Effects of Patient Scanning Devices on Implementation in the Electronic Health Record

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**INTRODUCTION**

 Technological advances are seen everywhere from computers, cell phones, the internet, to different areas such as in offices, in homes and now even at the nurse’s station. One such advancement is the use of the bar code medication administration or BCMA. In 1992 a nurse had a brilliant idea to help with medication administration efficacy. While the nurse was returning her rental car to a rental service which used barcoding and scanning to keep track of their inventory the nurse pondered if this simple barcode could be implemented and applied to medications (Coyle and Heinen, 2005). By 1995 the birth of the first BCMA took place in a Department of Veteran Affairs **(**VA**)** hospital in Topeka, Kansas. BCMA was groundbreaking and made a large difference in the management and carrying out of patient care by helping to verify the five rights of medication administration. On April 4th of 2004 theFood and Drug Administration **(**FDA**)** made a ruling which mandated that by 2006 barcode labeling must be applied at a unit dose level for medications and biological products in order to promote patient safety and decrease medication errors (Mastrian & McGonigle, 2012). The synergistic mandate by the FDA and the development of the BCMA has revolutionized the medication administration cycle; because of this an analysis about BCMA will be discussed in detail. An explanation of what exactly BCMA entails, including its technology, BCMA’s impact on patient care, and its implications in nursing will be explored in this paper.

**DESCRIPTION OF TECHNOLOGY**

 The foundation and basic principle of the barcode medication administration is the barcode. A barcode is a simple series of alternating bars and spaces which represents a unique code (Mastrian & McGonigle, 2012). The BCMA system has evolved throughout the years but the basic premise is the same and involves the key components of a set of barcode numbers assigned to each specific nurse (usually found on her badge), a patient identification bracelet with an exclusive barcode on it, the barcoded medication and a scanner which is linked to a computer. Typically the following is the process which occurs. First the nurse will scan her barcoded name badge which will identify her as the nurse who is going to administer the medication and log her into a specialized computer system. The next step which takes place is the patient’s barcoded armband is scanned thus causing a list of populated medications which are ordered for the patient to appear. Then the medication’s barcode which is to be given is scanned. Once the medication is scanned, it helps to ensure the five rights of medication administration by alerting the nurse of any discrepancies or issues with any particular order, such as an incorrectly written order, medication allergies or any possible contraindications given the particular medication (Mastrian & McGonigle, 2012). It also helps to ensure that the medication is for the specific patient which was scanned and that the medication coincides with the written order thus helping to avoid medication errors.

**ANALYSIS**

**NURSING KNOWLEDGE OR PRACTICE**

Nursing education programs are beginning to implement the use of BMCA and Electronic Health Records **(**EHR**)** into their nursing programs. Use of EHR documentation requires at least basic computer skills. All nurses, upon hire to a health care facility undergo some type of orientation. Most of the EHR orientation allows nurses to become familiar with the different charting methods and screens/error messages so that they will be able to complete the documentation in a timely manner. Use of hands on training with BMCA also helps the nurse to develop hardware skills. This helps them to avoid the stress of patient care and incorporating nursing knowledge and practice into a new documentation program at the same time. Support systems and usually an information technology consultant is on call for questions and additional help if needed. An efficient EHR which allows the nurse to expedite documentation and maintain the proper patient care without the added job stress, time constraints, and work-arounds could be used as a nurse retainer tool. Especially if the EHR has proper training and support staff available and significantly reduces nurse workload (Abraham, 2008).

**ACCESS TO CARE**

Access to care with hand held scanners is immediate. One simple scan of a patient’s wristband opens up the medication administration record (EMAR) and allows the nurse to scan the medications scheduled for that patient at the corresponding date and time. Safety checks pop up as little warning screens such as allergies, wrong time, wrong dose, etc. This ease of access saves time for nurses because they do not have to leave the room and go to the PYXIS to remove medicationsand then return to verify and chart each medication as administered. The administration of medicationsusing a hand held scanner via mobile stations is immediate and significantly cuts down on nurse’s workload and increases patient safety (Abraham, 2008).

**PATIENT SAFETY**

 The safety and effectiveness of bedside scanners reduces nurse workload and increases patient safety by reduction of medication errors (Abraham, 2008). BCMA with use of hand held scanners shows a significant reduction in medication administration errors through several studies. Such studies show a 40-70% reduction in hospital patient medication errors and an 80.7% reduction noted in the ER (Bonkowski, 2013). This reduction of medication errors signifies that BCMA is a positive improvement in patient safety. The computer interface system matches the medication to the patient’s medication orders and also verifies patient’s allergies upon scanning before it will accept the medication administration as completed. The time of administration is also documented. Safety is maintained by electronic record and is a lot easier to read which decreases risk for error than most handwritten charts. Detailed records and quick access to patient lab data and procedure reports enhance patient care access which also enhances timeliness of treatment and increases positive patient outcome. When a nurse questions a medication or dosage a quick note can be electronically sent to pharmacy for verification which is much quicker than calling and remaining on hold. This is safer and allows the nurse better access to care for the patient (Abraham, 2008).

**QUALITY OF CARE**

Medication errors remain problematic in regards to patient safety. The implementation of medication scanners into clinical practice has dramatically increased the quality of patient care. In the hospital, barcode scanning provides valuable patient verification methods, such as confirming the five rights of administration: right patient, medication, dose, route, and time. Prior to incorporating BCMA into healthcare, patient fatality due to simple medication errors occurred at an insurmountable rate. BCMA not only improves the quality of patient care but also forfends further systematic and human error to ensure the best possible patient outcome. “When fully and properly implemented, bar-code scanning will not permit the dispensing process to continue if a match does not occur” (Gaunt, 2010). This serves as a safety precaution before the medication is consumed, thereby possibly avoiding a potentially tragic event. Integrating the BCMA into practice also results in improved communication between the pharmacist managing the medication and the caregiver administering it. Medication errors remain hazardous; as a result the integration of technology is becoming increasingly common in an attempt to improve continuity of care, safety, and overall improvement of patient satisfaction.

**COST**

One of the largest focuses in the cost of a BCMA system is the amount of money that is saved in reducing medication errors and sentinel events. In 2008, medical errors cost the United States $19.5 billion. About 87 percent or $17 billion were directly associated with additional medical cost, including: ancillary services, prescription drug services, and inpatient and outpatient care (Andel et.al, 2012). When you factor in quality-adjusted life years, the number goes up towards $1 trillion yearly. Reducing medication errors and providing reliable safe medical care is not only less expensive, it is more effectual.

BCMA systems are expensive and there has been limited research to the cost-effectiveness of this technology. The bulk of cost-related literature focuses on computerized order entry systems. Sakowski and Ketchel (2013) published a study of the cost of implementing a BCMA system into 5 community hospital settings for five years. They estimated the implementation and operation of a commercial BCMA system to be $40,000 per BCMA enabled bed. This cost included medication dose repackaging and an electronic pharmacy management system for the initial five years. The study continues on to estimate “a 100-bed facility could anticipate that implementing and operating a commercially available BCMA system would cost between $3.6 and $5.5 million over five years” (2013).

All of the studies cited in the Sakowski and Ketchel article used computers on wheels to go room to room rather than installing computers in each patient room. The above study concluded that over a five year operating period, a BCMA system for inpatient medication administration costs $2000 per moderate or severe medication error prevented. BCMA, if used correctly, can be an effective and valuable cost-saving tool for avoiding the morbidities and mortalities associated with avertable medication errors (2013). To help with cost, the federal American Recovery and Reinvestment Act provided $20 billion to fund healthcare information technology (HIT) (Dubin, 2012). HITs include EHRs, computerized prescriber order entry (CPOE), and BCMA systems.

**EASE OF USE**

The trick of a successful BCMA system implementation is having one that is easy to learn and easy to use. If it is complicated and/or timely, healthcare workers will develop “work-arounds” to avoid this. There are multiple different types of BCMA systems. Most are comprised of a scanner like the kind you see at retail stores, a barcode that is printed on the patient’s wrist band and a portable computer that can be transported between patient rooms.

The VA is using a BCMA system. Rivish and Moneda (2010) reports the VA system begins with the physician placing an electronic order in the EHR, their system includes a process of order checks on all orders. Allergy assessments are used in these order checks, along with potential drug - drug interaction protocols. Once the pharmacist receives the order and verifies it, the pharmacy robot retrieves the correct medication and deposits it in the patient’s drawer. The pharmacy tech places the medication drawer on the medication cart and transports the cart to the applicable unit. On the unit the nurse verifies the medication order. To dispense the medication, a nurse logs into the BCMA laptop which is located on the medication cart. They must first scan the patient’s bar code on their wrist band. Once scanned, the BCMA screen displays a patient confirmation screen and if correct, the nurse checks the patient identity confirmation box. The electronic medication record will appear on the screen instructing the nurse to scan the bar code on the medication packet. If the nurse scans the incorrect medication, or incorrect dose, or a medication that has already been administered, the BCMA will flash an error message alerting the nurse to not administer the medication. When the BCMA system was used correctly, there was a 61.97% to 93.48% improvement in medication errors when comparing post BCMA and pre BCMA (Rivish & Moneda, 2010).

**INTEROPERABILITY**

Barcode scanners have become a part of our daily lives. Over the years as hospitals began to integrate scanners into the clinical setting, patient care and safety have steadily improved. The scanning process is the perfect example of interoperability within the healthcare system. For example, the connecting of systems within a care facility allots staff the ability to track medications dispensed from machines such as the PYXIS, to bar-codes scanned at the bedside via BCMA. The BCMA is also integrated with the EHR. “The interface between the BCMA and pharmacy systems creates and populates an EMAR, which becomes part of the patient’s medical record. This EMAR creates a worksheet to inform the clinicians what medications each patient is scheduled to receive and when they are due. The system automatically records the date and time of each medication dose given” (Sakowski & Katchel, 2013, p. e39). This then allows pharmacy the ability to easily identify variances. Interoperability improves accountability and saves clinician’s steps in medication workflow. Interoperability integration further permits patient information to be accessible to all providers and proves to be both time and cost effective to the organization. The production of an integrated system affords the entire healthcare team the benefit of being on one accord.

**AVAILABILITY**

 Healthcare technologies aimed at different components of the medication delivery process represent an important opportunity to prevent adverse drug events. Diffusion of these technologies into the healthcare setting is growing; however, in as recently as 2008, less than 25% of healthcare institutions have fully adopted these evidence-based practices. Without consistent medication delivery processes, technology has the potential to reduce human vigilance and increase the capacity for error (Early, Riha, Martin, Lowdon & Harvey, 2011). Due to supportive efforts by the FDA and the Joint Commission (JC), an increase in the number of hospitals purchasing BCMA systems is expected. BCMA will probably be utilized in the majority of hospitals by 2024 (Gooder, 2011).

**EDUCATION / TRAINING NEEDS OF STAFF AND / OR PATIENTS**

Every BCMA system will have some differences. A BCMA verification system was implemented at a 123-bed, magnet oncology facility in Buffalo, New York. Abbotoy and Sessanna (2012), report that pre-implementation education for direct care nurses consists of one hour in-classroom instruction. The classroom instruction covered the functional aspects of the BCMA system, with demonstrations by the BCMA training team. The classroom portion was scheduled two weeks prior to the implementation date for the specific units. A hands-on component was provided on the unit after the staff completed the classroom instruction. This included several BCMA scenarios in which staff might encounter with the system. The simulations purpose was to reinforce the classroom knowledge the staff already had and provide application and incorporation of the information. Some of the staff nurses became “super users” and were the go-to educators on the unit for their co-workers. The final phase of the BCMA education took place during each nurse’s initial use and medication scan with the BCMA system. The BCMA training team provided one-to-one support for this step.

Over the next few weeks the BCMA system was monitored and problems were addressed. The majority of the issues happened when the nurses did not follow the BCMA steps as they were trained. When the steps were not followed, the BCMA system was over ridden and the nurses reverted to administer the medication the pre BCMA way. These nurses were identified and used in focus groups for the BCMA teams. The focus groups allowed the educators to meet with and address the difficulties these nurses were having. The BCMA system does take longer to administer medications and it changes the nurses’ routine workflow. A 24 hour BCMA help line was suggested for future implementations.

**POTENTIAL ETHICAL ISSUES, PRIVACY ISSUES, REGULATORY ISSUES**

Ethical issues related to handheld scanners were not really found in the literature, thus for this section we will be referring to patient information via the EHR. Use of the mobile computer stations which go along with the hand held scanners to retrieve patient information can pose some ethical and privacy issues. At times, a patient may be accompanied by visitors, clinicians should assure the information screen is not left open on the computer, and if a visitor is attempting to read the information politely inform them of The Health Insurance Portability and Accountability Act (HIPAA) and close the screen. This protects the patient privacy and the nurse’s license. Other ethical issues involve the accessing of patient’s information by other hospital personnel not involved with the direct care of the patient. The fact that information can be accessed so readily poses a huge security threat to medical facilities because they are responsible for keeping data secure and patients safe (EHR use growing fast, but ethical concerns are, too, 2012). Data breach could occur, computer systems stolen or sold without removal of information from hard drives, data inadvertently transmitted to the wrong IP address, or data lost and pulled up in cyberspace. Any of these could occur at any time.

HIPAA is responsible for regulation of some electronic health information, such as health plans, health care clearing houses, and health care providers who transmit health information for billing, claims, and health plans. The rules are lax and not all areas are enforced leaving patient privacy and confidentiality open for access. Most states have medical confidentiality rules, however, the EHR is interstate and much needs to be modified concerning state regulation (Hoffman, 2008).

 Data on current regulation of EHR does not state any specific regulatory agency. Some of the regulatory agencies that have been looked at to take on the job of EHR regulation are the FDA, CMS (Centers for Medicare and Medicaid), or creation of a brand new regulatory agency. The FDA declined the offer to regulate the EHR due to the fact that they are set up to regulate medical equipment and don’t feel they are the best choice because they would have to rewrite their regulatory plan. CMS would require significant increase in resources to cover EHR regulation and increased cost. A new governmental agency would also be costly and require expansion of government. So, the EHR remains currently unregulated by any governmental agency (Hoffman, 2008).

**CONCLUSION**

 As analyzed above, the BCMA system has been a big contribution to the world of healthcare. It was the smart thinking of one nurse who helped change the medication administration cycle and essentially impacted law. The BCMA is simple to use, helps reduce medication errors, is cost effective in that it has saved thousands of dollars in negative outcomes from medication administration errors and has helped promote quality of care and patient outcomes. The BCMA is just another prime example of how technology has improved the world around us and it serves to remind us that there is a place for technology in the healthcare area and in patient care.

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