Bar-Coding Systems Reduce Errors

Penelope L. Dougherty

Christopher Hagan

Cynthia Hoange

Nathon Kelley

Ferris State University

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Bar-coding as applied to the dispensation of medication and blood is a growing trend. This trend is expected to increase significantly over the next twenty years. Reasons for this increase include an increase in governmental funding of such systems. Bar-coding has been shown to effectively reduce the risks of medication errors. Reductions were noted in all aspects of medication administration. Prevention of patients receiving the incorrect medication, the incorrect dosage of medication and the incorrect increments between doses of medication were noted. Reductions were also noted in the amount of unique instances as well as individual instances when the incorrect blood type was given. Studies have shown that implementing a bar-coding system helps lower the error rate in dispensing medication or blood to patients in a hospital setting. Increases were shown in patient and staff overall satisfaction rates. Decreases were shown in human error induced illnesses and increases were realized in patient healthy outcomes as a result. Increases to healthy outcomes were also realized as a result of timely medication and blood administration. Nevertheless there is resistance to the changes necessary to implement a bar-code system. Furthermore bar-coding has not yet been uniformly implemented.

Bar-Coding General Information

Bar codes are a series of black lines with varying widths that stand for numbers and/or letters, and punctuation symbols. The codes are found on items produced today to determine identification of items or contents of an item with the use of a scanner. The scanner is able to reflect light off the code and in turn reads the information, translates the code into numbers and letters. The computer is then able to manage and read the information and make it readily

available to humans for their use. Some benefits of bar-coding includes a scanner to record the

information and enter it up to seven times faster than a skilled typist doing the work

manually(Douglas & Larrabee, 2003). The bar-code medication administration system (BCMA)

takes several steps: first the information concerning a prescription medication is entered into the

computer program by the pharmacist (Connolly, et al., 2006). The medication orders appear in

"real time" at the patient bedside computers (Douglas & Larrabee, 2003). The Patient is given a

unique bar code that the patient wears on the wrist bracelet, the patients identification bracelet

contains information about the medication the nurse is to administer (Douglas & Larrabee,

2003). Prior to administering of the prescription medication the registered nurse scans the bar

code into the computer. The bar code on the medication includes information about the lot

number and expiration dates. The registered nurse receives and verifies that the medication is

the proper medication for the patient and receives a warning if a "drug-patient and/or dose-time-

route mismatch exists" (Douglas & Larrabee, 2003, p. 38).   A record of the patient receiving the

medication is automatically entered into the patient record (Douglas & Larrabee, 2003). The

patient medical record reflects that the medication has been given this is noted in "real time".

Bar –Code for Medication Disbursement

Medication error in hospitals is rampant. It is estimated that 1.5 million errors occur each

year (Agrawal, 2009). Preventable medication errors occur in up to 10% of hospital admission

(Fowler, Sohler, & Zarillo, 2009). It is estimated that 38% of all medication errors occur at the

time the medication is being dispensed by any given hospitals registered nursing staff (Douglas

& Larrabee, 2003). The actual amount of hospital errors associated with the administration of

medication is largely under reported. Nurses do concede, that they do not always report

medication errors to management staff. A study found that 76% of nursing staff under-report

medication errors for fear of managerial reactions to said errors, such as disciplinary actions

(Connolly, O'Leary-Kelley, & Ulanimo, 2006). The reason given by registered nurses (R.N.) for

errors in administrating the proper medication has been reported by nurses to include failure of

the nurse to check the name bracelet (45.8%), and nurse exhaustion (33.3%) (Connolly, et al.,

2006).   Bar-coding is one method to reducing the number of medication errors. While

medication errors can occur at any given time along the many steps included in the medication

process, the disbursement step of medication is particularly error prone. This is largely due to

the fact that it is the last step in the process, therefore the interception rate is low (Agrawal,

2009). It is estimated that only 2% of registered nurse errors in the administration of

medications are corrected prior to effecting a patients overall health (Douglas & Larrabee, 2003).

There have been a number of studies concerning the BCMA system. These studies have

demonstrated that the system is effective in the reduction of medication administration errors.

BCMA systems have been found to reduce the errors in administrating medication by "54-87%"

(Agrawal, p. 682).   A study conducted in 27 northern hospitals showed that errors were

prevented in 1.1% of medication that was administered at these hospitals (Fowler et al., 2009).

University of Pittsburg Medical Center found that by using the BCMA system that errors

concerning the distribution of medications reduce 55% (Fowler et al., 2009). The FDA has

estimated that if bar codes were to be universally implemented by U.S. hospitals it would help

prevent 500,000 errors in transfusions over the next 20 years ("Medical Benefits", 2004).

Researchers from Brigham and Woman's Hospital in Boston conducted a study involving 6,723

medications being administered in a hospital setting. They found that the BCMA system

reduced errors pertaining to the type of medication or the dose of medication by 41 %. It was

further discovered that a reduction in the time frame that the medication was given after initial

orders were processed ("meaning a patent was given mediation an hour or more off schedule")

was reduced by 27% ("AHRQ study", 2010). The BCMA has shown that prevention of errors

where timing is concerned in medication administration, are mostly effective in preventing doses

being administered prior to their scheduled time (Fowler, et al., 2009). While 20% of prescribed

medications were found to be given late; this was largely not due to a registered nurse error.

Late medication dispensing errors were found to be due to the tendency of standard medication

administration times. For example, it is impossible for a registered nurse to administer several

medications, to several unique patients all at the prescribed time (Douglas & Larrabee, 2003).

The BCMA system has been found to benefit nursing staff to enable them to become aware of

omitted doses that a prior shift registered nurse had failed to administer (Douglass & Larrabee,

2003). These studies varied in their size, methodology, and conclusions pertaining to the

percentage of errors, in the administration of medications being reduced by implementing the

BCMA system. All of the studies agree however that the errors contained in the administration of

medications by registered nurses, are substantially reduced with the implementation of a BCMA

system.

Indications for Under Utilization

There are several reasons why all hospitals have not introduced a BCMA system. These

reasons include the cost of the system, both in terms of purchasing and implementing software

and hardware. The cost of additional personnel and lost work time involved in training to

implement a system is a preventative factor. Furthermore the ongoing costs of the additional

time the pharmacist hast to spend to input the information into the system and the registered

nurse has to spend to use the system effectively. Additionally an increase in salaries expenses of

information services personnel would be incurred with the maintained of such a system. Without

the implementation of the BCMA system registered nurses spend up to 40% of their time

administrating medication (Fowler et al., 2009). The BCMA system will cause an increase in the

already substantial allocation of a registered nurses time for medication administration. Benefits

to patient care have been demonstrated through the use of a BCMA system. A negative effect is

the increase time and emphasis on the medication administration by the registered nurse

Consumption of the R.N.'s time that has in the past been spent on other critical duties in term of

patient care (Agrawal, 2009).

    The Douglas and Larrabee (2003) study showed that extending the late administration of

medication time frame to reflect 2 hours (as being late) reduced the tendency of nurses to

overemphasize the importance of medication administration. Prior to the BCMA systems

extension nurses tended to neglect other more critical duties in order to meet the deadline for

medication administration (Douglas & Larrabee, 2003). A study of nurse satisfaction with an

implemented BCMA system, demonstrated overall satisfaction with the system. The Nurses

were particularly satisfied with the increased safety the system afforded the patient. They were

most dissatisfied with the delay in receiving medication for the pharmacist. The old system of a

work clerk or nurse manually taking the physician order to the hospital pharmacy and getting it

quickly filled has been delayed as the pharmacist now has to also place the prescription

information into the BCMA system. Overall however the survey showed nurses believe the

BCMA system benefited patients (Fowler, et al., 2009).

    Another factor in slowing the implementation of the BCMA system is that prescription

medications processing a unique bar-code have only recently been implemented. The Food and

Drug Administration (FDA) implemented regulations in 2004 requiring the use of machine

readable bar-codes on most prescription drugs and some over the counter medications ("Medical

Benefits", 2004). The regulations however did not go into effect until 2006 (Fowler, et al., 2009). Furthermore the FDA regulates prescription and over the counter drug manufactures and not hospitals. While the purpose of the regulation was to facilitate hospitals implementation of a BCMA system in hospitals, the FDA does not regulate hospitals and has no authority to mandate that hospitals take advantage of the medications being scan ready by implementing a BCMA system (Fowler, et al., 2009). As of 2009 only 10% of U.S. hospitals have chosen to implement a BCMA system, although the benefits of such a system appear undeniable (Agrawal, 2009).

Bar-Coding for Blood and Blood Products

An additional area where bar-coding has been found to benefit hospitals is in the collection of blood samples and the dispensing of blood in the form of transfusions and transfusions of blood products. The system for using bar-codes with regard to blood and blood products is very similar the BCMA system. A phlebotomist would scan a patient hospital bracelet to confirm the time of the blood draw, as well as the correct identification of a patient. Upon taking the blood draw the phlebotomist would attach the patient specific label. The phlebotomist then scans the label to make sure the label matches the patient (Stewart, 2007). Using the system for blood transfusions should lead to 100% positive patient identification (Douglas & Larrabee, 2003). Blood and blood products can be bar-coding at the time of collection and or separation upon placing in proper containers. Bar-codes are based on blood type and the nature of the product.

Incentives for Increasing Usage

The recently passed Recovery and Reinvestment Act has provided incentives for hospitals to institute a BCMA system. The federal government incentive is provided to persuade hospitals to institute a BCMA system is not only based on providing the patient with better treatment but also

to lower overall medical costs. Costs reductions will be realized if hospitals are able to reduce additional patient services required to treat human error induced conditions. Such conditions that are brought on after receiving incorrect medication, medication dose and or incorrect intervals, or blood type in the case of a transfusion. The FDA estimated that the instituting of bar-coding systems nationally would realize a savings of 93 billion dollars over the next 20 years.

Interview with Information Services Personnel

Two interviews were conducted for the purposes of this research paper. The first interview was conducted in Manistee Michigan, with Kim Poma an employee of West Shore Medical Center's Information Services Department. The second interview was conducted with Jeff Stewart an Information Services employee, at Munson Medical Center (MMC) in Traverse City Michigan.

West Shore Medical Center (WSMC) is a small rural center containing twenty five beds. It is a nonprofit, acute-care, critical access hospital in Manistee, Michigan. They provide a full range of emergency, diagnostic, treatment, and rehabilitation services.

With 368-inpatient beds, Munson is the largest hospital in northern Michigan. They too are a nonprofit hospital offering a wide range of services to their patients. In fact the two hospitals are currently affiliated and share many resources. Interestingly enough, the two facilities do not have the same capabilities for technical services or bar-coding.

Currently West Shore Medical Center uses bar-coding in the blood bank only. When blood is delivered it is bar-coded and stored according to type. Patients who are in need of a blood transfusion are assigned blood based on type and bar-code, then paired with a specific bag or bags of blood accordingly. This is a first attempt by WSMC to implement bar-coding. West

Shore Medical Center is currently working on implementing bar-coding in the pharmacy department and the remainder of laboratory services.

Munson Medical Center demonstrated their medication administration bar-coding system. Interfaces are carried out in a number of ways throughout the system. Registered Nurses (R.N.) for example, carry a PDA that scans the patients bar-coded arm band for the purpose of medication administration. This process automatically updates the medical record. MMC uses Citrix connection from Caremobile to Powerchart. Communication between pharmacy and the registered nurse is constant and ongoing. Updates of a patient's medical record are performed in real time, affecting many other departments and the way in which they proceed with a patient's care. This allows pharmacy staff to make nursing staff aware of new orders, cancelled orders and changed orders immediately. The nursing and pharmacy staff are alerted to potential drug interactions and allergies, so that harmful effects to patients may be avoided. The system will alert R.N.'s of a missed dose of medication and the safe time frame to make up such a dose, if it should be made up at all. This feature is particularly useful to registered nurses coming on to a new shift when the previous nurse may have missed a patient dose. P.R.N. (as needed) medications are also suggested when a patient is eligible to receive the medication.

Munson Medical Center uses this system to fill one of its Meaningful Use Protocols pertaining to the new Medicaid Reimbursement Guidelines. Currently, in order to receive Medicaid reimbursement, facilities must provide proof of checks and balances within their systems of operation. Medication administration that utilizes bar-coding technology such as MMC's fulfills such a requirement by providing and tracking safety measures in "real time".

MMC provides clinical decision support with its bar-coding system. The system shows medication administration, tracks safety measures being used and verifies present medical records. Decisions pertaining to a patient's care may change significantly based on available data. Access to up dated medical records as incidents take place allow providers to diagnose and treat with a greater degree of accuracy, thereby increasing recovery time and a patient's ability to reach optimal levels of health.

Munson Medical Center's bar-coding system includes a reporting and safety features. The system is able to produce reports on medication occurrence, allergies, near misses, and incident reporting. The bar-coding system aims for 90% accuracy with medication administration. If a particular registered nurse or pharmacist has experienced a less-than 90% administration accuracy, there is an inquiry of performance. Additional guidance such as education and mentoring may be given to such an employee based on inquiry findings. Missed orders must be followed up within 12 hours of occurrence.

Maintenance of the system is performed in two ways. Dictionary updates of contents are done by clinical staff. Information Services personnel update the main structure of the system. During down times the Medication Administration Record (MAR) is unlocked and the system follow main application status. There is no "read only" capability when the application is down. Paper charting is utilized when needed as it is imperative that communication and records continue to be maintained. The unit clerk or charge nurse is designated as the point of contact to communicate with the nursing staff on updated orders. This is done after orders are physically transcribed on paper and put into a patient medication record.

Bar-coding has several possibilities for future trends at Munson Medical Center, many of which are already in use at larger hospital centers. Such trends include; laboratory, radiology and cardio-pulmonary orders. Communication in real time with other departments such as physical therapy, social work and dietician are also beneficial to expediting patient recovery. Materials management could capture items used by or for patients that need to be charged to that patients account. Additionally materials management could reduce waste and avoid over ordering by keeping more accurate records of supplies used. Registration records could capture personal belongings of a patient upon admission with bar-coding capabilities. Bar-coded discharges could be done by staff, literally while the patient is being picked up by family members at car side. Bar-coding has been used on Obstetric units for years to match a new born baby with the correct mother.

Conclusion

Bar-coding for use in hospital systems will benefit both patients and staff in a variety of ways. Initial cost realized to implement a bar-coding system may be substantial as well ongoing maintenance and increased staff costs must be factored in. Alternately savings, of time and money throughout all departments are expected to compensate and even exceed these numbers. Furthermore federal grant dollars will aid to off- set of costs of initializing such a system. A bar-coding system will enable hospitals obtain more accurate reimbursement from insurance companies and government programs such as Medicaid in a timely fashion. Nursing staff may need to spend additional time dispensing medication while learning the system and quite possibly even after the system is mastered. However patient benefits (in the form of healthy outcomes and the avoidance of human error induced conditions) far out way the cost of increased time/staffing for medication dispensing and blood transfusions.

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