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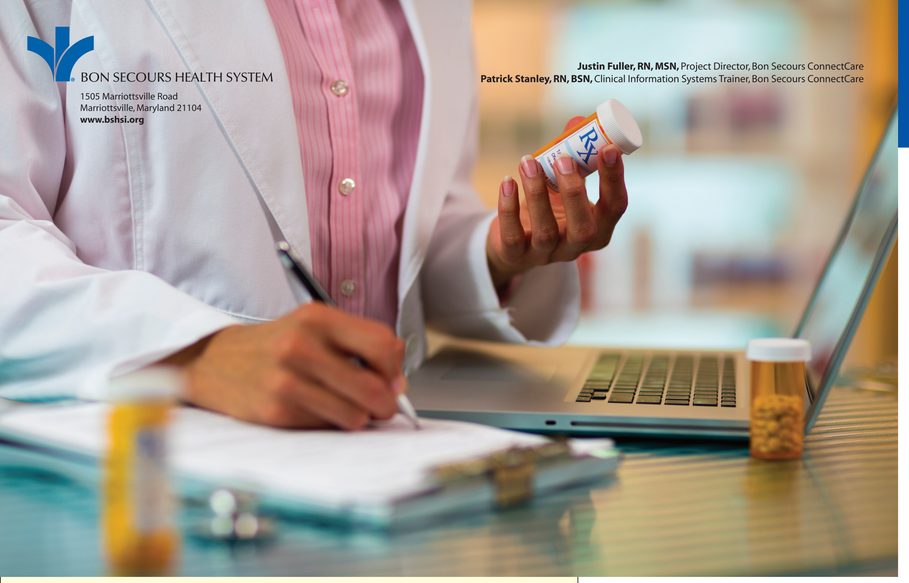


The Bar-Code Medication Administration System Process Improvement Initiative
Data, Information, Knowledge, Wisdom (DIKW) Hierarchy

Background

Bar-Code Medication Administration (BCMA) is a bar-code system designed to prevent medication errors, improve the quality and safety of medication administration, and generate online records of medication administration. A patient-specific bar-code is printed on the patient's armband at the point of registration. This bar-code is unique to the patient, and is used to identify the right patient.

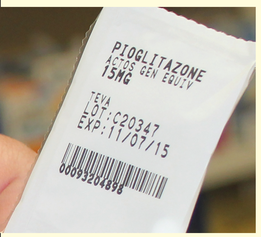
All medications except for multi-dose medications have a bar-code applied in the pharmacy by a unit-dose medication packager. The bar-code is unique to the medication. The bar-code on the medication contains information regarding the medication name, dose, and route (i.e., tablet or intravenous).

When a clinician is administering medications using the bar-code system, he or she first scans the patient's armband bar-code to open that patient's eMAR (electronic medication administration record) to the current time. After scanning the patient's armband, the clinician scans each medication prior to being administered. This allows the Clinical Decision Support (CDS) tools within the system to validate that the six rights of medication administration are being protected. The system verifies the patient's identification, and cross-checks the medication scanned against active orders in the system.

The Six Rights of Medication Administration

There are six patient "rights" with respect to patient safety during medication administration:

#1 Right Patient
#2 Right Drug
#3 Right Dose
#4 Right Route
#5 Right Time
#6 Right Documentation



In June 2013, the Clinical Informatics Department at Our Lady of Bellefonte Hospital, part of Bon Secours Kentucky Health System, Ashland, Kentucky, was notified that there were multiple complaints about the bar-coding system. At that time, the hospital's policy stated that "The goal is 100% patient armband scanning prior to administration." At the time, the policy did not set a target for **medication** scanning, but clinical leadership verbally indicated that 90% was the target.

According to the complaints, nurses who were giving medications claimed that the pharmacy routinely sent medications that were unreadable with the bar-code scanners. In June 2013, the bar-code scanning rates for patient armbands and medications **were below 90%** . In an effort to identify opportunities to reduce medication errors and to improve patient safety by using Clinical Decision Support Tools built within the hospital's electronic medical record, the Clinical Informatics Department opened an investigation.

Methodology

The Clinical Informatics Department identified four possible ways in which bar-code scanning was being implemented in the hospital and how they affected the six rights of medication administration.

1. Patient AND medication were correctly bar-code scanned
   - Ideal patient safety result. Satisfies all six rights
2. Patient was bar-code scanned, but medication was not
   - Positive for protecting Right #1.
   - If meds are given without bar-code scanning (and then documented after the fact), it does not let the CDS check for rights #2 through 6.
3. Patient was not bar-code scanned, but medication was bar-code scanned
   - Might protect Rights #2, #3, #4, #5, and #6 if the nurse selected the right patient from the list.
   - Hypothetical situation exists where two patients have the same medication due at the same time with same characteristics.
4. Patient AND medication were NOT correctly bar-code scanned
   - No rights are protected for the patient using the CDS in the electronic medical record.

The Clinical Informatics Department also examined the three elements required for the Bar-Coding Medication Administration system to work successfully – People, Process, and Technology.

People

Is there a behavior problem? Are people simply refusing to use the bar-code medication administration techniques?

The Informatics staff started by talking with the nurses to find out if staff were not using BCMA simply because they were too rushed or refused to use the technology. The nursing staff said they wanted to use it, but the bar-codes on the medications were unreadable more than 50% of the time. When this happened, they were told to contact the pharmacy. When they did, the pharmacy told them that the BCMA technology worked fine and refused to send up new medications. Often, if the pharmacy did send up new meds, the nurses had the same result. Thus, nurses had essentially "thrown up their hands in the air" and gave up on even bothering with BCMA. The Informatics staff tried to scan the bar-codes on the nursing units and verified that the bar-code scanner did not successfully identify many of the medications.

The pharmacy staff, on the other hand, believed the nurses simply didn't know how to do BCMA. In fact, when the pharmacy staff pulled some medications out and used their bar-code scanner on the medications, **the bar-code reader correctly identified the medication.**

Process

What is the actual real-world, step-by-step process used in the pharmacy and on the nursing units with respect to applying and using bar-codes?

The nursing staff demonstrated that they knew how to use the bar-coding system. The medications were all prepared with bar-codes and the patient armbands were also printed with bar-codes. The process broke down because the bar-code scanners on the nursing units frequently failed to read the bar-codes on the medications. After multiple failures, many of the nurses stopped using the system.

Technology

Is there a technical problem preventing either the pharmacy or the nurses from being successful with bar-code medication administration?

The Informatics staff tested the bar-code scanners in the pharmacy and on the nursing units. The pharmacy was using a different brand of scanner than what was in use on the floors. It was discovered that the pharmacy scanner could read the bar-code on a medication, but the nurses' scanners (sometimes) could not read the same bar-code. When the pharmacy swapped out its old bar-code scanner for the same brand the floors were using, the scanning results were identical for the pharmacy and nursing.

Once the bar-code scanner was replaced in the pharmacy, the pharmacy staff packaged one tablet of every medication in the formulary and printed its associated bar-coded label. Each medication was scanned with the new pharmacy scanner and a scanner on the nursing unit. While the results of "Scanned Appropriately" versus "Did Not Scan Appropriately" were the same for both scanners, roughly 60% of the meds did not scan appropriately with either device.

The pharmacy utilizes a machine that prints the bar-code on the unit-dose medications. This machine is maintained by the vendor. The pharmacy asked the vendor to come and replace the print-heads on the medication packager. After doing so, one tablet of every medication was packaged and labeled again and re-scanned. Over 95% of the medications scanned on the first try, and 100% scanned on the second attempt. The pharmacy requested an increase in the maintenance visits from the vendor.

Results

With the technical issues resolved by replacing the pharmacy bar-code scanner with one used by nursing and fixing the printer on the medication packaging machine, the Informatics staff took the results to the hospital's chief nursing officer. The team demonstrated that there had been legitimate technical issues that had been resolved successfully. However, the leadership of the nursing executive would be essential to convince the nursing and pharmacy staff to give the system another chance.

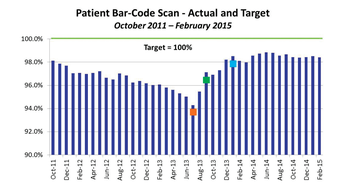
The chief nursing officer convened the directors of pharmacy, bio-med, and information technology and there was general agreement that the medication-packaging machine would be maintained more frequently by the vendor.

The chief nursing officer then convened the nursing managers and asked the Informatics staff to explain the technical issues that had existed and been resolved. Once the nurse managers understood the issues, the expectation was set that the nurses on the floor needed to embrace the bar-coding medication administration system to improve performance. The CNO attached the BCMA initiative to the staff members' yearly evaluation with the expectation that the BCMA utilization of each nurse would improve. She went on to write the initiative and goal as hospital policy. The chief nursing officer made 'accountability of results' a part of the process in late August 2013.

Within five months of fixing the technical problems and setting accountability, the bar-coding medication administration scanning results went from below 80% to above 95%. Those numbers have been maintained at that level for almost two years.

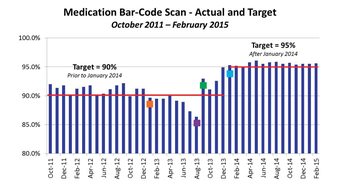
	After BCMA Performance Dropped	After the Pharmacy Replaced its Scanner
Data	The Bar-Code Medication Administration (BCMA) system uses a unique bar-code printed on every patient's armband and on every unit-dose medication to ensure patient safety. In January 2013, the performance for medication BCMA began to dip below the unofficial 90% threshold and reached a low of 86.34% in July 2013.	When scanning each medication with the new pharmacy scanner and a scanner on the nursing units, both scanners had the same results. However, roughly 60% of the meds did not scan appropriately with either device.
Information	Nurses claimed that the bar-code scanners did not work and could not read the bar-codes on the medications. Pharmacy staff claimed that the bar-code scanners worked fine and could read the bar-codes on the medications.	Since the scanners were reading the bar-codes some of the time and were consistent with the other scanners, the Informatics team believed that the problem lay in the printed bar-codes.
Knowledge	The bar-code scanners in the pharmacy and on the nursing units were tested. The pharmacy used a different brand of scanner than what was in use on the floors. The pharmacy scanner could read a medication bar-code, but the nurses' scanners (sometimes) could not read the bar-code on the same medication.	The bar-code packaging vendor was asked to come and replace the print-heads on the medication packager. Over 95% of the meds scanned on the first try and 100% scanned on the second attempt.
Wisdom	The pharmacy bar-code scanner was replaced with the same brand the floors were using. The scanning results were then identical for pharmacy and nursing.	To ensure that the printed bar-codes continued to print correctly, the vendor was asked to increase the frequency of maintenance visits.

GRAPH 1



- **July 2013** – The performance for patient bar-code scanning reached a low of 94.27% and the Clinical Informatics Department was working to address the problem.
- **September 2013** - Technical issues had been fixed and the CNO began holding staff accountable for results.
- **January 2014** – Patient bar-code scanning has stayed at or above 98% since January 2014.

GRAPH 2

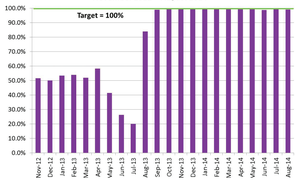


- **January 2013** – The performance for medication BCMA began to dip below the unofficial 90% threshold.
- **August 2013** – The performance for medication BCMA reached a low of 86.34% and the Clinical Informatics Department was working to address the problem.
- **September 2013** - Technical issues had been fixed and the CNO began holding staff accountable for results.
- **January 2014** – The CNO officially set the threshold for medication BCMA at 95%.

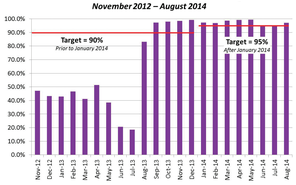
A Case Study

In one especially egregious example, an individual nurse ("Nurse AB") had particularly poor performance with the BCMA system. Scanning results data indicated that the nurse never scanned more than 60% of patient armbands between November 2012 and July 2013. In fact, in July 2013, the nurse scanned just 20% of patient armbands when giving medications. Similarly, during the same time period, Nurse AB scanned the medication bar-codes less than 50% of the time. By July 2013, the nurse's medication bar-code scanning fell below 20%. However, once the technical problems were resolved, Nurse AB became a model for others, with patient arm-band scanning exceeding 98% and medication scanning at or above 95% after August 2013.

GRAPH 3



GRAPH 4



It's hard to embrace technology when it doesn't work. It's easy to embrace technology when it works.