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Does Computerized Physician Order Entry Reduce Medical Errors?

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ABSTRACT

Introduction: *Computerized Physician Order Entry (CPOE) is a system that allows physicians to electronically order patient services. The services that can be ordered, but are not limited to include: prescriptions, labs, x-rays, and referrals. Adopting CPOE will eliminate the use of paper orders with illegible hand writing. The purpose of this research project was to examine the cause of medical errors and to determine if adopting a CPOE system would be an effective solution to this problem.*
Results: *The results of this study show that CPOE can reduce medical errors and adverse drug events significantly. CPOE coupled with other systems has shown a positive outcome preventing medical errors. Some major barriers of adoption and implementation of a CPOE system is the cost associated with it and older physicians being stuck in old ways of practicing medicine.*
Discussion/Conclusion: *Adoption and implementation of CPOE has been growing in recent years with the HITECH Act of 2009. While preventable medical errors and ADE's continue to increase; this study will show that adopting a CPOE system can reduce medical errors and ADE's.*

INTRODUCTION

The Health Information and Technology for Economic and Clinical Health (HITECH) provision of the American Recovery and Reinvestment Act of 2009 was put into place hoping health information technology would improve patient care, decrease medical errors, decrease costs, and advance the health of the population (Bloomrosen et. al., 2011). Medicare and Medicaid providers could be eligible to receive incentives once the standards have been met using a certified Electronic Health Record (EHR) for Meaningful Use (MU), (Blumenthal, 2010). The earlier the adoption the more incentives a medical clinic could make using an EHR. Medicare will pay $44,000 and Medicaid will pay $63,750 for the adoption and implementation of an EHR after demonstrating Meaningful Use (CMS, 2013). To make sure a facility is going to receive incentives 14 core objectives and 5 menu objectives needed to be met to demonstrate Meaningful Use (Jha, DesRoches, Kralovec, & Joshi, 2010). If medical clinics take advantage of the incentives and demonstrate MU the money that is received can help cover a huge amount of the cost.

Meaningful Use has been divided into three stages. Computerized Physician Order Entry (CPOE) use is involved in the all three stages. In the first stage CPOE needs to be used with at least 30% of patients who are eligible. This means that providers need to use CPOE to order medication for at least 30% of the patients. The next two stages would increase that percentage close to 80% of patients. CPOE use is stressed in stage one as the thought of preventable medical errors starts at the moment a provider hand writes a prescription (Jones, Heaton, Freidberg, & Schneider, 2011). With the mandate that medical facilities operate using a CPOE is underway, by the end of 2011 57% of physicians/doctors have already reported having an EHR system (Hsiao, Decker, Hing & Sisk, 2011).

In the United States (U.S) every year approximately 200,000 people die due to preventable medical errors (Andel, Davidow, Hollander, & Moreno, 2012). The physician when ordering services and prescriptions for patients initially starts most medical errors. Physicians that write out prescriptions using a paper pad often do not have legible handwriting and are not able to be read by a number of important individuals who process the prescription and prepare it for the patient. Adverse Drug Events (ADEs) are another cause of 770,000 patient injuries and or deaths a year (AHRQ, 2013). If a patient is given a drug that was not prescribed by the pharmacist who was not able to read the physicians hand writing, those patients are at risk for ADEs. The results from ADEs are patients experiencing negative reactions to drugs which can result in extended hospital stays, increased medical costs, permanent disability, and possibly death (Du, Goldsmith, Aikin, Encinosa, and Nardinelli, 2012). A solution to fix the increasing number of medical errors and ADEs is for hospitals to adopt a CPOE system. According to Jones, Heaton, Freidberg, & Schneider (2011), using a CPOE system will enhance patient safety and decrease preventable medical errors.

CPOE is a software system that can be utilized in hospitals and can remove physician hand written order legibility, remove abbreviations, and increase order speed by having physicians electronically order services and prescriptions (Cucina, 2013). CPOE systems coexist with Clinical Decision Support Systems (CDSSs) which offer additional functions for a providers use. Some functions of CDSSs include drug interaction checks, drug allergy checks, and prompts for the provider about when to order a service for a patient (Kaushal & Bates, 2013). Some CDSS's have been enabled with many different alerts for the physician to check on a patient's health. When there are so many different alerts popping up physicians can ignore them, which can be a problem especially if the alert was about a life-threatening drug that was prescribed, this is known as *alert fatigue*. Providing a tailored system to an individual facility for the type of patients the facility provides care for or a certain age group could help minimize the excess alerts and limit the number of alerts the physicians may receive (Kesselheim, Cresswell, Phansalkar, Bates, & Sheikh, 2011).

With the adoption of a CPOE system, the increased number of preventable medical errors can decrease considerably. Unfortunately, less than 10% of hospitals have adopted a CPOE system (Altuwaijri, Bahanshal, & Almehaid, 2011). Some barriers for implementing CPOE have been the significant cost to hospitals and small practices that cannot afford an EHR system and the concerns that CPOE could reduce medical errors and ADEs. At Brigham and Women's Hospital, $11.8 million dollars was spent to cover the cost of adoption and implementation of a CPOE system. This is a large cost for any facility yet the CPOE system saved the hospital over $28 million dollars (Kaushal et. al., 2006). The size of a health care facility is not the only factor to consider when looking at the adoption rate. Geographic areas, private or public regulation, teaching hospitals, are all factors to consider with adoption rates. Hospitals that have a higher bed capacity are more likely than smaller hospitals to adopt, this is due to the insufficient funds smaller hospitals have (Furukawa, Raghu, Spaulding, & Vinze, 2006). In an effort to help with the costs of the CPOE system implementation, incentives have been given out by the Government to facilities that adopt an EHR (GEC, 2009). On the other hand facilities that do not comply with MU and adopt a CPOE system will receive penalties by the Government which will result in lower reimbursements (Harrison & Lyerla, 2012). Starting in 2015, one percent penalties will go into effect by the Recovery Act (DHHS, 2011). The percentage will then increase in 2016 and in 2017 where it will stay at a five percent penalty (GEC, 2009).

Research Purpose

The purpose of this research project was to examine the cause of medical errors and to determine if adopting a CPOE system would be an effective solution to this problem.

METHODOLOGY

The hypothesis of this research paper was; hospitals would significantly decrease their medical errors and

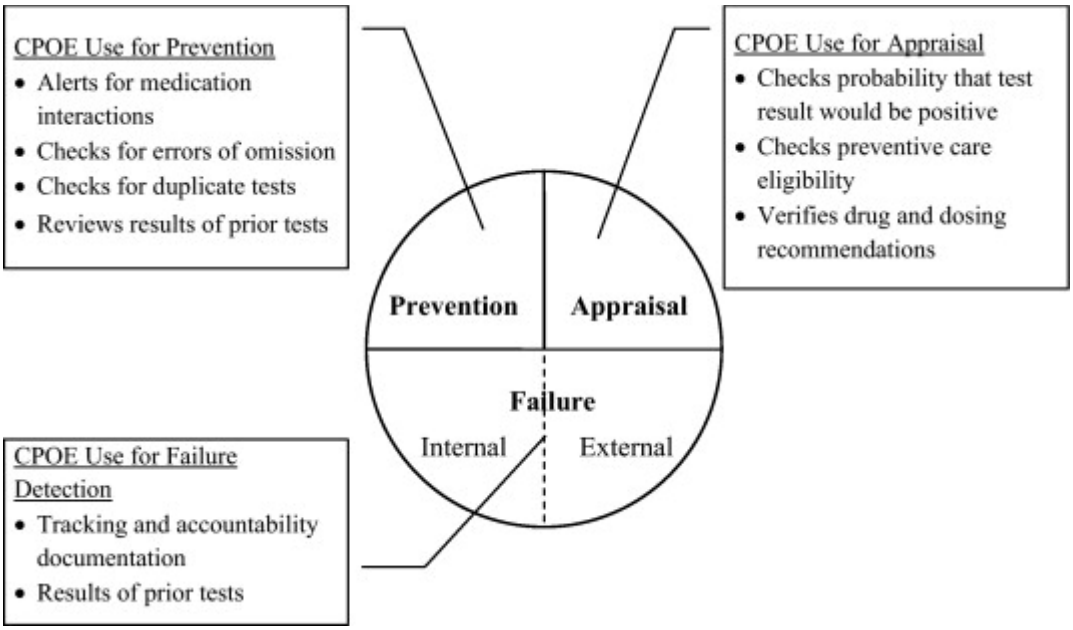
ADEs with the adoption and implementation of CPOE.

The methodology for this study was a literature and case studies review. The electronic databases of Google Scholar, Academic Search Premier, and PubMed were searched for the terms 'CPOE', OR 'Computerized Physician Order Entry', OR 'Meaningful Use', OR, 'Electronic Prescribing' AND 'Medical Errors' OR 'ADEs', OR 'Adoption', OR 'Implementation'. Reputable websites from the AHRQ, Health Affairs, and CMS were also used. Additionally, citations and abstracts identified by the search were assessed in order to identify relevant articles.

Attempting to stay current in research, only articles published from 2002-2013 were included in the review process. The search was limited to sources attainable as full texts, and those written in the English language. Original articles and research studies including primary and secondary data were included. The methodology and results of the identified texts were analyzed and key papers were identified and included within the research query. Thirty references were used for this study, nine of which were utilized in the results. In addition, a semi-structured interview with an Expert of CPOE systems in a hospital setting was added to the data collected (Appendix A). This Expert will be referred to as Expert in CPOE Systems within this study. The interview was recorded, and only relevant and pertinent answers were used to support the information found in the literature review.

The use of the conceptual framework by Queenan et. al. in the current study is appropriate as the focus is on prevention, failure detection, and appraisal of CPOE systems. Figure 1 depicts three uses for CPOE. CPOE is used for prevention by having alerts in the event of a medication interaction that could harm the patient. With the difficulty of providers ordering tests not knowing the patient just received the same test recently, CPOE can check a patients past history of tests given. Next is the use for failure detection, since CPOE is electronic, there exists a capability to track documentation of patients charts and prior test results. Lastly, is the use for appraisal; CPOE can check for dosing recommendations, preventive care eligibility and can check to see if a test ordered would give them positive results (Queenen et. al., 2011).

Figure 1



Source: Queenan et. al. (2011)
Figure 1. Prevention–Appraisal–Failure Conceptual Framework Model in the Context of CPOE Use.

RESULTS

Benefits of CPOE Adoption

Adopting and implementing a CPOE system has a number of benefits. Most importantly are the benefits the patient will gain from going to a facility that has made the transition from paper to electronic charts.

A medical group experienced a 70% reduction in medical errors when electronic prescribing was implemented Devine et. al. (2010). Within the same study, many benefits were noted for an independent medical group. Some of the benefits included were a decrease in patient paper charts, improvements in accessible patient information, additional coordination of care, reduction in prescription ordering by the physician, and by having total support by the organization helped the process of implementing the new system.

The Expert in CPOE Systems mentioned that one of the biggest benefits to adoption at the hospital he is employed with was the turnaround time. Providers are able to utilize electronically order entry of a service for the patient, thus resulting in faster patient care. An additional benefit the hospital experienced is instant access to patient's previous medical history.

CPOE Use for Prevention

CPOE systems can be tailored to individual healthcare facilities. Once an organization identifies its main problem, whether it is with a certain age group of patients or increased medical errors during a certain procedure, the facility can adopt a system within CPOE to help decrease the errors. In 2004, a study was performed on a Massachusetts medical center that was experiencing problems with potentially inappropriate medication with older patients. Programmers were able to develop a program within CPOE that would alert physicians once a patient's medication order would be placed (Mattison, Afonso, Ngo, & Mukamal, 2010). The same authors explain that the study was performed and tracked before and after the new system was

embedded into their CPOE system. The researchers demonstrated the alert system prevented numerous potentially inappropriate medication orders to their older patients. In addition, the use for CPOE to prevent medical errors was found to be successful at that medical facility in Massachusetts (Mattison, Afonso, Ngo, & Mukamal, 2010).

CPOE Use for Appraisal

A CPOE system has many capabilities for providers. The initial stage of a medication error begins when a provider prescribes the patient medication (Riedmann et al., 2011). Implementing a CPOE system can help clinicians and physicians have a check and balance system. Doolan & Bates (2002) reported; CPOE coupled with a CDSS can check for all drug interactions and for the recommended doses for patients with limited organ function. The authors stated, the technology can reduce medical errors and ensure appropriate tests are ordered while alerting the provider when a duplicate test has been ordered. Further, it was reported, CPOE can allow users to utilize drug references and provide specific drug recommendations for a patient.

CPOE Use for Failure Detection

In 2004, eight billion dollars was estimated to be wasted on duplicate tests for a patient (Jha, Chan, Ridgway, Franz, & Bates, 2009). Often time's patients who go to the doctor excessively might not remember what tests were performed from one doctor's visit to the next. One of many perks to implementing a CPOE system is the rewards it can offer for the patient and hospital by reducing the extra healthcare costs. Using a CPOE system, the ordering physician has instant access to a patients' electronic health record, including testing and the results of those tests (Callen, Westbrook, & Braithwaite, 2006).

Within a CPOE system interruptive or non-interruptive "pop ups" can be installed to decrease unnecessary testing. The same authors stated that "pop ups" can allow a physician to know when a test has been selected and if that patient has previously had the test performed or not. The interruptive "pop ups" can halt the physician from going any further in the ordering process, and the non-interruptive "pop ups" inform the physician but does not interfere with ordering tests (Baron & Dighe, 2011).

Barriers of CPOE Adoption

Barriers to implement CPOE systems begin with cost. CPOE systems are costly and the cost threatens small clinics while sufficient funds to adopt are not available. Another barrier to implementation is the limited function of a basic CPOE system. If the standard CPOE system is adopted and does not have any added features, for example, for increased medical error reduction, then this can become another barrier for the facility. With additional features of an integrated system, medical errors can be reduced more effectively.

According to the Expert in CPOE Systems another barrier to the implementation of a CPOE system is the hesitation by physicians to adopt because all they have known their entire medical career is how to use paper charts which has worked for so many decades, why would they want to learn a whole new way of charting electronically now. One concern physicians do have is on patient satisfaction. If the doctor goes into a patient room then they think that patients will not be satisfied by the loss of eye contact, decreased opportunity for psychosocial communication, and less sensitivity to the patient from missed nonverbal cues. This was measured by rating patient satisfaction before and after the implementation of a CPOE. The overall results illustrate there was no significant decrease in patient satisfaction (Irani, Middleton, Marfatia, Omana, & D'Amico, 2009).

One of the purposes of going electronic was the ability of providers to have easy access to a patient's medical record; also the speedy access of records was a benefit. Physicians have the ability to be at home or

another office and have access to a patient's past visit with for example, a specialist. Unfortunately, some systems have a lack of interoperability with other systems hindering the physician ability to access to a patient's medical record (Yaffee, 2011). If a physician cannot access needed information it defeats the purpose of having the system.

A few studies have shown that implementing a CPOE system can do more harm than good. It is important for all health care personnel to have in depth knowledge of what a CPOE system can offer. A way to get that knowledge is researching and reading studies on the subject. If there are not many studies on the topic then those individuals will not have all the knowledge required to make an educated decision about adopting a CPOE system.
. If CPOE is going to be effective then other systems need to be integrated into it. As reported earlier one of those systems could be the CDSS's. Additionally, pharmacy and EHR systems can impact medical error reduction (Aartz & Koppel, 2009). While there are few barriers to adopt and implement CPOE none of the ones reported are significant enough to change the facilities decision about implementing such a system.

DISCUSSION

The purpose of this research was to examine implementing a CPOE system in medical facilities to reduce the number of medical errors and ADEs. The results of the literature and case studies review and the interview with an Expert in CPOE Systems have demonstrated, implementing a CPOE has positive effects on the number of preventable medical errors. This literature review supports the adoption and implementation of CPOE in most healthcare facilities.

While preventable medical errors and ADEs continue to increase, it is important for healthcare facilities to implement a CPOE system for the clinical staff and providers to utilize. A CPOE system with CDSS capability can be used to diminish individual facilities' preventable medical error rates and this is proven by this literature review. CPOE is seen as a significant technology to enhance patient safety (Aarts & Koppel, 2009). CPOE has been around since the 1970s, yet only recently has it become more popular and found to be very effective in healthcare facilities. With the recent mandate of EHR and all the incentives and penalizations a facility can receive CPOE is gaining popularity every day while as facilities try to demonstrate MU.

Limitations

This literature review was limited due to the restrictions in the search strategy used, such as the number of databases accessed, and publication and researcher bias may have affected the availability and quality of the research identified during the examination. While there are many studies focusing on CPOE, there are significant amounts of studies, which favor facilities adopting and implementing a CPOE system.

Practical Implications/ Recommendations

Out of 30 journal papers, one paper included a conceptual framework involving how CPOE could be used for different functions. The framework that was used in this research paper is one of the first literature reviews including a conceptual framework describing some of the attributes CPOE has to offer. Future research should address the importance and effectiveness of CPOE as one of the leading systems for reductions in medical errors and ADEs.

The adoption and implementation process can take a very long time. Extensive studies need to be done to make sure the most effective system for the individual organization is adopted. Training needs to be available for all authorized personnel using the system, as well as, technical support needs to be accessible

at all hours of the day (Crosson et. al., 2011). Hospitals are open twenty-four hours a day and seven days a week and hospital employees need to be able to contact technical support in the event of a system error or malfunction. Once all employees are trained and ready for the change from paper to electronic forms of charting the transition process should run a lot smoother.

CONCLUSION

CPOE has been demonstrated to have a vast ability to improve the overall healthcare system in the U.S. This literature review has indicated that adoption of CPOE in hospitals and medical clinics have significantly decreased medical errors and ADEs among the population.

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APPENDIX A

Questions asked in semi-structured interview of an Expert of CPOE systems on April 25, 2013

- How is CPOE related to EHR and EMR?
- Has CPOE reduced medical errors at CHH? How?
- How much did the CPOE system cost here? Ball park figure?
- What have been the barriers to adoption so far?
- What has been the main challenge to adoption?
- What has been the biggest benefit to CPOE adoption?
- When did you adopt CPOE, how long did it take to train physicians?