Impact of electronic health record technology on the work and workflow of physicians in the intensive care unit

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ABSTRACT

Objective: To assess the impact of EHR technology on the work and workflow of ICU physicians and compare time spent by ICU resident and attending physicians on various tasks before and after EHR implementation.
Design: EHR technology with electronic order management (CPOE, medication administration and pharmacy system) and physician documentation was implemented in October 2007.
Measurement: We collected a total of 289 h of observation pre- and post-EHR implementation. We directly observed the work of residents in three ICUs (adult medical/surgical ICU,

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pediatric ICU and neonatal ICU) and attending physicians in one ICU (adult medical/surgical ICU).

Results: EHR implementation had an impact on the time distribution of tasks as well as the temporal patterns of tasks. After EHR implementation, both residents and attending physicians spent more of their time on clinical review and documentation (40% and 55% increases, respectively). EHR implementation also affected the frequency of switching between tasks, which increased for residents (from 117 to 154 tasks per hour) but decreased for attendings (from 138 to 106 tasks per hour), and the temporal flow of tasks, in particular around what tasks occurred before and after clinical review and documentation. No changes in the time spent in conversational tasks or the physical care of the patient were observed.

Conclusions: The use of EHR technology has a major impact on ICU physician work (e.g., increased time spent on clinical review and documentation) and workflow (e.g., clinical review and documentation becoming the focal point of many other tasks). Further studies should evaluate the impact of changes in physician work on the quality of care provided.

1. Introduction

The impact of electronic health record (EHR) technology on physician work can influence their acceptance and use of the technology [1–6]. In particular, physicians have expressed concerns regarding changes in how they spend their time after EHR implementation. EHR technology may create more or new work for physicians [7] such as increased time spent on documentation. This occurs in a context where residents are reporting spending significant time on documentation. For instance, according to a 2006 survey of internal medicine residents [8], about 68% of residents reported spending in excess of 4 h daily on documentation. A recent survey confirms the extensive time spent by hospital physicians in documentation-related activities [9]. Limited research has assessed changes in physician work after EHR implementation [10–12]; the focus of that research has been limited to specific physician tasks (e.g., documentation) [13], and studies are plagued with methodological problems (e.g., small sample size; additional information on time and motion study and sampling can be found in a review of time studies in healthcare [14], or in books by Salvendy [15] and Barnes [10,16]). Additionally, sparse research has assessed the impact of EHR technology on intensive care unit (ICU) physician work [13,17,18]. Caring for complex critically ill patients requires communication and coordination of multiple healthcare team members, and changes in physician work routines could affect their ability to provide safe, high-quality care. Therefore, we postulated a need to better understand the impact of EHR technology on how ICU physicians spend their time on various tasks. Our study systematically examines the impact of EHR technology on the work of resident and attending physicians in the ICU.

1.1. Background

Studies have assessed the impact of various forms of EHR technology on specific physician tasks, such as documentation [13]. This research demonstrates the need to clearly define the EHR technology and its functionalities as these can have

varying impact on clinician work, and the need for more comprehensive studies that record data on all tasks performed by physicians. For instance, Overhage and colleagues [19] examined a total of 81 tasks in 11 major categories performed by 34 physicians at 11 primary care internal medicine practices before and after the implementation of a homegrown computerized provider order entry (CPOE) system. Physicians spent slightly more time per patient overall and less time writing orders. In a study of 20 primary care physicians [20] using an adapted task list from that of Overhage and colleagues [19], physicians were found to spend more time on indirect patient care after EHR implementation, such as looking for patient-related information, and reading charts, data or email.

A few studies have examined EHR implementations in hospitals and their impact on physician work. The implementation of an electronic medication management system in an Australian hospital did not lead to any changes in time spent on direct care or medication-related tasks [12]. However, this study was unable to examine the impact of CPOE as it was already implemented at baseline. After the CPOE implementation at Massachusetts General Hospital, interns' time spent writing orders went from 2.1% to 9% of their total work time and was associated with less time talking and reading [21]. Other studies have documented additional time spent by physicians on the computer after implementation of CPOE in a pediatric emergency department [22], CPOE and electronic nursing documentation in an emergency department [23], and electronic medical records (EMR) in a hospital [24]. A systematic review of research on the impact of EHR on physician work time confirmed that EHR technology tends to increase documentation time [10]. However, little research focuses on ICU physicians [25]. One study examined the time spent by physicians documenting during rounds in a pediatric ICU and an adult ICU, finding that documentation time decreased significantly [26]. This study included residents, attendings and sub-specialty fellows, but did not compare results by type of physician, and focused on documentation-related tasks as opposed to understanding the impact of the technology on all tasks performed by physicians. A second study collected data