Exploring the Perceptions and Use of Electronic Medical Record Systems by Non-Clinicians

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ABSTRACT
Electronic medical record (EMR) systems are used by a wide variety of users. However, current research on the design and use of the EMR primarily focuses on clinical users such as physicians and nurses. While it is important to understand EMR use by clinicians, there is also a need to understand how non-clinicians use these systems because of the important role they play in the patient-care process. In this note, we present results of an ethnographic field study on the use and perceptions of EMR systems by non-clinicians in an emergency department. We then discuss design implications that can improve the system usability and strengthen the empowerment of these non-clinicians.

Author Keywords
Electronic medical records (EMR); non-clinical users; collaboration; system design; user empowerment.

ACM Classification Keywords
H.5.3 [Group and Organization Interfaces]: Computer-Supported Cooperative Work; J.3 [Life and Medical Sciences]: Medical Information Systems.

INTRODUCTION
Given the information-intensive and highly collaborative environment of hospitals, healthcare professionals are dependent on the availability of accurate medical records to make well-informed decisions about their patients. Due to recent government legislation, an increasing number of hospitals in the United States are transitioning from paper-based medical records to electronic medical records (EMR). With the increasing use of these EMR systems, many clinical and non-clinical users are dependent on the EMRs to do their daily tasks. Therefore, the success of EMRs depends on how effectively these systems facilitate the activities of both the clinical and non-clinical users in hospital teams. For the purpose of this study, we operationally define *clinical users* as any hospital staff members who are directly involved in providing medical diagnosis and treatment to patients (e.g., physician, nurse). *Non-clinical users* are any hospital staff members who do not provide direct medical diagnosis and treatment to patients, but who interact with the patient and are a part of the patient-care process (e.g., registration assistant, social worker, care coordinator).

Clinical users are frequently seen as the primary users of EMRs [8,9]. However, there is limited research on the non-clinical users, who are often seen as secondary users of the system [2]. Although non-clinical users have different roles and responsibilities, the EMR is still their primary tool for communication and documentation. Therefore, through an ethnographic study of EMR use in an emergency department, we seek to better understand these non-clinical users by examining their use and perceptions of the EMR.

BACKGROUND
The perceptions and use of EMR systems by clinicians is well known. Studies have described the impact that EMR design has on the work of clinicians, including how they use system workarounds or modify their work practices during system use [8], and how designers can improve the EMR for clinical users [9]. However, there is another large group of hospital staff who also use the EMR systems on a daily basis – non-clinicians.

Few researchers have examined these non-clinical users [2], and most of the studies only include non-clinical users within the context of the larger patient-care team [1]. This research also tends to focus on describing activities of the non-clinicians, and does not focus on how the design of the EMR affects these non-clinical users [1]. Although this research provides important insight into the patient-care teams as a whole, there is still little research that focuses solely on the non-clinicians and their EMR use [2].

RESEARCH SITE AND METHODOLOGY
This study was conducted in the emergency department (ED) of a large teaching hospital in northeastern United States. In the ED, non-clinical users primarily used the EMR for their work activities. This system included the patients' medical records, laboratory and medication orders, laboratory results, registration information, and patient tracking board. One group of non-clinical users, registration assistants, also used an Admissions Discharge and Transfer

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(ADT) system that was integrated with the EMR system when patients first arrived in the ED.

This study focused on the following non-clinical users:

- *Registration Assistant (RA)*: Responsible for generating the patients' unique IDs upon arrival and recording patients' personal and insurance information in the EMR.
- *Social worker*: Responsible for providing support and resources to patients with drug or alcohol abuse, physical abuse, and/or psychiatric concerns.
- *Care coordinator*: Responsible for providing patients with disease management training, financial assistance options, and/or coordination with external medical facilities (e.g., nursing homes, rehabilitation).

We used qualitative methods including observations and semi-structured interviews to collect data. Human-computer interaction (HCI) researchers have highlighted the benefits of conducting this type of ethnographic research to identify opportunities for technology improvements and interventions [1,8,10]. The first author conducted 54 hours of observations in the ED to understand the ED's workflow and to inform the interview protocol. We observed approximately 85 clinical and non-clinical staff, including: Physicians, nurses, care coordinators, social workers, registration assistants, ED technicians, emergency medical technicians (EMTs), pharmacists, maintenance, chaplains, transporters, and ED volunteers. Detailed field notes were taken about the workflow, communication, collaboration, and technologies used by both clinical and non-clinical staff. We also performed member-checking by informally talking with participants to verify assumptions and ask questions about specific tasks.

We then conducted 5 semi-structured interviews with non-clinical users about their daily work activities, their interactions with the EMR, and whether the system supports their work. This interview data strengthened the study's internal validity by triangulating the observational data. The interviews included 3 registration assistants (RA) [RA1, RA2, RA3], 1 social worker [SW1], and 1 care coordinator [CC1]. The number of interview participants was representative of a typical shift, which included 5-6 RAs, 1 social worker, and 1 care coordinator.

The transcribed data resulted in 175 pages of observations and 23 pages of interviews. We analyzed the data using Braun & Clarke's six-phase thematic analysis approach [3]. The approach facilitated the process of becoming familiar with the data, systematically identifying codes and themes, and then defining and naming the common themes found across the data. The first author iteratively collected and analyzed the observational data throughout the data collection period. The first and third authors collaboratively coded the interview data.

FINDINGS

These findings describe the importance of the EMR to non-clinicians, the impacts of EMR design on these users, and the technical limitations and empowerment issues that occur during the non-clinical use of EMR systems.

Importance of the EMR to Non-Clinical Users

The non-clinical users did not believe that the system was specifically designed for them. As one RA stated, "*we don't use [the EMR] for information history or patient info. It's mostly for doctors and nurses*" [RA1]. Additionally, the social worker explained that, although she can see the patient records, she did not have editing rights because that access is only given to the primary users, the doctors and nurses. Therefore, the non-clinical users perceived themselves as secondary users of the EMR system.

At the same time, they still described how the EMR system was critical for their work and acted as the primary tool for their communication and documentation activities. An RA described the EMR's tracking board as, "*our map, our life line to the ED*" [RA1]. Another RA described a time when the EMR system went down: "*it was more work, and we were more prone to error without the system*" [RA2]. In addition, the social worker explained, "*I use the system all the time. It plays a huge role…if it goes down, everything stops*" [SW1]. The social worker also specifically described how it reduces the time to perform tasks: "*The system helps me not spend long amounts of time on the phone. I don't need to read information to someone and talk to them, I can just send the information"* [SW1]. In addition, the care coordinator described the importance of the EMR system to her job: "*I use the system all the time. And I look at all of it – labs, x-rays, studies, doctors' notes, nurses' notes*" [CC1]. Consequently, the EMR's ability to appropriately support non-clinical users' activities is crucial to these users.

Impacts of EMR Design on Non-Clinical Collaboration

The non-clinical users stated that the EMR reasonably supported their work, but they also described a variety of ways that the system design negatively impacted their work including general usability issues and collaboration challenges. Many of the general usability issues (e.g., user-friendliness, drop-down list issues) have been discussed by other HCI researchers [5]. Therefore, these findings will focus on the more under-researched area of how the EMR design impacts collaboration for non-clinical users.

Collaboration is an essential aspect of hospital work, especially in a busy setting like the ED. All of the participants described how they had to work with both clinical and non-clinical staff inside and outside of the ED to do their work. At times the EMR made it more difficult to collaborate with others. A care coordinator explained how the ED has a different EMR user interface than other areas of the hospital and that this can make it challenging to communicate and collaborate with others outside the ED: "*It's cumbersome to go upstairs and work with people up there because it's a different [user interface]! I get confused because it's all different*" [CC1]. The social worker also described how system limitations made it time-consuming to send information to external medical

facilities: "*I can't send things electronically [in the EMR]. So I have to print and fax information for each individual site, which just adds time*" [SW1].

During observations, RAs were seen trying to use a "comments" field in the system to collaborate with nurses about patient visitation. However, the use of the field was not consistently used and presented an issue for the RAs: *RA1 tells RA2 that she reads the "comments" field before letting a visitor see a patient since the nurses write notes in this field about patient visitation. She also mentions that the field is not always reliable, so they usually have to call or track down the nurse to double-check* [field notes].

Additionally, the participants described how the EMR provides a collaborative document used by many different ED staff members. The system actions of one user (e.g., add, edit, delete) can affect all other users who are dependent on the information in that record. The social worker specifically talked about this issue: "*There is also patient history that we look at [in the EMR], but I can't edit any of it…If it's wrong or outdated, it's more dangerous than having no information in there. When people don't verify the information in there and don't update it, it affects all of us*" [SW1].

Technical Limitations and Empowerment Issues Facing Non-Clinical Users

The EMR design limited the actions that the non-clinical users could perform in the system. The limitation of users' authorization rights in an EMR is important for enforcing confidentiality of patient records and ensuring that only the necessary people are adding or editing patient information. However, the non-clinical users discussed how these technical limitations led to additional work and resulted in statements about organizational tensions between clinical and non-clinical staff.

Technical Limitations

The non-clinical staff frequently described how the EMR design limited their use of the system. An RA explained: *"[The EMR] is not really used by us, except for the main tabs. We don't use it for information history or patient info. It's mostly for doctors and nurses"* [RA1]. The social worker also discussed the editing limitations of the EMR: "*There is also patient history that we look at [in the EMR], but I cannot edit any of it…"* [SW1]. When asked if a care coordinator could fix wrong patient information that she had identified, she stated: "*No, we're not allowed to do that*" [CC1].

These technical limitations frequently led to longer amounts of time to complete tasks or additional work for the non-clinical staff. As a social worker explained: "*I can't send things electronically [in the EMR]. So I have to print and fax information for each individual site, which just adds time. It might sound like a silly and insignificant request to want to send to multiple sites at once, but it adds lots of time and time is important…in the ED we're talking in minutes, not days*" [SW1].

The care coordinator discussed how she had to spend time finding someone to fix wrong patient information she identified in the EMR: "*Since I couldn't just fix it, I had to track down the nurse to fix it*" [CC1]. The social worker also encountered a similar situation: "*Since I cannot update it as a social worker, I try to call others to update it. But they say that it's someone else's responsibility. I talk to registration, but they say that it's the nurse's responsibility, but when I talk to the nurse, they say it's not their responsibility*" [SW1].

Organizational Tensions and Empowerment

The discussion of the EMR's technical limitations resulted in some non-clinical users articulating a tension between themselves and the clinical staff (e.g., physicians, nurses). For example, a social worker's statement and tone suggested a perception of being inferior to the clinical staff: "*Only doctors and nurses can do that in the system [eye roll, tone suggesting superiority]*" [SW1]. A care coordinator also suggested that physicians lacked awareness of what care coordinators do: "*They [hand motion & eye roll, referring to physicians] don't even know half of the stuff that we do*" [CC1].

In addition, non-clinical users described a number of EMR limitations. Yet, when asked to suggest changes to the system, they provided minimal suggestions. Most users stated that they would not change anything or that they could not think of anything to change. When users did suggest minor changes, the tone of the participants suggested a lack of empowerment. For instance, a social worker described a possible improvement to the system but prefaced it by saying, "*it might sound like a silly and insignificant request"* [SW1]. The care coordinator appeared to settle for the system's current state by stating, "*I guess it serves its purpose for now*" [CC1].

DISCUSSION

We discuss how to improve EMR design for non-clinical users and how to better involve these users in the EMR design process.

Improving EMR Design for Collaboration and Empowerment of Non-Clinical Users

When designing EMR systems for hospital environments, it is critical to consider the collaboration and communication activities that occur within patient-care teams [1,8]. We described a number of collaboration challenges that non-clinical users faced while using EMR systems within the ED – different EMR interfaces, the inability to send information electronically, and the inability to make others aware of information problems.

Different interfaces: Non-clinical users in this study described how they followed patients from the ED into the in-patient area if the patient was admitted to the hospital. This led to non-clinical users experiencing confusion and frustration when having to switch between the ED and in-patient systems, which had the same information but different user interfaces. This did not affect the clinicians who typically stayed within their respective areas.

Therefore, designing systems for highly collaborative hospital teams should consider the movement of staff between different areas and ensure consistency of information displays to lessen confusion and frustration of hospital staff.

Inability to send information electronically: A primary responsibility of some non-clinicians is to collaborate with external facilities (e.g., nursing homes, rehabilitation). The non-clinical users in our study stated that they could not send information to these external collaborators directly from the EMR or from an EMR-generated digital file (i.e. PDF). This led to more time-consuming methods of printing paper reports and faxing the report to each individual facility. Although hospitals must comply with privacy and confidentiality regulations related to the distribution of patient information, electronically sharing patient data has been successfully implemented for billing and for sharing information across providers by using effective technical security mechanisms [4]. EMR designers should consider this ability to electronically transmit patient information to external facilities when designing for non-clinical users.

Inability to make others aware of information problems: The non-clinical users also expressed frustration when they identified an error in the patient record, but they could not change the error because of their lack of editing rights. Instead the non-clinicians had to track down the correct clinician to fix the issue. Although EMR authorization rights for non-clinicians may restrict them from editing patients' medical information, the design of EMRs could provide a way for them to flag this incorrect data within the system. This flagging mechanism would alert other members of the collaborative team that there is a problem with the information without interrupting the non-clinical users' work. Additionally, the flagging mechanism could also strengthen the non-clinical users' empowerment by not completely restricting their activities in the EMR. This allows them to perform corrective actions in the system while still adhering to the EMR's authorization rights that restrict them from directly editing medical information.

Involving Non-Clinical Users in the EMR Design Process

The non-clinicians in this study described a tension between themselves and the clinicians, including a perception of being inferior and a lack of awareness of what they contribute to patient care. This tension created a sense of disempowerment for the non-clinical users, which may have resulted in their lack of system improvement suggestions and the modification of their own behaviors and practices to use the existing EMR system [8]. This socio-technical phenomenon is also evident in prior HCI research that discusses the importance of addressing power structures to develop systems that support all types of users [6]. Additionally, designers can increase the engagement and empowerment of these non-clinical users through the use of participatory design processes [7], which consider the various types of system users during the development of the EMR (for EMR vendors), and during the configuration and implementation of the system (for hospital IT staff).

CONCLUSION

Clinical providers are seen as the primary users of the EMR because of their central role in providing direct care to patients. However, we should also start considering whether non-clinical users are "primary" users as well. After all, these non-clinical users depend on the EMR to do their work. Therefore, it is important that we examine the role of non-clinical users to better understand how they can be incorporated into the EMR design process.

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