Physician Order Entry and Medication Bar Coding in Healthcare

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The use of computer technology in the healthcare industry has continued to develop and has rapidly expanded over the past five decades. Healthcare computer systems have broaden their degree of usage from individual systematic functions from areas such as billing and ancillary test resulting to an information systems structure incorporating patient information, communication sharing between healthcare providers and the ability to collect, analyze and disseminate data , with the intent on improving patient services and outcomes. Important nursing documentation that was frequently lost or not easily retrievable because it was on paper, can now be found instantly and utilized to review trends in patient care management, leading to appropriate treatments decisions. Today, there are several computerized systems that are being implemented in healthcare facilities which include electric medical records (EMRS), electronic healthcare records (EHRs), computerized physician order entry (CPOE) and barcode or medication scanning, all of which can assist in more reliable and consistent patient documentation and patient safety (Thede & Sewell, 2010).

The electronic medical record (EMR) is an electronic computerized system that allows a patient's medical information including assessments, medications, allergies and physician orders for each patient visit to be stored in a database and be quickly and easily retrievable. With each subsequent patient visit, the healthcare provider is able to review the patients past visits and provide appropriate disposition of the patient. EMRs are located in many different healthcare facilities including hospitals, outpatient clinics and private physician offices; however each facility may utilize a different data collection tool which may result in duplication of documentation. Another negative aspect of EMRs is related to the inability of multiple healthcare facilities being able to share a patient's health information (Thede & Sewell, 2010). If a patient has a designated primary physician where their information is stored electronically but presents to an emergency department for acute care treatment, the hospital is often not able to retrieve this patient's health history since the private EMR is not shared with the hospital.

The terms Electronic Medical Record (EMR) and Electronic Health Record (EHR) are often used interchangeably. With the EMR, although the health information is that of an individual patient, the actual computerized medical record is owned by the healthcare facility. The EHR should be designed to provide the patient ownership of their health history while being able to share information to all healthcare organizations that play a role in the patient's treatment plan, no matter the location of the patient or facility (Thede & Sewell, 2010).

The Joint Commission defines annual National Patient Safety Goals (NPSGs), which are developed to prioritize items that relate, and result in hospital and patient quality improvement measures. In 2011, NPSGs included items such as patient identification and medication management including labeling, interactions and reconciliation. Utilizing an electronic means of collecting, delivering and storing patient care is vital to meeting the NPSGs. Two technology programs that are being used in healthcare organizations today, which are directly related to the NPSGs, are computerized physician order entry (CPOE) and bar code medication administration (BCMA) (Radecki & Sitting, 2011).

"The Institute of Medicine estimates that, on average, hospitalized patients are subject to at least one medication error per day" (Radley, Wasserman, Olsho, Shoemaker, Spranca, & Bradshaw, 2013, p.1). It remains common practice in many healthcare settings for physicians to hand write patient orders. Medication errors often occur due to illegible physician handwriting or when orders are transcribed. When a medication error occurs, there is an increase in potential for harm to patients, which can lead to additional treatments, increasing healthcare costs and potential litigation (Radley et al, 2013). Computerized physician order entry (CPOE) is a tool that allows physicians to place their own orders into the system, decreasing the number of order entry errors related to wrong patient and initiating compliance with patient safety goals. The Institute of Medicine has encouraged the use of CPOE in healthcare facilities for more than ten years, however, as of 2009, "less than 10% of hospitals

have fully implemented these systems" (Manor, 2010, p.18). CPOE systems can be effective in decreasing order entry errors because of the additional checks that are built into the system that provide the ability to electronically verify correct drug dosages and medication interactions. Although the use of CPOE may have a direct impact on decreasing medications errors by reducing human error through writing, reading and transcribing orders, there are concerns that CPOE may also contribute to medication errors. The potential risks for errors is related to CPOE not being fully implemented in all departments of a facility, some CPOE systems are designed and built within a facility versus being purchased as a complete system and the fact that there are very few studies that exist related to CPOE effectiveness. Radley et al. (2013) conducted a survey to see if implementing CPOE in facilities decreased medication errors. This study was conducted on CPOE data from 2008. This was the first study conducted that provided an estimation of the effectiveness of the use of CPOE and reduction of medication errors at a national level. The study's findings supported a 12.5% reduction, nationally, in medication errors. This calculates to 17.4 million medication errors that were probably avoided due to CPOE implementation. Another study concluded that there was an increase in medication errors after implementation of CPOE. The increased errors most frequently noted were when the physician was choosing medications and dosages from drop down boxes, when duplicate orders were placed and when the wrong patient was chosen with ordering (Radley et al, 2013). In the emergency department where patient volumes are frequently high, there is an increased risk of physicians choosing the wrong patient when using CPOE. One observation study focused on emergency department physicians using CPOE and found that they often choose the wrong patient when placing CPOE orders because they fail to confirm the patients' name (Radecki & Sittig, 2011).

It is also important to understand that CPOE implementation affects not only physicians, but also nursing staff. This technology will alter workflow for both the physician and the nurse and will change the way communication between the two professions occur. With CPOE initiation, the

physicians may become negative or resistant with the new process and may experience decrease efficiency and productivity. Where with written orders they provider would just write down the test be performed on a physician's order sheet, CPOE now requires them to not only choose the order, but add any additional information that may be needed to ensure the order is complete. This electronic order, although now legible and quickly showing up in the system, requires the nurse to retrieve and review orders differently; possibly using symbols from a tracking board, which can potentially lead to delays or missed orders when this system is implemented (Manor, 2010). CPOE may also lead to errors depending on if the entire facility is utilizing the technology, or just certain units. Are inpatient units able to find and review CPOE orders that are placed in the Emergency Department?

How can CPOE be successfully implemented in a healthcare facility? It is very important to have a team approach and representation from all disciplines, including physicians and nurses, throughout the entire process. It is also important to involve frontline staff, who will be using the system once implemented. Having open and honest communication and providing education to staff regarding the reasons why it is important to implement new technology such as to increase patient safety, as well as to address governmental requirements, is imperative to a successful implementation. Some staff members may have fears about changing from paper to electronic charting due to lack of computer knowledge and skills and these fears need to be recognized and addressed to promote positive attitudes toward change (Manor, 2010).

Medication administration barcoding is another informatics technology system that is becoming more popular in acute care settings. Most medication errors and adverse drug events occur somewhere within the medication process. Previously, nurses were taught the '5 rights' to medication administration, however, the '8 rights' are now being discussed to ensure correct medication administration. These 8R's include, "right medication, right dose, right patient, right route, right time,

right assessment, right reason and right documentation" (Daya, Hasman, Huijer, & Dimassi, 2010, p. 112). When nurses thoroughly review this information while performing the medication administration process, medication errors are less likely to occur.

Medication bar-coding has been used by drug manufacturing companies since 2004 when the US Food and Drug Administration began requiring them to do so to assist with increased medication safety toward consumers (Marini et al, 2013). Medication barcoding systems use a scanning system to scan the patients' armband, as well as the medication label, to ensure that the correct patient is receiving the correct medication. Medication administration errors range between 26-32% in adult patients in acute care settings. Although bar-coding is designed to help decrease medication errors by ensuring correct patient and medication ordered, it is not a flawless system. When a patient's armband is scanned, the nurse must still ensure that they have the correct patient, by verifying the patient's identity per their facility policy. The bar-coding system does not ensure that the patient has the correct armband on. Failure of the nurse to validate patient identity reduces the effectiveness of the tool. Another patient safety concern related to medication barcoding system is 'work arounds'. Nurses find ways to manipulate the system or alter the correct process for medication administration. A nurse can pre-scan and remove multiple patients' medications and have multiple bar codes in their work area which may save them time, while jeopardizing patient safety. Additionally, there can be defects in the systems scanner or sometimes in the ability of the scanner to read the barcode on medication labels, leading to manually over riding the system, so the nurse can complete tasks timely (Henneman, 2009).

Nurses attitudes toward bar-coding systems need to be evaluated and their concerns need to be addressed. It is important to assess end-user's thoughts regarding new systems that are going to be designed and implemented. When nursing or other professional staff are not involved in technology changes, their attitudes my become negative, leading to unsuccessful implementation of systems. In a

literature review, it was shown that there can be up to 65 steps from the time a physician writes a medication order until the medication is actually administered to the patient. Although an error can occur in any of the '8 rights' discussed earlier, 39% of errors occur with physician ordering and 38% occur with administration. Although errors are often found and corrected, only 2% of the administration errors are caught, exposing the nurse to an increased potential for being responsible for the administration error. When utilized correctly, bar-coding systems decreased medication errors between 65% - 74%, resulting in improved patient safety goals. When nurses have a positive outlook on new technology, the system and staff are more likely to be successful. "The most widely used variables that predict IT success in the literature are (1) user satisfaction and (2) system usage" (Marini et al, 2010).

One study conducted looked to see how nurse's attitudes effected implementation and success of medication bar-coding systems. This study used the theory of reasoned action (TRA). The TRA theory supports the idea that people react, respond or behave in a particular way in response to their attitude to an outside stimulus. How a person believes the object will help or hinder their performance is the attitude that will be reflected in their decisions related to usefulness of the system (Marini et al, 2010). For this example, a person will develop their own thoughts and ideas of how a new medication bar-coding system will affect them. If the person is not comfortable with technology or has heard negative comments from others related to a similar system, the person is more likely to display a negative attitude prior to ever working with the system, leading to unsuccessful implementation. This study showed that staff was more likely to accept a bar-coding system if they believed that it was useful to them and easy to use. If the new system was believed to be user friendly and assist with decreasing medication errors, then again, staff was more positive during implementation (Marini et al, 2010).

Both CPOE and Bar-coding systems have areas for improvement as the future of healthcare ordering and documentation systems continue to develop. It is very important to ensure that end-users are involved with all aspects of planning, designing and implementing new systems. This will allow all healthcare providers to better understand use and flow of systems and become more adaptable to future changes. Additional studies are showing that CPOE may have the ability to improve overall patient quality of care through design and implementation of best practice. Is this occurring due to increased coordination and communication of care or the ability to retrieve important documentation and data promptly? One study reviewed ten quality care measures and showed an increase in clinical performance for both AMI and CHF. One major obstacle for any new computer technology advancement is cost. Many healthcare facilities will face financial obstacles when making decisions about adopting new information systems and they must decide if the potential outcomes will be worth the cost (Kazley & Diana, 2011).

Advanced technology systems will continue to be implemented and play important roles in the future of healthcare. It is important that the design and implementation of all systems are utilized to provide safe patient care and quality patient outcomes that will hopefully assist with a decrease in overall healthcare expenses.

Research Summary

Author	Year	Research Question	Type of Study: Quantitative Qualitative Correlational Descriptive	Protocol	Ethics IRB Confidentiality	Sample Evaluation # is Included/excluded criteria	Lit. Review Groups	Findings	Analysis Measure Reliability Validity	Limitations	EBP Relate to Practice to Nursing
Marini, S.D., Hasman, A., Huijer, H.A., & Dimassi, H	2010	Nurses attitudes toward bar-coding and use.	Qualitative	Questionnaire	University IRB Voluntary	425 RNs invited 67 Participated Convenience sample		Perceived usefulness relates to RN attitude. Negative attitudes r/t if not viewed as a user friendly system.	Reviewed by 2 experts for face and content validity. Construct validity was assessed by factor analysis. Cronback score for interterm reliability.	1 cohort of nurses used from an email list. Convenience sample Does not allow for generalization of results.	Implementing systems will all involved can significantly reduce Med. Errors and increase patient safety.
Henneman, E.A	2009	Discussion of patient safety technology in acute and critical care settings	Case Study	Na	na	Na	Na	Technology more effective if used as intended and as taught.			Ensuring education and maximum use of technology provided.
Radley, D., Wasserman, M., Olsho, L., Shoemaker, S., Spranca, M. & Bradshaw, B.	2013	Provide baseline national estimate of ME CPOE reduced.	Random affects met analytic techniques. Systemic Lit Review	Data and surveys	Na	4701 hospitals included. Provided general or pediatric acute care, medical and surgical care, private, for profit, private not for profit or public. Excluded long term care and federally owned hospitals.	Systemic review of the peer-reviewed literature.	CPOE decreased order errors by 48% (95% Cl 41-55%) 12.5% in med errors, ~17.4illion MEs reverted in 1 year in the US.	na		CPOE reduces MEs, but does it reduce patient harm?
Tschannen, Talsma, Reinemeyer, Belt & Schoville	2011	Determine impact of CPOE on RN workflow	Quantitative (Direct Observations) and Qualitative (Interviews)	Observations and Interviews	Verbal consent	Randomly selected RNs, 1-24 yrs exp., FT/PT and travel RNs.				Generalizability, possible observer errors, steps in process may very and no specific time consistently measured.	More time with CPOE r/t proximity of rooms, # of meds, interrupted RN workflow. Different orders found which does not eliminate errors. Lack of Face to face communication between MDs and RNs

Kazley & Diana	2011	Relationship between technology adoption and quality care.	Retrospective Cross-sectional with multiple regression	Relationship between 10 quality measures		4606 hospitals, 307 had CPOE which was 6% of sample.		CPOE potentially increased quality of care in AMI and CHF patients. CPOE gave real time feedback.		Cross sectional design 'did not allow for conclusions of causation. Variance among users of the system. CPOE systems are different in each healthcare facility.	The possibility that CPOE does increase adherence to clinical indicators that improve quality of care and outcomes.

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