What's New in the Patient Safety World

January 2018

Can We Improve Barcoding?

Bedside medication verification, using barcoding, is arguably our most successful patient safety intervention to reduce medication errors. Yet barcoding systems are not infallible and we likely have room for improvement in such systems.

We still vividly recall our first observation of a nurse administering medications as we implemented our first barcoding system. The label on the medication was smudged so the nurse simply copied and pasted the medication label from the CPOE system, totally bypassing the safety built into the barcoding system. There have been many other workarounds related to barcoding systems. Our June 17, 2008 Patient Safety Tip of the Week "Technology Workarounds Defeat Safety Intent") discussed, among other studies, the seminal study by Koppel and colleagues (Koppel 2008) that identified 15 types of workarounds and 31 types of causes for the workarounds in barcoding medication administration systems.

Three recent studies show we still have considerable room for improvement in barcode medication administration (BCMA) systems. A review of 11 studies on the impact of BCMA on medication errors (Strudwick 2018) showed that most studies found BCMA significantly reduced the incidence of medication errors. Specifically, BCMA prevented wrong patient, medication, dose, time, and route errors, by ensuring that the medication administered correctly corresponded to that on the medication administration record.

Strudwick and colleagues were interested in identifying factors that helped or hindered the ability of BCMA to prevent medication errors. Being able to bring the technology closer to the point of care was identified as helping avoid medication errors. This was often accomplished by use of workstations on wheels (WOW's). But in some cases the WOW's could not be taken into patient rooms, so use of untethered barcode scanners or putting computer terminals within those rooms were solutions used.

Monitoring nurse scanning was identified as a way of identifying nurses and clinical areas that required more support, or where noncompliance with scanning might lead to a patient safety risk. Counting the number of times wristbands were printed for patients was a way of identifying potential "workarounds" (i.e. could be indicative that a nurse was scanning a printed copy of a wristband barcode, instead of the wristband that was supposed to be attached to the patient).

Systems that allow nurses to document deviations in medication administration were identified as improving medication safety. Examination of nurse workflows was

considered important in identifying processes that need improvement. Nurse training and patient education were also identified as important to the successful use of BCMA in clinical practice And, no surprise, involvement of nurses in the planning and implementation of BCMA was an important success factor.

The second study was a Pennsylvania Patient Safety Authority study highlighting how Blue Mountain Health System reduced its barcode-workflow events by 53% between 2014 and 2016, using a near-miss event analysis (Magee 2017). The majority (81.3%) of events reported to the PA-PSRS (Pennsylvania Patient Safety Reporting System) involved the administration step of the medication use system but events were reported for the dispensing (27%), prescribing (1,6%), and transcribing (0.8%) steps as well (totals exceed 100% because sometimes multiple steps were involved). Of events reported to the PA-PSRS, failure to follow a policy or procedure or employing workarounds was identified in 40.3%. But 25.7% involved a problem related to equipment, including unreadable patient identification bracelets, uncharged scanners, missing or smudged barcode labels on medication, and lack of wireless connectivity. Equipment-related events sometimes also involved staff bypassing policy or procedure.

When Blue Mountain Health System's bedside barcode scanning software application was upgraded to allow for increased data capture and internal reporting capability, the system was able to recognize both actual adverse events related to barcoding and near-misses. That allowed them to focus on quality improvement activities that resulted in a 52.9% reduction in near-misses over a 3-year period. Those activities included review of actual events and near-misses, direct observations, and a FMEA (failure mode and effects analysis).

They found that their BCMA system allowed for variations in access to patient medication administration records and charting and that this variation created increased risk of near-miss events associated with barcode scanning workflow, such as potential wrong-patient selections. When they identified that increased rates of near-misses occurred in certain rooms, they identified lack of internet connectivity as a root cause and expanded the internet connectivity to those rooms. Also, when individual nurses were noted to have higher rates of events, those nurses were interviewed by the unit director and provided education.

One interesting workaround was identified during observation and discussion of workflows. The policy expectation was that the patient is scanned first, then the medication. However, in practice, some nurses in certain circumstances (such as when the same medication, e.g., acetaminophen, was ordered for multiple patients) would first scan the medication. This workaround contributed to some of the wrong-patient scan totals. So in addition to re-education on the policy, nursing directors affixed a STOP sign-shaped visual reminder to the mobile computers, which reinforced the proper scanning sequence:

S scan the patient, then the medication
C close the screen
A advance to the next patient

N next patient

There were multiple success factors involved in the Blue Mountain project. Involving front line staff and obtaining support of administration were important first steps. Promoting event reporting, especially reporting of near misses, was a key element. And the organization used both root cause analyses (RCA's) and failure mode and effects analysis (FMEA) to better understand vulnerabilities. A point we have always stressed, they conducted direct observations of staff workflows. That often identified deviations from policy and highlighted workarounds that had evolved. It also helped identify problems with equipment. Conducting simulation exercises was also seen as useful.

In the third article, ISMP has highlighted some problematic issues with barcode labels on medications (ISMP 2017). Barcodes on some products have been repositioned in ways that may render them unreadable. For example, horizontally oriented barcodes on the FLOVENT HFA (fluticasone) inhaler and Teva's enoxaparin injection now round the circumference of the canister or barrel, respectively, making them difficult to be read by barcode scanners. To further complicate matters, there are multiple different types of barcodes, including the linear (1 dimensional) barcode, the 2D (two dimensional) data matrix barcode, and the Quick Response (QR) barcode, and OTC products have a Universal Product Code (UPC). Not all barcode scanners are capable of capturing all these barcodes. The presence of two barcodes on medications has led to confusion about which barcode to scan.

Since there is a new requirement (as of November 27, 2017) to include a 2D data matrix barcode on certain product labels, ISMP recommends organizations alert all practitioners to the new requirement and ensure that practitioners understand which barcode to scan for verification during the drug preparation, dispensing, and administration processes. ISMP also recommends organizations should have a process in place to program new medication barcodes into information technology databases and ensure that they are linked to the correct product and operational before use. ISMP requests organizations report any barcode scanning problems to ISMP so they can alert the manufacturer and FDA.

ISMP also highlights the American Society of Health-System Pharmacists Foundation tool kit for pharmacists (ASHP 2016) as an excellent resource on implementing barcoding systems.

Yes, barcoding has been a wonderful patient safety tool. But these three studies show that we always have room for further improvement.

See some of our other Patient Safety Tip of the Week columns dealing with unintended consequences of technology and other healthcare IT issues:

- June 19, 2007 "Unintended Consequences of Technological Solutions"

- May 20, 2008 "CPOE Unintended Consequences – Are Wrong Patient Errors More Common?"
- June 17, 2008 "Technology Workarounds Defeat Safety Intent"
- August 26, 2008 "Pattern Recognition and CPOE"
- September 9, 2008 "Less is More….and Do You Really Need that Decimal?"
- December 16, 2008 "Joint Commission Sentinel Event Alert on Hazards of Healthcare IT"
- February 2009 "Healthcare IT The Good and The Bad"
- March 3, 2009 "Overriding Alerts…Like Surfin' the Web"
- October 2009 "A Cautious View on CPOE"
- November 24, 2009 "Another Rough Month for Healthcare IT
- April 20, 2010 "HIT's Limited Impact on Quality To Date"
- March 22, 2011 "An EMR Feature Detrimental to Teamwork and Patient Safety"
- January 24, 2012 "Patient Safety in Ambulatory Care"
- June 26, 2012 "Using Patient Photos to Reduce CPOE Errors"
- June 2012 "Leapfrog CPOE Simulation: Improvement But Still Shortfalls"
- July 17, 2012 "More on Wrong-Patient CPOE"
- January 2013 "More IT Unintended Consequences"
- April 30, 2013 "Photographic Identification to Prevent Errors"
- October 8, 2013 "EMR Problems in the ED"
- March 11, 2014 "We Miss the Graphic Flowchart!"
- October 2014 "Ebola Exposes Fundamental Flaw"
- January 2015 "Beneficial Effect of EMR on Patient Safety"
- March 2015 "CPOE Fails to Catch Prescribing Errors"
- March 31, 2015 "Clinical Decision Support for Pneumonia"
- August 2015 "Newborn Name Confusion"
- December 2015 "Opioid Alert Fatigue"
- January 12, 2016 "New Resources on Improving Safety of Healthcare IT"
- January 19, 2016 "Patient Identification in the Spotlight"
- February 9, 2016 "It was just a matter of time…"
- April 5, 2016 "Workarounds Overriding Safety"
- May 2016 "Name Confusion in the Pharmacy"
- May 3, 2016 "Clinical Decision Support Malfunction"
- May 24, 2016 "Texting Orders – Is It Really Safe?"
- August 23, 2016 "ISMP Canada: Automation Bias and Automation Complacency"
- November 22, 2016 "Leapfrog, Picklists, and Healthcare IT Vulnerabilities"
- January 2017 "Joint Commission Thinks Twice About Texting Orders"
- February 28, 2017 "The Copy and Paste ETTO"
- March 2017 "Yes! Another Voice for Medication e-Discontinuation!"
- April 2017 "How Much Time Do We Actually Spend on the EMR?"
- June 27, 2017 "Texting – We Told You So!"
- August 1, 2017 "Progress on Wrong Patient Orders"

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