

A Custom-Developed Emergency Department Provider Electronic Documentation System Reduces Operational Efficiency

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Study objective: Electronic health record implementation can improve care, but may also adversely affect emergency department (ED) efficiency. We examine how a custom, ED provider, electronic documentation system (eDoc), which replaced paper documentation, affects operational performance.

Methods: We analyzed retrospective operational data for 1-year periods before and after eDoc implementation in a single ED. We computed daily operational statistics, reflecting 60,870 pre- and 59,337 postimplementation patient encounters. The prespecified primary outcome was daily mean length of stay; secondary outcomes were daily mean length of stay for admitted and discharged patients and daily mean arrival time to disposition for admitted patients. We used a prespecified multiple regression model to identify differences in outcomes while controlling for prespecified confounding variables.

Results: The unadjusted change in length of stay was 8.4 minutes; unadjusted changes in secondary outcomes were length of stay for admitted patients 11.4 minutes, length of stay for discharged patients 1.8 minutes, and time to disposition 1.8 minutes. With a prespecified regression analysis to control for variations in operational characteristics, there were significant increases in length of stay (6.3 minutes [95% confidence interval 3.5 to 9.1 minutes]) and length of stay for discharged patients (5.1 minutes [95% confidence interval 1.9 to 8.3 minutes]). There was no statistically significant change in length of stay for admitted patients or time to disposition.

Conclusion: In our single-center study, the isolated implementation of eDoc was associated with increases in overall and discharge length of stay. Our findings suggest that a custom-designed electronic provider documentation may negatively affect ED throughput. Strategies to mitigate these effects, such as reducing documentation requirements or adding clinical staff, scribes, or voice recognition, would be a valuable area of future research. [Ann Emerg Med. 2017;■:1-9.]

Please see page XX for the Editor's Capsule Summary of this article.

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INTRODUCTION

Background

In 2009, the federal government enacted a national incentive program to encourage the adoption of electronic health record systems.¹ Under this federal “meaningful use” program, adoption of electronic health records has increased rapidly.²⁻⁴ Consistent with overall trends in health care, electronic health record adoption in emergency departments (EDs) has swiftly expanded, from 46% in 2006 to 84% in 2011.⁵ However, the benefits of the federal incentive program have also been questioned because health information technology has contributed to inefficiencies, introduced unintended consequences, and only started to achieve promised benefits.^{6,7} The American

Medical Association has expressed particular concern with lack of electronic health record usability and called for delaying meaningful use implementation.⁸

Importance

Given the time-sensitive nature of emergency care, inefficient electronic health records have the potential to affect ED throughput and quality of care. Previous evidence on the effect of electronic health records is mixed; multiple studies have suggested that their implementation can improve ED efficiency⁹⁻¹³ and quality of care.^{14,15} However, others have found that electronic health record implementation may have a neutral or negative effect, potentially increasing provider documentation time and patient length of stay.¹⁶⁻²² This mixed

Editor's Capsule Summary*What is already known on this topic*

New electronic health records have frequently led to less efficient clinical practice, although it is often unclear which aspects of electronic systems produce this result.

What question this study addressed

How did a newly developed, custom-designed, computer-based documentation system affect emergency department flow exclusive of preexisting electronic tracking and computer physician order entry?

What this study adds to our knowledge

Electronic documentation added an average of 6 minutes to daily average length of stay.

How this is relevant to clinical practice

Even custom-designed and -tailored electronic documentation slows clinical practice. Although the increase was small, in a department functioning near capacity, it can have substantial influence.

literature reflects heterogeneous electronic health record implementations at various clinical sites and does not isolate the effects of individual electronic health record features from one another (eg, patient tracking, computerized provider order entry, provider documentation) compared with paper-based documentation. Provider documentation is perhaps the most time-consuming component of electronic health record use.^{16,17,23}

Goals of This Investigation

At our institution, we designed, built, and implemented a custom provider electronic documentation system (eDoc) to replace paper documentation in the setting of existing, well-established, electronic patient tracking and computerized provider order entry systems, providing a unique natural experiment that could isolate the effect of replacing paper-based documentation with an electronic provider documentation system. The objective of our study was to examine the effect of implementing eDoc on ED efficiency as measured by daily mean ED length of stay 8 weeks and 1 year before and after implementation. We initially hypothesized that implementation would result in transient increases in length of stay as providers

learned the new system, but that during a 1-year period it would have a neutral effect on or reduce length of stay.

MATERIALS AND METHODS**Study Design and Setting**

This study was a retrospective analysis of operational data obtained from Brigham and Women's Hospital ED, a 43-bed, urban, academic ED in Boston, MA, with an annual volume of approximately 60,000 patients. We had robust, custom-developed, electronic patient tracking and computerized provider order entry systems in place. All order entry during the study period was performed with the existing computerized provider order entry system. Patient tracking (including admission and discharge times) was performed by the existing electronic tracking system throughout the entire study period.

Before the implementation of eDoc, provider documentation was completed on paper by residents and physician assistants; the paper documentation template is shown in [Appendix E1](#) (available online at <http://www.annemergmed.com>). Completed paper documentation was scanned into our hospital electronic health record after the ED encounter by health information management staff. Attending physicians documented using traditional telephone dictation, which was transcribed by professional transcriptionists and electronically transferred into our electronic health record.

Our institution developed eDoc to work with our existing electronic ED patient tracking and computerized provider order entry systems. The eDoc system was custom-built according to the input of health information technology experts and emergency medicine clinicians. An interdisciplinary team of attending and resident physicians, health information management, and information systems professionals led by a dually trained emergency physician-clinical informatician (A.B.L.) iteratively designed the electronic documentation system to meet work flow, quality of care, legal, and billing compliance requirements. The team designed all system components, including data elements, work flows, and output, producing detailed design specifications. An internal team of software developers built the system according to these specifications. [Appendix E2](#) (available online at <http://www.annemergmed.com>) includes sample screenshots of the eDoc system.

After implementation of eDoc on March 18, 2013, resident physicians and physician assistants entered documentation electronically. Attending physicians had the option of typing their notes in eDoc or using a real-time voice recognition tool that transcribed speech into text in eDoc (Speech Anywhere 360 Direct; Nuance

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