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The effect of EHR implementation patient length of stay in the Emergency Department

1. Study purpose and rationale

Since the American Recovery and Reinvestment Act (HITECH section) of 2009, there has been an increased pressure to implement the use of Electronic Health Records (EHR's) in hospitals across the country.[1] However, the simple implementation of an EHR is not enough to qualify for federal support, and insitutions are responsible for demonstrating the "meaningful use" of EHR's based on criteria like improved quality and efficiency of care.[2] Thus far, it has become apparent that, in many aspects, the implementation of EHR's is a mixed bag, with improvements in some areas of patient management but with others lagging far behind.[3]

One place the EHR has been expected to improve quality is in the management of patients in the Emergency Department (ED). The continual rise of crowding and increasing length of stay (LOS) in ED's at hospitals across the country is a major medical concern as it is associated with delays in definitive treatment, a higher rate of adverse events and increased mortality.[4] Emergency Department mean length of stay has been shown to be dependant on the key factors of input, throughput and output.[5, 6] The implementation of a fully functional EHR, with its ability to make readily accessible past notes and patient history while allowing an easy interface for medication ordering along with decision support should help improve the throughput factor by streamlining the process of patient management in the ED. Furthermore, when available, emergency physicians are some of the most active users of EHR's for acquiring past medical information from patients and reviewing old lab values and tests.[7]

ED LOS has been well established as a marker of patient flow,[8] and because visit data (time of arrival and departure) from each patient that enters the ED is kept in a database, it is possible to easily calculate the amount of time patients spent in the ED, or the hospital, in general, if admitted. In January of 2010, a fully functional EHR was instituted in the Columbia University ED, changing the way physicians interact with patient information and manage patient data. However, since these systems can take some time to get used to, especially upon initial implementation, gains in productivity may not be readily apparent as physicians struggle to learn how to navigate the system.[9] To control for this, we will study the patient visit data from the last 6 months of 2009 (July through December), when the paper charting system was still in use, and compare that with the patient visit data from July through December of 2010 - assuming that 6 months is adequate time for clinicians to become comfortable with the software.

There is currently a great deal of uncertainty in the effectiveness of EHR's to improve clinical outcomes. While it has been shown to improve clinician workflow and efficiency, this has yet to translate over to better outcomes and efficiency of management for patients, an essential element of "meaningful use."[3] Much has been expected of these systems, but with

a major push to simply increase rates of use, numerous EHR's have become available with varied features and interfaces but without much improvement in clinical function. This has also made it difficult to study the effect of EHR implementation on a national level due to the heterogeneity of systems and various expectations of physicians. Nevertheless, to begin to limit the "quality chasm" and prevent from becoming too diverse (and thus limiting the interconnectivity and health information exchange that would be a major benefit of broad EHR use), a set of best practices must be implemented and data from EHR use needs to be compared to a standard rubric.

Since the implementation of the EHR at CPMC was broad and instantaneous and because approximately 80,000 patients enter the emergency department here each year, we have a unique opportunity to measure the true effect of EHR implementation on an important patient outcome like LOS. From this data and the further understanding of EHR systems on the workflow of physicians, we can begin to actualize some of the effects that are hoped for from the EHR.

2. Study design and statistical procedures
This study will be a retrospective cohort study. The study involves review of visit records for patients admitted to the adult ED from the months of July through December of 2009 and 2010 with the diagnoses of "acute trauma" and "shortness of breath."
To detect a decrease in LOS by at least 20 minutes, assuming an average length of stay of approximately 360 minutes and a standard deviation of 90 minutes, with a power of 80% and $p=0.05$, at least 325 records will need to be reviewed from each group of subjects to be analyzed by an unpaired t-test in Statistical Analysis Software.

3. Study Procedures:
As this is a retrospective analysis, patients enrolled in the study will already have been treated for their diagnosis and no intervention or change in treatment is planned for the study populations.

4. Issues
None

5.Study drugs or devices
The study will involve the use of the commercially available Eclipsys EHR and order entry system provided by the company Allscripts.

6. Study questionnaires
None

7. Study subjects
Study subjects will be visitors to the adult emergency department at New York Presbyterian Hospital, Columbia Campus between the months of July and December of 2009 and 2010 with the diagnoses of "acute trauma" and "shortness of breath." This will include all medical diagnoses, excluding psychiatric patients. Other patient characteristics such as gender and ethnicity will not be specifically selected for.

8. Recruitment
A list of the visitors to the emergency department at NYPH-Columbia will be generated along with their length of stay information and diagnosis.

9. Informed Consent
The investigators believe that a waiver of documentation of informed consent is appropriate in this case, as it meets the criterion that "That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context."

10. Patient Confidentiality

Data obtained in this study will be coded to protect patient confidentiality. Upon enrollment in the study, patients will be assigned a random ID by the research coordinator. These IDs will be kept by the research coordinator at that site in a password-protected document on a hospital computer. Only the research coordinator will have knowledge about the identifiable patient information.

11. Privacy Protection:
The confidential information for each patient such as the identity and contact information will only be available to the clinical team (participating surgeon and nurse practitioner) who would already have access to it based on their clinical duties. The only exception to this is when an institution has a research coordinator that was not involved in the care of that patient. In that case, the research coordinator should be trained in HIPPA compliance.

12. Potential risks
We believe there is no or minimal risk to the patients enrolled in this study.

13. Data Safety and Monitoring
There is no risk associated to this study as it is observational and retrospective in nature. The only risk is a violation of HIPPA compliance, which will be avoided as all research personnel will have HIPPA training.

14. Potential benefits
The potential benefits of this study include but are not limited to a better understanding of the impact of EHRs on physician practice such that best practices can be developed with the hope of improving clinical outcomes for ED patients in the future.

15. Alternatives
We do not believe that there are any alternatives to chart review in these patients.

16. Compensation to Subjects
Subjects enrolled in this study will not receive any form of compensation, either monetary or otherwise.

17. Costs to subjects
Subjects will not incur any additional expense as a result of their enrollment in the study.

18. Minors as Research Subjects:
Not applicable

19. Radiation or Radioactive Substances:
Not applicable

20. Research at External Sites
The study will not require any period of study at an institution other than CPMC.

References:

1. Blumenthal D. Stimulating the adoption of health information technology. *New England Journal of Medicine.* 2009;360(15):1477-1479.
2. Jha AK. Meaningful Use of Electronic Health Records. *JAMA: the journal of the American Medical Association.*304(15):1709.
3. Zhou L, Soran CS, Jenter CA, et al. The relationship between electronic health record use and quality of care over time. *Journal of the American Medical Informatics Association.* 2009;16(4):457-464.
4. Hilton JA, Pines JM. Emergency Department Crowding. *Handbook of Healthcare Delivery Systems.*
5. Solberg LI, Asplin BR, Weinick RM, Magid DJ. Emergency department crowding:: Consensus development of potential measures. *Annals of emergency medicine.* 2003;42(6):824-834.
6. Asplin BR, Magid DJ, Rhodes KV, Solberg LI, Lurie N, Camargo Jr CA. A conceptual model of emergency department crowding. *Annals of emergency medicine.* 2003;42(2):173-180.
7. Hripcsak G, Sengupta S, Wilcox A, Green RA. Emergency department access to a longitudinal medical record. *Journal of the American Medical Informatics Association.* 2007;14(2):235.
8. Asplin BR. Measuring crowding: time for a paradigm shift. *Academic Emergency Medicine.* 2006;13(4):459-461.
9. Greiver M, Barnsley J, Glazier RH, Moineddin R, Harvey BJ. Implementation of electronic medical records. *Canadian Family Physician.*57(10):e381-e389.