Bring barcoding to the bedside: Patient safety series, part 1 of 2

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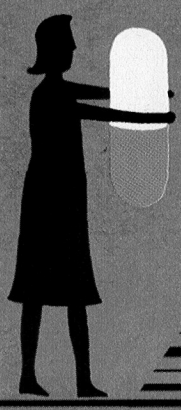
BRING BARCODING TO THE BEDSIDE



PATIENT SAFETY SERIES, PART 1 OF 2

IMPLEMENT INFORMATION TECHNOLOGY TO TRACK AND REDUCE MEDICATION ERRORS.

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Abstract: A 240-bed regional hospital shares best practices for implementing a patient safety initiative that targets point-of-care barcode technology. [Nurs Manage 2003:34(5):36-40]

No one intends to make a serious medication error. But more than 7,000 Americans die each year when clinicians improperly prescribe, transcribe, process, or administer medications.[1]

Our 240-bed regional referral hospital had already implemented several medication safety technologies, including a unit-dose medication system, automated dispensing devices, and a computerized pharmacy system. Our facility also made the maximum number of modifications possible to the in-place paper medication documentation system. In short, we were well positioned to take the next technology step to reduce and prevent medication administration errors—barcode-enabled point-of-care (BPOC) technology.

Poised and ready

In a 1998 quality improvement initiative, our medication errors team mapped our facility's drug therapy management process from the "tip of the prescriber's pen" (prescriber-ordering) to the "tip of the patient's tongue" (patient administration). Our team found that this process included more than 65 steps—any one of which were vulnerable to human error. We scrutinized one year's worth of medication error occurrences and flagged one or more of the 65 steps engaged in the error. We learned that the majority of medication errors occurred in the steps associated with physician ordering and medication administration.

Our team also discovered that most of these errors involved insulin and certain standing orders. By improving insulin administration documentation, we were able to reduce insulin-related errors and standing order mistakes by simplifying and clarifying ambiguous orders.

During the next 12 months, medication occurrence reports substantiated that we had produced the best paper medication use process possible. Nevertheless, errors persisted. Clearly, the situation merited a technological solution. But we remained undecided as to the right technology until two factors converged to help us make our decision:

1. The realization that most of our facility's medication errors originated during the prescriber ordering and nurse administration phases of the medication process. This finding mirrored those of large, medication error studies that show the majority of medication errors occur in the prescriber ordering stage (39%) and at the patient bedside (38%).[2,3]

Nurses and pharmacists in these studies were responsible for capturing almost one-half of prescribing errors and approximately one-third of transcribing and dispensing inaccuracies before these errors reached the patient.[4] In contrast, only 2% of the nurse administration errors were caught, making nurses particularly vulnerable to causing medication mistakes that actually reach the patient.[5]

2. The second factor that influenced our technology decisions was our hospital administrator's growing awareness of software that specialized in BPOC technology. We had a unique opportunity to serve as software development partner, which helped refine and enhance the existing BPOC system, as well as maximize safe medication administration by our nurses and other clinicians.

Casting a safety net

Exactly how does barcoding work? Barcodes are a series of vertical lines; when read by a laser scanner, they create electrical signals. These signals are decoded and translated into data interpretable by a computer. The data represented by the barcode is expressed in alpha and/or numeric characters, such as a drug's name, strength, and lot number. When used correctly and consistently, barcoding can reduce manual entry errors by 17%, decrease medication errors by 86%, and provide 100% positive patient identification during blood transfusion.[6-9]

Usage of a BPOC system entails the following steps:

- First, when the pharmacist enters a prescriber's order into the computerized pharmacy system, the order appears, real-time, on the bedside computer through interfacing with a dedicated server. Radio frequency allows the laptops to be wireless and portable, permitting use among multiple patient locations.
- Second, to access the computer screen, the nurse barcode scans his/her name badge and then enters a secure password.
- Third, the nurse barcode scans the patient's wristband and the patient's medication administration record appears on the computer screen.
- Fourth, the nurse barcode scans the applicable unit-dose-packaged medications. If a drug-patient-dose-time-route mismatch exists, the system generates a warning. In cases where the medication is frequently confused with another drug that looks or sounds alike, sophisticated BPOC technology warns the nurse of this potential problem.

An electronic medication administration record (EMAR) is produced automatically as an end result of the administration process; the system also offers an updated printable log for final documentation. Advanced BPOC technology includes standard reports that reflect potential errors made, potential errors prevented, and reasons why nurses over-rode warning messages.

Bedside implementation

When implementing BPOC, we formed a steering committee of end-users from hospital administration, pharmacy, nursing, quality improvement, medicine, and information technology (IT). We then identified a project coordinator to work closely with steering committee members, and clinical and technical experts.

Our team scrutinized several key elements: the patient care delivery system, the complete medication process from prescriber prescription through nurse administration, pharmacy procedures, admitting activities, current staffing methods, and possible training needs. We also considered the steps in the pharmacy information system, including how the main information system, automated dispensing devices, compounding system, repackagers, and cart fills would interact with bedside barcode scanning.

We developed flowcharts outlining our current process and detailing the modifications barcoding would require. We also updated our formulary, then mapped the associated medication barcodes to it. We purchased barcode-labeling software to generate labels for those medications not already barcoded by the pharmaceutical manufacturers, upgraded our drug-packaging machine, and reprogrammed our I.V. labels to contain barcodes. We considered our staffing requirements and training timeline with guidance from the director of inpatient services, the director of pharmacy, and pertinent nurse managers.

After crafting an implementation timeline and goals, we identified two pilot units and involved all staff about the program's nature, purpose, and intended outcome. At first we met monthly, then biweekly as the implementation date grew near.

The software we selected is currently accessible through a handheld personal digital assistant, dedicated desktop computer, or laptop computer. Our nursing staff was already familiar with, and successfully using, touchscreens for other IT applications, so we elected to use wireless laptop computers with touchscreens. We placed one laptop in each patient room.

Putting IT into practice

On October 31, 2001, we implemented our BPOC technology on a 24-bed medical-surgical step-down unit. Each nurse received 2 hours of usage orientation. We also identified one "super user" for each shift to serve as a staff resource. We allowed 2 weeks for all nurses to become fully acquainted and comfortable with the system. During these 2 weeks, nurses "double-documented" the medication administration record; that is, they documented medication administration on both the paper and electronic medication administration record.

ADVANCED BPOC TECHNOLOGY INCLUDES STANDARD REPORTS THAT REFLECT ERRORS MADE, ERRORS PREVENTED, AND REASONS WHY NURSES OVER-RODE WARNING MESSAGES.

The project coordinator, unit nurse manager, and technicians supported the nurses' use of the technology, providing one-on-one assistance in becoming successful system users. On occasion, the nurse manager intervened with reluctant users. Due to careful planning and interdisciplinary cooperation, all inpatient medical-surgical, telemetry, and intensive care units adopted the BPOC technology by December 31, 2001.

Our first major, yet not entirely unanticipated finding, was the number of late doses nurses administered at least 60 minutes *after* the scheduled dose time: Over 8,000 doses each month—almost 20% of all doses administered. When discussing this finding with staff, we

heard several important messages: Nurses administered medications as close to the scheduled time as possible. Because our pharmacy uses standard medication administration times to avoid transcription and administration errors, nurses often were challenged to give all their patients several medications within the 60-minute dose due-time window.

We also found that because nurses discovered other patient concerns during medication delivery, precise drug administration timeliness were sacrificed for more pressing patient needs. We grew concerned that the number of late-dose warnings would desensitize nurses to other, potentially more critical warnings. Eventually, with pharmacy and therapeutics committee support, we increased the system alert "grace period" to 2 hours before and 2 hours after the scheduled dose. Our late doses have dropped substantially without any untoward effect on patient outcomes.

While our BPOC technology permits nurses to select assorted reasons for late doses such as "med unavailable," and "patient condition," nurses haven't used this option consistently. We may revisit this feature with staff in the future, as we believe that if used consistently and correctly, the feature may yield further insight into nurse workload.

We also became more aware of omitted doses—those that nurses failed to administer to patients, accounting for the majority of more than 40,000 medication errors detailed in the 2000 Summary of MedMARx, the medication error database maintained by the U.S. Pharmacopeia.[10] In a recent study of medication administration errors in 36 health care facilities in the greater Atlanta and Denver areas, omitted errors accounted for more than 30% of all medication mistakes, the second most frequent type of errors described in this study.[11]

Going "live"

Prior to implementing our BPOC technology, we had to rely on self-reporting via occurence reports as a measure of omitted doses. Now, our technology ensures that nurses address all scheduled doses, including those doses that weren't documented as given, or those that truly were skipped. In addition, the technology, through a pick list, supplies nurses with reasons to describe why they legitimately omitted a dose.

When we compared occurence reports related to omitted doses from the 9 months immediately post implementation, we noticed a 22% decrease in this type of occurence.

From January 2002 through August 2002, we prevented more than 1,300 medication errors. The majority of

these being wrong dose, wrong drug, and discontinued order errors. Examples of avoided wrong dose errors included nurses attempting to give one tablet when two were ordered; giving two tablets when one was ordered; mixing up doses of frequently titrated drugs such as warfarin, furosemide and metoprolol; and pharmacy dispensing errors.

Examples of wrong drug warnings that prevented nurses from administering a medication erroneously included nurses confusing combination products containing hydrocodone versus oxycodone, extended-release medications with regular-release medications—especially metoprolols, oxycodone, and morphine preparations—and pharmacy dispensing errors.

With respect to discontinued medications, the BPOC technology provides an electronic alert to nurses when medication orders have been discontinued, which gives them an extra safety net if they don't have an opportunity to check for newly written prescriber orders and are unaware that a prescriber has discontinued the drug.

One feature we're just beginning to fully utilize is order clarification reports. The first computer screen nurses see when entering a patient's medication record is the new orders screen, which displays any new medication orders entered in the pharmacy. If a nurse questions the accuracy of the transcription or has a question about the order, she may flag this order and subsequently review it with the pharmacist before confirming the new order. We look forward to reviewing data from the orders clarification report to gain insight into possible risk factors for physician-ordering and pharmacy-transcription errors.

This input of previously elusive medication error data gives our medication error team—as well as our pharmacy and therapeutics, patient safety, and quality improvement committees—a plethora of information from which to devise informative and useful root cause analyses, and implement effective quality improvement programs. Although our implementation was only in a pilot phase during our 2000 Joint Commission on Accreditation of Healthcare Organizations (JCAHO) visit, JCAHO showed great interest in learning how we would use the system data successfully to improve patient care.

Meeting challenges

The most obvious obstacle to implementing BPOC technology is that medications aren't universally barcode-labeled. We met this challenge in two ways: First, we reprogrammed our unit-dose repackaging machine to produce barcode labels for most medications. Second, we generated a list of our most-frequent high-risk, high-volume medications. If these medications weren't already barcode labeled by the manufacturer, we prioritized barcode label generation. While initially only 30% to 40% of our formulary medications were routinely barcode labeled, we've since been able to barcode label 50% to 60% of all medications administered.

On March 14, 2003, the FDA proposed that all prescription and over-the-counter medications used in hospitals contain a national drug code number.[12] Pharmaceutical manufacturers, drug re-packagers, and distributors would have 3 years to comply with this ruling after it's formally accepted.

Another challenge to user acceptance? BPOC technology use represented a fundamental change to how our nurses administer and document medications. Naturally, as with anything new, we encountered some resistance. Managerial support and consistent implementation team follow-up enabled most users to adapt successfully to the new technology. Many have since become BPOC supporters. For a few others, experience proved the best teacher. Frequently, the most skeptical users converted after the technology helped them avoid medication errors.

Timely success

Our BPOC system data, assembled in standard medication error reports, is crucial to understanding potential problem areas in our medication management process, identifying systemic issues influencing potential error commission and developing means to optimize the medication use process. The approach we used to select, implement, and utilize IT to track, reduce, and prevent medication errors proved successful in a relatively short timeframe. This technology positively impacts the quality of our patient care. We look forward to its continued contributions to patient safety in the future. NM

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