

Nursing Perspective Crucial to Successful Implementation of Technology for Medication Management Safety



by Carol Dueck RN BScN MCE

Abstract

Improved interconnectivity of computer programs, development of robust infrastructures to support an Electronic Health Record and a recognition of the role of patient safety has sparked an interest in projects for medication management. The adoption of programs such as Computerized Provider Order Entry (CPOE) and bar-coding medications for Electronic Medication Records (eMAR) with bedside medication validation (BMV), automated dispensing devices (ADD), and smart pump technology are common examples. Compelling supportive data reports significant reduction in medication errors by presenting prescribers and clinicians with options that guide better decisions, a reduction in lack of clarity related to handwriting or incomplete orders, better compliance to formulary approved medications and standardized order sets, decreased turnaround times, and improved work flow.

Although this technology is a welcome addition to patient safety, it significantly impacts the routine work flow patterns and communication of all healthcare providers. Attention to work flow and promoting adoption strategies that include change management principles with an emphasis on a systems approach is pivotal for successful implementation of the medication management components of the electronic health record.

Application

This article reviews the variety of complex components related to safety strategies in medication management and highlights the importance of ensuring that nursing's voice is included in the early planning stages of adoption into daily practice. A template of recommendations that guide the creation of a detailed action plan to support a successful implementation medication management initiative to enhance safety is offered.

Key word search: medication management strategy, CPOE, eMAR, error reduction, nursing input

What and Why: Technology for medication management?

Recent report writers lament that the current status of hospital patient safety systems is not close to meeting The Institute of Medicine (IOM) recommendations for implementation. System progress is slow causing an urgent trend to hasten improvements in system adoption for patient safety within healthcare (Longo, 2005; Leape, 2005, Chassin 1998). Advances in technology have introduced programs that close the gaps in risk management by focusing on medication management. Components such as CPOE (Computerized Provider Order Entry), eMAR (advancing Computerized Medication Administration Records (cMAR) to a complete Electronic Medication Administration Record), Bar-coding, Bedside Medication Verification (BMV), Smart Pumps, robotics and automatic packagers are mechanisms that put decision support tools in the hands of nurses, physicians and pharmacists to reduce risks related to medication administration. Using mobile and wireless tools, these systems are capable of linking relevant knowledge resources to specific patient profiles and clinical events, customizing the presentation of information to each practitioner anywhere, at any time, with the promised result of better, safer and more consistent patient care.

The key characteristics and benefits expected from these programs include:

- 1) fewer medical errors and adverse drug events (safety);
- 2) achieving desired health outcomes (effectiveness); and
- 3) informed prescribing and clinical decision-making (appropriateness) (Canada Infoway, 2007).

Practitioners need to understand that the drive to implement these programs is ultimately to support safety, not just a vehicle to save time and costs. Nursing must actively engage in the planning stage for this next step in developing the electronic health record; search for relevant information; and ask insightful questions about the process to achieve successful implementation without introducing secondary causes for error or reworking of related tasks.

A survey of hospital pharmacy directors in the USA demonstrated that computer-generated or electronic medication administration records (MAR), pharmacy computer systems interfaced with laboratory values, and unit-based medication dispensing cabinets were the most common medication safety technologies used (Schumock, 2003). Nearly 9% of sites in the States reported having no safety plan and while a substantial percentage of hospitals have medication safety systems, only 34.1% reported full implementation of computerized physician order entry systems for medications (Longo, 2005). Less than 2% of Canadian hospitals have achieved a closed-loop technological solution for medication safety, but components of medication management programs are now included in many strategic plans for facility technology infrastructures. In the States, JACHO reports claim that CPOE with little or no decision support can still improve work flow processes by eliminating lost orders and ambiguities related to illegible handwriting, and generating related orders automatically (2003). Others reports provide compelling data where medication errors can be significantly reduced, by presenting prescribers with options that guide decisions for drug of choice, appropriate doses and dosage forms, common indications, compliance to formulary standards, standardization of order sets, decreased turnaround times, and improved work flow (Reider, 2003).

As organizations merge into this lane of the information highway, successful implementation relies on nursing participation in the early decision-making stages, not just as invited parties to a panel that chooses equipment from a short list. Also, parameters for choice need to be based on usability functions, not simply on user-friendly attributes. The Canadian Health Services Research Foundation spotlighted topics for managing quality and safety resources and put forward ten recommendations for adopting new programs. One of these recommendations cautioned that "...healthcare staff employees must be involved in planning and implementation in order for safety culture to improve" (Fleming, 2006, p 2).

When does nursing need to get involved?

Facilities that strive for successful implementation of new computerized programs must involve nursing representatives in focus groups and explorations to identify gaps related to risk in the current systems before moving forward with a new system. A proactive quality tool such as *Failure Modes and Effects Analysis (FMEA)* can be used to guide interdisciplinary teams to examine potential failure points when introducing a new system

(Nieva, 2003). To provide knowledgeable input, nursing needs to become acquainted with new equipment and programs that can streamline work and apply safety measures to nursing care.

It is imperative that change management principles are applied in all phases of the medication system implementation process to develop an understanding of the magnitude of change that will impact the work flow. Following a nurse, step-by-step in the task of assessing the need for and administering medications can help to produce a work flow diagram that is clear and logical rather than resembles an unfathomable scribble. But to truly be representative, this process requires a nursing voice to interpret and recognize the functions behind each step in the illustrated process before new actions generated by a computer system can be overlaid onto existing manual systems. Identifying the intersections where potential omission or commission of error occurs is like unraveling a puzzle as work flow patterns often have evolved into various informal cross-checks designed to alert nurses when tasks are expected outside normal routines or to help prevent errors. Computerizing manual processes provides an opportunity to unveil substandard practices, shortcuts and lack of standardization that can jeopardize safe handling of medications.

In 2001, the Agency for Healthcare Research and Quality's (AHRQ) report on making health care safer, identified 11 patient safety practices that were the most highly rated in terms of strength and deserve support through widespread implementation. Four of these practices are all directly related to medication management where technology can add value to an organization's strategic plan for patient safety. These include computerized physician (provider) order entry that incorporate computerized decision support systems to decrease medication errors and adverse events that occur primarily due to the drug ordering process.

This report also advocates for healthcare providers to look to practices supported by evidence in other fields such as commercial aviation, nuclear safety, aerospace, and human factors engineering for hints about safety. Strategies such as root cause analysis, computerized physician order entry and decision support, automated medication dispensing systems, bar coding technology, aviation-style preoperative checklists, promoting a "culture of safety," crew resource management, the use of simulators in training, and integrating human factors theory into the design of medical devices and alarms could all be applied in healthcare (AHRQ, 2001). Compelling reasons for healthcare to accept programs that puts information about all parts of the medication system, status of orders, delivery of drugs, awareness of allergy information, potential side effects, date and time of the last dose at the fingertips of clinicians is crucial, including time-sensitive elements required for an accurate, effective health record.

Examples from pioneers

One paper reported how the complexity of CPOE promotes collaboration in the multiple decision-making processes that emerge when orders are entered directly into the computer system by a physician which profoundly impacts the work flow of all team members. The authors found that while quality of care is the main impetus for implementation, it was difficult to measure the impact on quality. They stressed that a proper understanding of CPOE requires collaborative effort to understand how orders are created and processed, how CPOE can support work flow, and the necessity to identify the risks during hand-offs in the work flow (Aarts, 2006). University Health Network in Toronto generously shared their journey for medication management, known as MOE/MAR, in a special edition of *Healthcare Quarterly* (2006). This team stressed the importance of focusing on clinical best practices, safety and operational efficiency – all key elements of success in the iterative approach to work flow design. Part of their success was attributed to using small pilot sites, listening to front-line users at all points in the project and being willing to pull back, redesign and re-pilot with the influence and requirements of nurses and physicians. The team reported an impressive 85% of prescriptions ordered through their version of CPOE, with improvements in efficiency as evidenced in a 28% reduction in elapse time from order entry to administration.

Risks in Medication Systems

The complexity of medication systems, the number of interruptions in daily work environments and the multiple, potentially toxic drugs in use demand safety nets for nurses, pharmacists and physicians working in the system. Redundancy actions, independent double checks and alerts are the safety nets that computers are well suited for in helping busy professionals catch potential errors that are integrated in all medication systems. To be accepted and effective, these computer tools need to be intuitive, logical in information flow, written in clear language and augment the normal tempo of work flow, not impede it. These traits represent the positive actions and conditions that help humans use equipment and computers effectively.

In the search for factors that foster successful implementation and acceptance of computer programs, attention needs to be focused on the human factors theory – the way humans interact with machines. Computer screens designed logically that allow the eye and hand to readily flow in a sequence from field to field as data is entered; and limits the number of clicks to retrieve useful information, augmented by a seamless route that connects one computer program to another, and the ability to slide the computer keyboard and mouse into an ergonomic position to fit both the tall and the small on staff, are all examples of human factors engineering principles that nurses on a search team need to look for as evidence for usability in a system.

The AHQR (2001) critique on patient safety reviewed the practical limitations of medication systems and outlined a variety of process deviations engaged in by nurses to complete all the tasks in a shift. These include nurses removing doses from automated dispensing devices prior to the time to circumvent waiting at busy scheduled administration times and overriding the device when doses were needed rapidly. These procedural failures re-emphasize the necessity to follow core principles for the introduction of new technologies, and the realization that new innovations are not a solution for inadequate or faulty underlying processes or procedures. Although automated dispensing systems are increasingly common, the report advocates for further study to demonstrate the expected effectiveness and suggested the need for studies that compared unit-dose dispensing with automated dispensing devices. Unit-dose dispensing is expected to generate system improvements when linked to robotics and informatics. As nursing teams learn to work with these safety devices, they need to remember that errors have been reported when staff fill cabinets without a double check system, or when nurses remove more medications than ordered and return unused doses to dispensing cabinets (ISMP 1998).

Susan Newbold and colleagues (2004) offered a process to create research questions which promotes technological infrastructure as an integral part of nursing practice in all domains of practice (assessment, diagnosis, planning, intervention, and evaluation). Nursing councils are encouraged to collaborate with Informatics or Information Technology staff to develop scenarios specific to their environment and test how the work flow with new technology (such as automated dispensing cabinets, eMAR and so on) supports the standards of safety in an institution.

Benefits for Nursing

The benefits of linking CPOE to eMARs can be augmented in practical ways by the adoption of other recognized national safety strategies. Evidence of this is seen when hospitals share examples of computerization of Medication Reconciliation initiatives (Safer Healthcare Now, 2006). For example, alerts and warnings can be added to dictionaries and fields in CPOE systems to restrict the use of known dangerous abbreviations to reduce errors in the interpretation at the ordering phase (ISMP Canada, 2006). Risk assessments of narcotic supplies in patient care areas, with a view to eliminating high-dose or high-concentration items can be tracked through automated inventory systems integrated to medication orders. Streamlining and standardizing the time for input of orders and validation by a pharmacist may be achieved by adding approved order sets or evidence – based protocols into the CPOE program.

The landmark article "To Err is Human" is frequently referenced to champion leadership and research into new quality programs and to raise expectations and create organizational systems that promote safe care. This report also stresses that technology can augment human cognitive functions

to improve patient safety, but appropriately cautioned that poorly designed or overly complex technology can actually increase errors (Kohn, 2000). Research is just starting to emerge that examines the effectiveness of these initiatives. In October, 2006, Mount Sinai Hospital in Toronto, Ontario released their findings of enhanced patient care and work satisfaction after medications were moved from a unit-dose medication cart to medication locked in cupboards at each patient's bedside. The team found that by engaging nurses in the research they were able to achieve a redesign of the system that demonstrated more time with patient care, less time invested in preparing and distributing medications, fewer interruptions, increased access to accurate data resources on the hospital intranet and less time spend searching for missing doses (Bennett, 2006)

Keys to Successful Planning for Technology in Medication Safety

During the design stages for one or more of the components of medication management, recommendations must be based on the consensus of an interdisciplinary team: nursing in particular needs to focus on the analysis of work flow of both the people and the practice, and assess how technology fits into the pattern of each unique care area in the facility. A key action to take when developing this section of the electronic health record is to listen to nursing staff's descriptions at hand-off points as a medication order travels through the various stages and to support mechanisms that allow practice to drive technology rather than let technology determine practice.

During the introduction of new computerized programs, Healthtech consultants have frequently encountered skepticism from nursing staff related to previous implementations that have failed or experienced prolonged implementations and lack of acceptance. Contributory factors to these failures can often be traced back to budget projections that underestimate or did not include replacement time for dedicated nursing involvement in the planning, designing, testing and training. Policies that support evidence-based practice and standardized processes must reach consensus on paper before they are build into dictionaries of the computer module. It should be no surprise that the logical method used by computers to handle data will uncover some unsafe or inefficient practices in manual systems that nurses and pharmacists have adopted to cope with workload or poorly designed processes. To achieve a successful adoption of technology for medication management and to reduce the frustration experienced by staff and physicians, processes that expose risk to the medication system need to be identified and resolved *prior* to delivery of new equipment and again during a robust testing phase.

Medication Management is an exciting step in technology, offering a level of safety that human actions alone can't match; but the complexity of these new systems and the lack of role models add challenges that are often faced by novice design teams. Nurses will naturally be leery of embracing

computerized systems that radically change the comfortable medication administration processes already used, especially if it appears to add time to an already crowded work day. But, with an active voice on steering committees, nursing can assist to keep the team focused on safety, human factors and practical work flow. By continuously referring to key characteristics throughout the project to keep the action plans grounded in practice and process; listening attentively to reactions and suggestions of providers while testing and using the system; and applying techniques such as small rapid cycle testing for continuous performance improvements, the opportunity to embrace a safe medication delivery system is within reach. A sample template of these key characteristics to guide an implementation team is offered in the table below.

Template to Build Medication Management Safety

1. Align project to corporate vision and goals.
2. Recognize safety as the driver for project.
3. Use a framework to develop strategic plan for Medication Management Safety and detailed action plans.
4. Assess state of readiness.
5. Use Change Management principles to guide project.
6. Conduct baseline safety assessment (e.g. Medication Safety Self-Assessment tool) to develop action plan based on specific gaps.
7. Collaboration and partnership for project success = nursing, physicians, pharmacy, IT, Senior Management involved early and in all phases of process: strategic planning, environmental scan, vendor choice, business case, testing, deployment, implementation, and training.
8. Build consensus for policies and protocols based on evidence-based practice, standardization and restrictions to formulary before processes are developed.
9. Clearly articulate scope of practice for each member of the care giving team.
10. Develop a detailed workflow patterns for all phases of medication management (ordering, transcribing, dispensing / delivery, administration/documentation and monitoring) based on survey / interview / observation.
 - a. What and how data is collected?
 - b. Who uses the data?
 - c. How is data communicated?
 - d. What information is reported?
 - e. What processes need improvement to prevent system failure?
11. Test changes in workflow and equipment choice with usability and human factors theory.
12. Build in sustainability with support and staff replacement during implementation, flexible training modalities,

References

- Aarts, J., Ash, J., Berg, M. (2006). Extending the understanding of computerized physician order entry: Implications for professional collaboration, workflow and quality of care. *International Journal of Medical Informatics* .ww.intl.elsevierhealth.com/journals/ijmiIJB-2250;
- Bennett, J., Harper-Femson, LA., Tone, J., Rajmohamed, Y. (2006). Improving Medication Administration Systems: An evaluation study. *Canadian Nurse*, 102, Nov. 8, P 35-39.
- Canada Health Infoway (2006) *EHR Benefits Accessed at* <http://www.infoway-inforoute.ca/en/Home/home.aspx>
- Chassin MR, Galvin RW. (1998). The urgent need to improve health care quality: Institute of Medicine National Roundtable on Health Care Quality. *JAMA*, 280:1000-1005.
- Committee on Quality of Health Care in America. (2001). *Crossing the Quality Chasm: A New Health System for the 21st Century*. National Academy Press, Washington, DC.
- ISMP. (1998). Placing limits on drug inventory minimizes errors with automated dispensing equipment. *ISMP Safety Bulletin. Acute Care*. December 2, 1998. Retrieved Jan 24, 2007 at <http://www.ismp.org/Newsletters/acutecare/articles/19981202.asp>
- Joint Commision Resources. *Is CPOE Right for Your Organization?* Retrieved Feb 16/2006 <http://www.jcrinc.com/printview.asp?durki=11893>
- Kohn,L.T., Corrigan, M.S. (Eds.) (2000). *To Err is Human: Building a safer health system*. The National Academies Press, Washington, D.C. 2000.
- Leape, L. L., Berwick, D. M. (2005). Five Years After To Err Is Human: What Have We Learned? *JAMA* 293: 2384-2390
- Longo, D., Hewett, D., Ge, B., Schubert, S. (2005). The Long Road to Patient Safety: A Status Report on Patient Safety Systems. *JAMA*, 294(22), 2858-2865
- AHRQ. (2001). *Making Health Care Safer: A Critical Analysis of Patient Safety Practices*. Summary. July AHRQ Publication No. 01-E057. Agency for

- Healthcare Research and Quality, Rockville, MD.
<http://www.ahrq.gov/clinic/ptsafety/summary.htm>
- Nieva, V.F., Sorra, J. (2003). Safety culture assessment: a tool for improving patient safety in healthcare organizations. *Quality and Safe Health Care* 12, ii17
- Newbold, S., Kuperman, G, Bakken, S, Flatley Brennan , P., Park, H., Radenovic , A. (2004). Information technology as an infrastructure for patient safety: nursing research needs. *The International Journal of Medical Informatics*, 73, (7), 657-662. Retrieved Jan. 03/2007.
- Reider, J. (2003). Computerized Physician order entry: has the time come?, *Medscape General Medicine* 5(2). Retrieved Aug 06/03.
- Safer Healthcare Now! (2006). Communities of Practice, Medication Reconciliation. <http://communities.saferhealthcarenow.ca/medrec>. Retrieved Jan 2/ 2007
- Schumock, G., Nair, V., Finley, J.M. Lewis, R.K., (2003). Penetration of Medication Safety Technology in Community Hospitals. *Journal of Medical Systems*, 27(6), December/
<http://www.springerlink.com/content/luxpjhycbwnw>
- Editorial. (2006). Special Issue.. Change: The challenge of CPOE. *Healthcare Quarterly*, 10

About the Author

Carol Dueck RN BScN MCE

Carol is a Consultant with Healthtech Inc. offering project management for healthcare facilities during the journey to implement the Electronic Health Record and to adapt technology to improve safety in medication management.

Before joining Healthtech, Carol was Project Leader with the Institute for Safe Medication Practices Canada and held the positions of Director of Critical Care and Director Clinical Informatics at The Scarborough Hospital.

Contact information

cdueck@healthtech.on.ca

416-483-5974 ext. 37

www.healthtech.on.ca



210 Glencairn Avenue
Toronto, ON, M4R 1N2