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A preliminary analysis on CPOE functioning in Mississippi and implications for future research

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KEYWORDS
CPOE;
Mississippi;
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Abstract
Objective: This study seeks to describe the state of the hospitals in Mississippi in terms of the computerized physician order entry (CPOE) scores in relation to their overall performance rankings, safety standards, mortality rates from treatable serious complications, as well as the racial composition and the median household income of the city or the town whether the hospital is located. A secondary goal of this study is to determine whether clusters exist among these hospitals in terms of these characteristics.
Methods: Data is obtained from the 2015 Leapfrog Survey, HealthInsights, and the 2010 U.S. census. Descriptive statistics are used to describe the state of the hospitals in Mississippi in terms of CPOE scores, as well as performance rankings and safety standards in relation to the demographic and socioeconomic characteristics of the city or the town whether the hospital is located. Two-step clustering within SPSS is used to segment hospitals based on the above mentioned characteristics.
Results: There is a great variation in terms of CPOE scores among hospitals in Mississippi. Most hospitals in Mississippi have a relatively well functioning CPOE system (the scores range from 65 to 100%). Hospitals with low CPOE functioning scores tend to have low safety grades and tend to be located in low income areas.
Conclusion: Strategies to promote usage of the CPOE systems should be continued. Priority should be given to hospitals characterized by low performance rankings and low safety standards that are located in located in areas that are either predominantly black or in areas with low median incomes.

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Introduction

Medication errors pertaining to prescription, dosage, and overlooking imminent allergies are ubiquitous and have led to life-threatening consequences in patients [1]. Each year, approximately 200,000 people in the United States die as a result of medication errors [2]. Medication errors have also led to serious financial consequences [3]. In fact, the Institute of Medicine (IOM) estimated that on average, a patient in a given US-hospital faces at least one medication error per day [4]. The majority of these medication errors occurred during the prescription phase [5,6]. As such, it is important to have an integrated system that allows health providers to directly enter prescription, medication, laboratory, radiology, admission, procedural, referrals orders via the computer system [7,8] instead of writing it out by hand.

Indeed, the computerized physician order entry (CPOE) system is one of evidence-based medicine's greatest successes that integrate physicians' orders with patients' laboratory and prescription data as well as care giver communications such as nursing and dietitian instructions [7,8]. This adoption of the CPOE system is mandated by the American Recovery & Reinvestment Act (ARRA) of 2009 [9]. The goal is to attain Meaningful Use (MU) by the year 2014 in order to further improve client care and patient safety [9]. Meaningful use has been described as using certified EHR technology in a "meaningful way" with the purpose of improving patient care [10].

The CPOE is essentially an electronic prescribing system that enables health providers to order medications for patients directly through a computer system instead of writing out prescriptions by hand [7,8]. Treatment standardization is enabled under the CPOE system for certain patient conditions like pneumonia, congestive heart failure, and acute myocardial infarction because it automatically checks for potential errors or problems [7,8]. Patients can also reap direct and indirect benefits from the CPOE system because it improves coordination of care among medical professionals (i.e. physicians, pharmacists, nurses, etc.) by providing prompts that inform the possibility of drug interaction, allergy or overdose. The system also helps these professionals keep up with new medications and other patients' updates. As such, patients' records are still accessible to physicians even if they choose to work offsite. Potential errors or problems can also be automatically checked for under the CPOE system since orders are incorporated with patient information, such as other prescriptions and lab results [7,8]. At times, the Computerized Decision Support (CDS) systems are integrated with the CPOE systems [11] and this integration has proven to be even more effective in reducing medication errors [12,13] as well as costs associated with medication errors and adverse drug events [14].

Previous studies have found that the usage of the CPOE system has led to significant reductions in medication errors [15-20]. Some of these medication errors are due to illegibility, use of inappropriate abbreviations, and missing information [21]. The usage of CPOE has also led to a reduction in blood transfusion in children [22] as well as the length of hospital stay as well as pharmacy, radiology, and laboratory turn-around times [23-25].

Findings pertaining to the implementation of the CPOE system on patient system are mixed. Some researchers claimed that the CPOE system has led to improvements in patient safety [26,27] while others found that the introduction of a CPOE system can be detrimental to patient safety [28]. Findings pertaining to the implementation of the CPOE system on mortality rates are also mixed. Some researchers found that usage of CPOE has either no impact or has led to a reduction in hospital-wide mortality rates [27,29]. Others found that mortality rates increased following CPOE implementation [18], particularly in the first few years of implementation [6].

The negative unintended consequences of CPOE and the barriers to CPOE adoption are also widespread. The main negative unintended consequences are delays in obtaining the drug for treatment, leading to increased risks of medication errors or mortality [18,30]. Other negative consequences include duplicate medication orders, new work/more work, increased system demands, decreased interpersonal communication, and increased dependence on the technology [31-33]. The barriers to CPOE adoption are mainly attributable to the lack of start-up funds and financial incentives, suboptimal health IT systems, the lack of attention to human factor approach and design, the lack of organizational support, and high resistance from potential users [34-38]. CPOE implementation introduces radical change to every single aspect of the hospital's work, including a customization of the existing system for such installation [6]. Likewise, the cost-saving expectations of the CPOE systems remain to be realized; this endeavor requires significant financial investment [8].

75.6% of non-federal acute care hospitals in Mississippi have basic EHR adoption, which is very close to the national percentage of 75.6 [39]. At present, the Mississippi Health Information Network (MS-HIN) provides a secure and reliable way for health providers to access and exchange patient health records and other information [40]. The purpose of the MS-HIN is to improve the quality, safety, and efficiency of health care for all Mississippians by providing a sustainable, trusted exchange of health information among health providers [40]. To date, no studies in Mississippi have attempted to understand the progress of CPOE adoption and how well a CPOE system functions in a given hospital. Data on CPOE scores from the 2015 Leapfrog Survey is only available for 20 hospitals in Mississippi and the challenges for making EHRs usable remains unknown. Specifically, we do not know much about whether CPOE systems have been implemented in the other hospitals and their abilities in leveraging the CPOE systems in reducing medication errors like alerting the hospital staff if they try to order a medication that could cause harm or when a wrong dosage is prescribed for a patient. In addition, the limited data that exist do not tell us whether hospitals and healthcare facilities in Mississippi satisfy the expected ARRA standards for meaningful use and are eligible to receive the financial incentives.

Since the advantages of CPOE adoption remain compelling, this study seeks fill in the research gap by describing the state of the hospitals in Mississippi in terms of CPOE scores in relation to their overall performance rankings, safety standards, mortality rates from treatable serious complications, as well as the racial composition and the

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