The Electronic Health Record System and Hospital Length of Stay in Patients Admitted with Hip Fracture

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Abstract: Information technology is rapidly changing the manner in which health care is provided to consumers. The purpose of this research study was to determine if Epic®, an electronic health record, impacted the hospital length of stay (LOS) for patients admitted with hip fracture. When comparing six months of data pre- and post-implementation of Epic, there was not a significant difference in the hospital LOS for patients admitted with hip fracture. Although there was not a decrease in the hospital LOS post-implementation of an EHR, there was also no increase in hospital LOS, which might be expected with a major system change that required process and workflow modifications.

Keywords: Electronic Health Record, Hip Fracture, Hospital, Length of Stay

I. INTRODUCTION

Information technology (IT) is rapidly changing the manner in which health care is provided to consumers. Electronic medical records (EMRs), electronic health records (EHRs), barcode scanning technology for medication safety, and clinical decision and support tools were all developed through the use of IT [1]. Although an EMR and EHR are used interchangeably, they should not be confused with each other, as in reality these are two different models. An EMR is a legal record developed by healthcare organizations and used as a basic component of an EHR. The EHR is an electronic longitudinal health information record that can be shared among stakeholders, including the patient, across the continuum of care.

Electronic health records have been researched extensively and the benefits identified include multiple access points, improved legibility, reduction in medical errors, decreased diagnostic tests, and improved access to decision support and expert tools [2-8]. The literature suggests substantial advantages to using electronic records [9-11]. While many studies on electronic records have concentrated on the return on investment and patient safety, the full scope and benefits of an EHR are yet to be determined.

According to Clancy and colleagues [12], the largest gain from utilization of an EHR and increased productivity, results in decreased length of stay. Other benefits identified by Beiter and colleagues [13] include improved quality of care, patient safety, patient education and coordination of care services. Instant benefits of an EHR are decreased paper use, printing and transcribing costs, legibility and easy access to patient records [14].

Sisters of Mercy Health Systems (SMHS) recognized the need to align with federal government goals and objectives for health care and meet customer demands for quality, safety and cost. SMHS realized staying competitive in the health care environment required technology innovation; it was time to investigate software and technology systems. Prior to selecting Epic, many hours of exploration and onsite visits with customers concluded that Epic would be the technology vendor of choice for SMHS. Epic is a robust system with the level of technology needed to provide a fully integrated EHR [15].

The purpose of this study was to determine the influence of Epic on the hospital length of stay (LOS) for patients admitted with hip fracture. Patients with this diagnosis were selected because they typically require surgery, in addition to multiple treatments and therapies. According to SooHoo, Correa, and Pandarinath [16], hip fracture is one of the more common, severe, and costly injuries suffered by Americans. Patients admitted to the hospital with hip fracture typically spend greater than three days in the hospital setting and occupy a large percentage of hospital

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beds. The results of this study will be useful for health care organizations and health care practitioners moving forward as they explore implementation of an EHR. The study hypothesis was that hospital length of stay for patients admitted with hip fracture would be influenced by the implementation of the electronic health record, Epic, as reflected by a decrease in hospital length of stay post Epic implementation.

II. STUDY METHODS

This study was performed in a 343 bed acute-care hospital which formally implemented Epic on September 26, 2010. The study is a quasi-experimental design using a historical control group. Length of stay was compared between hip fracture patients admitted during the six months preceding Epic implementation and those admitted during the six months after Epic implementation. Epic is a practice-proven electronic health record software system which allows for a single, integrated, patient record to extend across all avenues of healthcare nationally. Epic provides providers and other healthcare clinicians with a patient's complete, up to date healthcare information. Epic places the patient at the center of the program and integrates tools to augment quality of care and patient safety while working productively and efficiently. Patients benefit when the provider has access to updated healthcare information and can make information decisions while providing continuity of care.

2.1. Sample

Participants in this study included all patients admitted into the hospital, 18 years of age and older, regardless of co-morbidities, from March 26, 2010 through March 25th, 2011, with an International Classification of Disease (ICD) code of 820.00 – 820.9, and confirmed by radiography. ICD codes 820.00 – 820.9 encompass all hip fractures. The ICD codes are alpha numerical diagnosis and procedure codes that facilitate measurement of and billing for health care services. Study exclusion criteria included patients less than 18 years of age, who were admitted with the primary diagnosis of hip fracture but transferred outside the facility to receive another service or level of care and patients who were admitted with a primary diagnosis of hip fracture but expired during the course of treatment.

2.2. Data Collection

The information was collected from clinical records at admission and discharge conducted by nurses. One certified reporting coworker collected the data. The dependent variable was hospital LOS, measured by a hospital generated computer printout that calculates the overall LOS from the admission time to the discharge time. The independent variable was the implementation of Epic, operationalized by time, as either pre- or post- Epic implementation. Pre-Epic data were collected from March 25, 2010 through September 25, 2010. Post- Epic data were collected from September 26, 2010 through March 24, 2011. Data collected included principal diagnosis, description of diagnosis code, LOS, age group and gender. Reliability of measurements is expected due to the consistency of the information generated by the computer and the standardization of documentation at the organization. Validity of measurements is expected due to standard training of hospital staff to learn how to enter patient information data. Ethical considerations would include having access to patient sensitive information and potential for privacy breach. Lack of patient confidence may deter the patient being forthright.

2.3. Data Analysis

Data analysis was conducted using IBM SPSS Statistics, version 19 (SPSS, Inc., Chicago, IL) [17]. Data were cleaned and Kolmogorov-Smirnov (K-S) tests were conducted to determine whether pre- and post- Epic LOS were normally distributed. The results of these tests showed that both pre- and post- Epic LOS were not normally distributed. Therefore, a non-parametric test was necessary to complete the hypothesis testing. Descriptive statistics including means, standard deviations, frequencies, and percentages were calculated for all variables as appropriate. Chi-square tests were performed to determine if there were age or gender differences between pre- and post- Epic groups. The mean LOS for the pre- and post-Epic group was compared using a Mann Whitney U test with alpha set at 0.5.

III. RESULTS

Among the 109 patients in the pre- Epic phase, one was excluded because the patient expired. Among the 131 patients in the post- Epic phase, one was excluded because the patient expired and another was excluded because the patient was transferred outside the facility. Therefore, a total of 237 patients were included (n=108 pre-Epic, n=129 post-Epic).

Two-thirds of the patients were female and most patients were older adults. The most common age group was 81 years or greater; patients in this age range comprised 50.5% of the sample. A chi-square test showed that there were

not significant age differences between pre- and post- Epic groups, $\chi^2(2, N = 234) = 0.53$, p = .77. A second chi-square test showed that the proportion of males and females were not significantly different between the pre- and post- Epic groups, $\chi^2(1, N = 234) = 0.034$, p = .85, as shown in Table 1.

The minimum LOS for patients pre- Epic was one day, the maximum was 22 days. The minimum LOS for patients post- Epic was also one day, and the maximum was 35 days. The mean LOS for patients pre- Epic was 6.2 days with a standard deviation of 3.0, while the mean LOS for patients post-Epic was 6.3 days with a standard deviation of 4.2, as shown in Table 1.

A Mann-Whitney U test was conducted to evaluate the hypothesis that hospital LOS for patients admitted with hip fracture would be lower after Epic implementation. The results of the test indicated there was no significant difference in LOS pre- and post- Epic implementation ($U = 0.68$, n1 = 108, n2 = 129, p = .24).

Table1. *Characteristics of Sample*

	Pre-Epic (N 108)	**Post-Epic (N 129)**	**p value**
Age			.77
0-60	11 (10.3)	10 (7.9)	
61-80	42 (39.3)	54 (42.5)	
81+	54 (50.5)	63 (49.6)	
Gender			.85
Male	35 (32.7)	43 (33.9)	
Female	72 (67.3)	84 (66.1)	
LOS			.24
Minimum	1	1	
Maximum	22	35	
MeanLOS(SD), days,	6.2 (3.0)	6.3 (4.2)	

Note. Values are reported as N (%) unless otherwise noted.

IV. DISCUSSION

When comparing six months of data pre- and post- implementation of Epic, there was not a significant difference in the hospital LOS for patients admitted with hip fracture. Although there was not a decrease in the hospital LOS post-implementation of an EHR, there was also no increase in hospital LOS, which might be expected with a major system change that required process and workflow modifications. Findings of this study are consistent with similar studies examining electronic records and hospital LOS [2,6,18]. When health care providers have access to complete and accurate information, patients receive better medical care. EHR may improve risk management by enabling evidence-based decisions at point of care, preventing adverse events, gathering all relevant information in one place and enhancing research and monitoring for improvements in clinical quality [19]. In addition, EHR can improve the ability to diagnose diseases, reduce medical errors, and improving patient outcomes. A national survey of doctors who are ready for meaningful use offers important evidence: 94% of providers report that their EHR makes records readily available at point of care; 88% report that their EHR produces clinical benefits for the practice; 75% of providers report that their EHR allows them to deliver better patient care [20]. Furthermore, A randomized control trial by Feldstein and colleagues [21] shown that EHR reminder improves osteoporosis after fracture a fracture. Patient-specific post fracture advice to the provider through an EHR message significantly increased bone mineral density measurement and osteoporosis medication. As EHRs become more widespread, this intervention could improve osteoporosis management for many post fracture patients [21]. The content analysis revealed six categories of outcomes being impacted as a result of the use of EMR systems including accessibility of records and information, cost, practice efficiency, security, patient- nurse relationship and communication, and quality of patient care [22].

V. CONCLUSION AND IMPLICATIONS

Most healthcare facilities make substantial efforts to decrease the hospital length of stay for the purpose of efficiency and healthcare expenditure reduction. The findings of this study suggest more research is needed to gain a better understanding of how Epic and other EHR systems can impact hospital LOS. Future studies on the effect of EHR on LOS and other outcomes will be beneficial for healthcare executives and nursing leaders as they move forward with the challenges of selecting an EHR.

VI. LIMITATIONS

The limitations of this study include a six month data collection period pre- and post- Epic implementation; it is possible that a longer period of pre- and post- implementation data collection would reveal different results. The study was also limited to examining the effect of one EHR implementation. Epic is one of many EHR systems, so similar studies on different EHR systems may have conflicting results. Finally, the study site was a single acute care hospital and the study was limited to only those patients admitted with hip fracture.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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