The Institute for Safe Medication Practices Canada (ISMP Canada) is an independent national nonprofit agency established for the collection and analysis of medication error reports and the development of recommendations for the enhancement of patient safety.

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Lowering the Risk of Medication Errors: Independent Double Checks

ISMP Canada was recently informed of two near misses involving patient-controlled analgesia (PCA). In both cases an independent double check prevented errors from reaching the patient. In the first instance, a PCA 'demand' dose of hydromorphone 0.2 mg was ordered postoperatively for a patient. Although the correct solution was used, the nurse inadvertently programmed the pump to deliver a dose of 2 mg. The PCA programming was independently double checked by a second nurse, who caught the error. The pump was reprogrammed correctly, which averted a 10-fold overdose. In another case, meperidine 10 mg/mL was ordered postoperatively, but morphine 1 mg/mL was used. An independent check by a second nurse revealed the error.

Errors in programming PCA pumps are relatively common because of issues such as poor human factors design and complex programming requirements. Between 1987 and 2004, PCA infusion pumps accounted for almost 8% of incident reports related to medical devices that were received by Health Canada; these incidents included injuries caused by pump and user error.[1] Between September 1, 1998, and August 31, 2003, a total of 5,377 PCA errors were submitted to MedMARx and the USP/ISMP Medication Errors Reporting Program (MERP).[2] Of these, 7.9% were categorized as harmful, whereas the overall harm rate from **all** error reports was 2%. The authors concluded that "it appears that when PCA pumps are involved, the chance for patient harm increases more than 3.5 times."[2]

Many Canadian hospitals have implemented a double check process in an effort to enhance PCA safety. PCA devices are one example of medical equipment that may have poorly designed usability and engineering to safeguard against errors that could cause serious patient injury.[3] One example is the design of a pump with the default setting to a low concentration.[4,5] When such poor design is combined with an often rapid-paced work environment and the distractions that can regularly occur in health care, the potential for error increases further. For example, according to publicized data, the general rate of errors of commission is 3 in 1000, the general rate of errors of omission when no reminders exist is 1 in 100, and the general error rate in a highly stressed environment with rapidly occurring activities is 1 in 4.[6] Although one of the keys to improving safety is for pharmaceutical and medical device companies to redesign their products according to human factors principles, it will likely take years before this is standard practice.[7]

ISMP Canada recommends conducting **independent** double checks with **selected** high risk processes and high-alert drugs, such as administration of PCA.

What is an independent double check? Not all double checks are equally effective in preventing errors. An independent double check is a process in which a second practitioner conducts a verification. Such verification can be performed in the presence or absence of the first practitioner. In either case, the most critical aspect is to maximize the independence of the double check by ensuring that the first practitioner does not communicate what he or she *expects* the second practitioner to see, which would create bias and reduce the visibility of an error. For example, an error in calculation is more likely to be detected if the second person performs all calculations independently, without knowledge of (seeing) any prior calculations.[8]

Why conduct an independent double check? Mistakes happen even when people are doing their best. In other industries, independent double checks are not intended to question the practitioners' skills or competence; rather, they acknowledge the high-risk nature or complexity of the work and the fact that *all* practitioners are only human and therefore fallible. Consider initiation of a check of selected high-risk processes or high-alert drugs as being similar to the checks that are done before an airplane takes off – a critical point for safety enhancement and error prevention. Independent double checks can reduce the probability of error. Research has shown that people find approximately 95% of mistakes when checking the work of others.[9] Thus, if the error rate for a process is 5% (1 in 20), then an independent double check will reduce the chance of the error reaching the patient to 5% of 5% or 0.25% (1 in 400).

How do you conduct an independent double check? Have the second practitioner perform the independent double check by starting from a different vantage point, without any advance knowledge of what findings to expect. For example, after the first practitioner has set the pump in accordance with an order, ask the second practitioner to read the values or settings directly from the pump or solution bag before telling or showing them the order form. The goal is to maximize the visibility of an error.

How do you implement an independent double check system?

1. **Develop a policy** on independent double checks. Apply independent double checks selectively to the medication-use processes that most warrant their application[5] such as selected high-alert medications that have the potential to cause serious harm when errors are made. A few well-placed independent double checks will be much more successful than an overabundance of double checks.

2. **Develop tools**

   - Reduce the cognitive load on practitioners. Redesign order forms to facilitate cross-checking of information, by making sure that the sequence of information has one-to-one mapping. For example, in the case of a PCA order form, start by reviewing the pump entries required for programming drug delivery (unalterable) to identify the terminology (e.g. "lock out" vs "time delay") and the sequence for data entry, then apply the same progression of information and terminology to the form design (alterable).
   - Make it easy for practitioners to follow the independent double check policy at the bedside without relying on vigilance and memory. For example, add a checklist and signature boxes as a reminder of what aspects of PCA therapy should be checked and when. An ISMP Canada usability study found that a tool (in the form of a checklist) embedded into a PCA order form effectively structured the independent double check process so that practitioners could find often-overlooked programming errors, specifically those related to solution concentration and those related to potential confusion between micrograms and milligrams.
   - Ensure that the tool focuses the double check on critical information.
   - Make the tool intuitive so that it requires minimal or no formal training for its correct application.

3. **Teach staff** why independent double checks are important and how to conduct them (e.g., without bias). Emphasize that independent double checks are NOT a question of competence but a tool to assist practitioners with the complexity created by medication use and medical equipment.

4. **Apply human factors engineering principles** in the development and design of policies, forms and tools: ensure readability of the policy, clarity of information and ease of learning. Test the tool with front-line practitioners to allow improvements before full implementation.

Health care practitioners must deal with complex systems that are not necessarily designed with the principles of human factors engineering in mind. Practitioners regularly "fit" work processes or make efforts to accommodate equipment because the work process or the equipment was not designed to fit with the way practitioners work. The risk for errors can be mitigated by developing and implementing an independent double check system for selected high-alert medications. Any independent double check system should be supported by tools such as a checklist to alleviate the cognitive load on practitioners. A properly developed independent double check system has the potential to enhance medication system safety by increasing the visibility of errors and thus preventing errors from reaching patients.

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ISMP Canada is a national voluntary medication incident and 'near miss' reporting program founded for the purpose of sharing the learning experiences from medication errors. Implementation of preventative strategies and system safeguards to decrease the risk for error-induced injury and thereby promote medication safety in healthcare is our collaborative goal.

To report a medication error to ISMP Canada: (i) visit our website www.ismp-canada.org, or (ii) e-mail us at info@ismp-canada.org, or (iii) phone us at 416-480-4099. 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 our publications.

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