercially available or pharmacy premixed solutions for infusions (Cohen & Kilo, 1999). • Do NOT use dangerous abbreviations such as "MSO4" for morphine sulphate (JCAHO, 2004).
Drug protocols and standard order forms	• Use preprinted order forms with a standardized concentration (Cohen & Kilo, 1999). • Include vital patient safety strategies into preprinted orders, such as "use tubing **without** injection ports" for all epidural infusions.
Independent double check systems and other redundancies	• Apply *independent* double checks for select narcotic administration, such as for PCAs and epidurals (ISMP Medication Safety Alert!, July 10, 2003). Narcotic medications are usually obtained from stock and thus bypass the pharmacist/nurse independent check (ISMP Canada Safety Bulletin, June 2004). (Note: *Independent* double checks *must* be performed correctly in order to prevent approximately 95% of errors that would otherwise reach the patient (ISMP Medication Safety Alert!, March 6, 2003). • Have pharmacy add labels to narcotic stock to differentiate narcotics with look alike/sound alike names, using, for example: - tall-man lettering, such as "HYDROmorphOne"; - familiar brand names such as "DILAUDID®" (ISMP Canada Safety Bulletin, June 2004).
Education and information	• Provide quick, up-to-date references at narcotic cupboards such as a list of narcotic generic names with corresponding trade names. Consider posting equi-analgesic dose charts with common doses and dosing frequencies for each narcotic. • Ensure all practitioners know how to contact the on-call pharmacist after hours. • Educate staff (e.g., in-services and newsletters on narcotics, include examples of error reports).
Please note: Lower leverage strategies are least effective, particularly if used exclusively, since they rely more heavily on the individual health care practitioner.	

presence of underlying cardiovascular disease (CPhA, 2004). Practitioners can guard against complacency when working with frequently administered high-alert medications such as narcotics. Narcotic adverse events and near misses that occur in any hospital or on any nursing unit, when shared, provide valuable information regarding weaknesses in medication systems. Critical care teams can take leadership roles in hospitals to enhance patient safety by reducing the reliance on individual performance through system-based changes. Potential for error-induced patient injury can be reduced by implementing a variety of higher leverage strategies that incorporate human factors principles and enhance safety in the narcotic medication system.

Report an error to Institute for Safe Medication Practices Canada (ISMP Canada):
i) through the website, www.ismp-canada.org;
ii) by e-mail to info@ismp-canada.org; or
iii) by phone at (416) 480-4099
or 1-866-54-ISMPC [47672].

ISMP Canada guarantees confidentiality and security of information received. ISMP Canada respects the wishes of the reporter as to the level of detail to be included in publications.

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