

User Experiences and Satisfaction with an Electronic Health Record System

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Abstract. Electronic health records have a crucial role for communication and information management in health care organizations. Electronic health records have improved the access to up-dated medical information at the point-of-care, but they have also been linked to usability issues and user problems. This paper presents a study about the user experience among health care professionals regarding an electronic health record system in Norway. Qualitative research methods were used, with interviews and observations made at a university hospital, where 14 clinical end-users of an electronic health record system contributed. The aim was to study the user experiences and the user satisfaction regarding the system. The study concluded that the health care professionals in general were satisfied with the system, but they had to make some work arounds to efficiently carry out care in their daily work practice.

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1 Introduction

Electronic health records play an important role for the management, storage and exchange of medical information in health care organizations [1][2]. They are also the main entity for communication and processing of information for decision making [3]. The implementation of electronic health records has influenced the clinical workflow and daily routines in health care organizations, providing access to medical information at the point-of-care and in critical situations [4].

In Norway, there is an ongoing national strategy for enhancing the electronic information flow and collaboration within and across health care organizations [5][6], but also between the citizens and the health care providers [7][8]. The adoption of electronic health records in Norway is close to 100 % and three out of four health regions are using the same electronic health record system.

Electronic health records have been linked to usability issues [9][10] and user problems [11][12] such as overloaded user interface, button inconsistency and unclearly indicated required fields [13] and not being well-adapted to the clinical workflow. Another user problem is the copy and paste of text between sections in the rec-

ord, which might produce potentially outdated and inaccurate information. Studies have shown that electronic health records can create technology-induced and system-related errors [14][15]. However, there are national initiatives for improving the usability of electronic health records [16].

In this context, this study was made to focus on the user experience and perceived usability of an electronic health record system among health care professionals at a university hospital in one of the Norwegian health regions. The research questions stated were:

RQ1: *What are the user experiences among health care professionals regarding a commonly used electronic health record system?*

RQ2: *What workarounds have been necessary and which workflow activities are not supported by the electronic health record system?*

RQ3: *What are the lessons learned that are transferable and applicable to other clinical contexts?*

Following this introduction, the methodology is described. In the third section, the results of the study are presented. The discussion and conclusion reflect on the lessons learned and study contributions.

2 Methodology

The objective was to study the user experiences, perceived usability and the attitudes among health care professionals towards a specific electronic health record system that is commonly used in Norway. To answer the research questions, a qualitative research approach was chosen for the study [17][18].

2.1 The Data Collection

The data collection consisted of interviews and observations that were made between June 2017 and October 2018 at a university hospital.

A total of 14 clinical end-users of the electronic health record system working at six different departments of the hospital contributed in the study. The informants were 4 males and 10 females with the average age of 37 years, spanning from 25 to 63. The informants had the professions physician, nurse and nursing assistant.

Semi-structured interviews were conducted with 12 of the informants. The initial part of the interview guide collected demographic and background information, followed by the topics user experience and perceived usability of the electronic health record system. In addition, working routines, information flow and the ergonomics of the work stations was targeted. The interviews had a duration of approximately 30 minutes and were performed in consultation rooms or staff rooms within the hospital departments. All the interviews were audio-recorded, and, in addition, annotations were made.

Observations were made within the hospital departments to provide insights regarding the daily use of the electronic health record system in a clinical context. The focus was on the digital practices at the work stations and the procedure for exchange

of information at the beginning of or between shifts. Annotations were made during the observations. In addition, two thorough demonstrations were made of the electronic health record system by experienced users. The user interfaces and different functions were studied during the demonstrations, and also how the technology interacted with the workflow.

The collected data was analyzed qualitatively with transcriptions of the recordings and categorization into sub-themes.

2.2 Ethical Considerations

The informants were recruited in collaboration with the Head of the hospital departments. The participation in the study was voluntary and the informants received written information about the study and they all signed an individual consent form.

The Norwegian Centre for Research Data approved the study, with project numbers 53771 and 56288 [19]. No confidential patient data were collected. The authors declare that there are no conflicting interests with any of the participants, organizations or industry.

3 Results

The results are presented in the three sub-themes 1) the system and the user interface, 2) the user experiences and user satisfaction and 3) the workstations and ergonomics.

3.1 The System and the User Interface

The electronic health record system was used by all the hospitals in the health region. To log in, the user had to enter username and password to the individual Windows user account and after that click on a graphic icon at the desktop for the electronic health record system and repeat the same username and password. Each user could customize the user interface of the electronic health record system based on the user's needs. Several functions could be permanently visualized in the user interface, such as the patients' overview in own department, individual task flow and laboratory results. In the overview of progress notes, it was possible to choose from which roles/professions to show or hide information.

When a nurse created a new nursing progress note, there were 12 default standardized keywords to guide the documentation procedure [20], however the ones not used could be manually removed. Mainly free text was used in the progress notes, but there were standardized phrases that could be inserted. There were different kinds of progress notes and each one had to be digitally approved. The system did not have a digital medication timeline/curve, so each patient had a short additional paper-based record for this purpose. The observation curve was also paper-based and later scanned into the electronic health record system, see Fig. 1.

The patients that had been treated in the health region had reading access to their own electronic health record through the National Health Portal (*helsenorge.no*) with a secure log in procedure [21]. However, two-way communication between the patient and the health workers was not facilitated by the system.

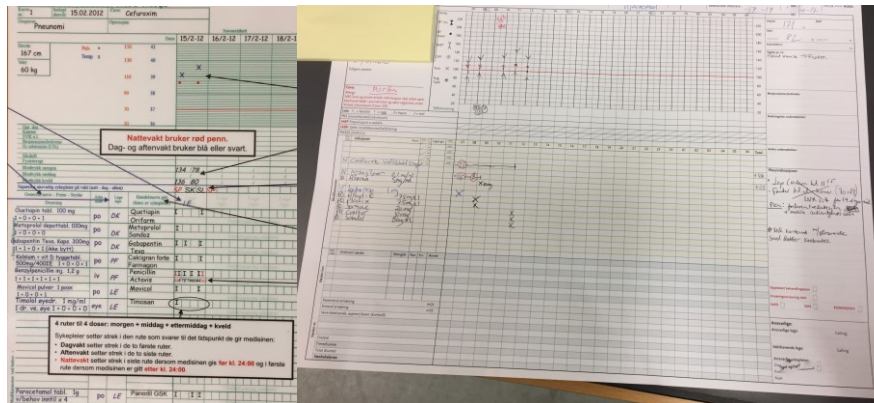


Fig. 1. The paper curve/medication timeline (left) and observation curve (right).

3.2 The User Experiences and User Satisfaction

Overall, the users expressed satisfaction with the electronic health record system. Nine users found the system easy to use, with all information accessible in one place. Two users found the system a bit complicated with many functions that were difficult to use without user training. Two other users expressed that they found the usability low, because of an overloaded user interface with many information windows open simultaneously. A new window had to be opened to find the wanted information about a patient, such as X-ray and laboratory results.

At first view, several of the users stated that the user interface could be perceived as messy, but one quickly got used to the most common functions. It was observed that there was an information overload in the progress notes/document's overview, which implied many mouse clicks to find important information. There was a search function, but familiar only to one of the informants. Also, the function customization of the screen was unfamiliar to several of the users.

There was a major system update approximately 1.5 year before the first interviews. Two of the users expressed that some functions became more complicated after the update, such as administrative transfer of patients, accessing X-ray results and sending of internal referrals. Also, nurses could no longer read the patient's prescriptions. But an appreciated improvement was the increased interoperability between several systems with one unique password to access them. However, it was expressed that from a user perspective, the change of password was cumbersome running out of ideas for new passwords. The time and the performance of the log in and log out procedure was described as acceptable. One user expressed that the progress notes had become better and were quicker and easier to open, with the standardized keywords as helpful. Another major change in the update, was the reading access for patients to their own electronic health record. This was described as a bit unaccused for the health workers in the beginning with careful wording of progress notes, but after a while they got used to this system change. There was an e-learning course available for the employees that specifically targeted the system upgrade.

3.3 The Workstations and Ergonomics

The electronic health record system was mainly used in desktops that were placed in workstations within the departments, see Fig. 2. The informants described the ergonomics of the workstations as quite basic and with lacking customization for individuals, such as through adjustable desks and ergonomic chairs. It was told that there were too few desktops and there was often queue for using them close to shift change. The technical equipment was described as a bit outdated, and there was a suggestion of using large screens to better visualize the user interface of the system. In some of the departments, laptops were available and could be used in the workstations or within patient rooms.

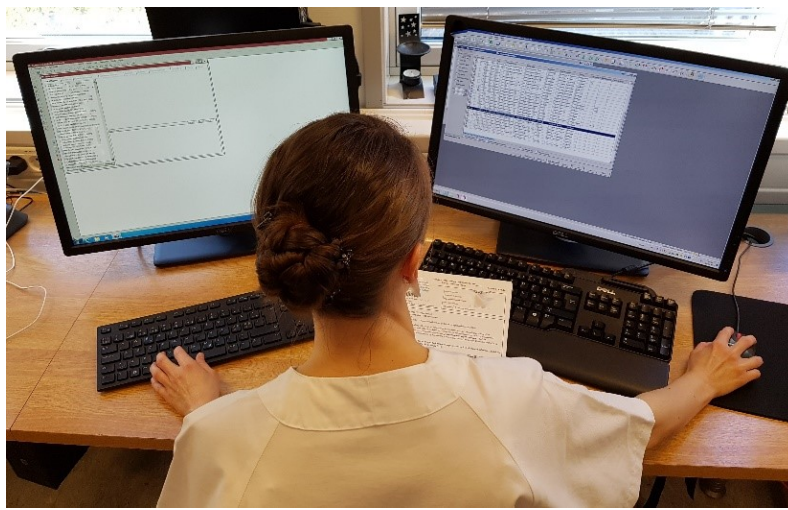


Fig. 2. A workstation in one of the departments.

4 Discussion

This work was made to study the user experience with an electronic health record system used in clinical practice, by observing and interviewing health care professionals. The research questions (RQs) formulated are answered below based on the results from the study.

Regarding the RQ1 that addressed the user experiences. The users were in general satisfied with the system and categorized it as easy to use in the daily operations within the departments. However, the user interface was a bit overloaded of information, especially regarding the progress notes. The high number of open windows made the screen view a bit messy and might impact negatively on the navigation. Implemented functions that were meant to ease the use of the system, such a search function and customization of the screen view, were not familiar to or seldom used by the system's users.

RQ2 asked about limitations and workarounds. There was one major limitation of the system regarding digital communication and interoperability, a digital medication timeline/curve was lacking. Instead, a paper-based curve was used as a workaround. However, implementation of digital curve at the particular hospital will start during 2019. Another limitation regarding patient safety, is the fact that information about patients might be stored in at least three different information systems: the hospital electronic health record, another one used by the municipal health services and a third at the General Practitioner's office. Those systems have a lacking interoperability and do not share important information, such as the latest updated medication list for the patient.

The RQ3, lessons learned that are transferable and applicable in similar contexts. It was experienced in the study that electronic health records have mainly been designed for the information and communication needs of health care professionals [22]. However, nowadays the patients have reading access and can follow in the log who has accessed their information and for what purposes. Therefore, it has to be taken into consideration that patients have become a new user group of electronic health record systems [20]. Further, the study showed that the clinical end-users did not know how to use some system's functions, even though they had heard about them existing. In respect to that, targeted user training might play a key role for the understanding and successful performance of electronic health record systems and related technologies. Even though user interfaces can be customized by each user, this does not facilitate adaption of access to clinical information in other systems or change the information flow when new service design models are implemented. Redesign by the vendors is a costly and time-consuming procedure, and this has shortcomings when health care organizations implement new services models that need changes in the information flow.

This study had some limitations such as including one single hospital in one health region. However, the informants meaningfully represented the clinical end-users of electronic health records and they contributed with sharing their user experiences and the interactions between the system and their clinical working routines.

5 Conclusion

This paper was made to study the user experiences of an electronic health record among health care professionals in clinical practice. The study showed that the electronic health record was an important tool in the daily operations, and was described as user-friendly, even though some workarounds were made to efficiently carry out clinical work processes. The main contribution of this work lies on the descriptions of the user experience by health care professionals, generalizable and with implications to designers and developers of other similar systems. The results presented are congruent with other user studies of electronic health records showing that there are usability issues, and that health care professionals make workarounds to efficiently carry out their work [11][12]. To cope with this, electronic health records should be co-designed with health care professionals to systematically analyze the clinical information- and workflow and the user needs. That might cause fewer usability problems and enhancing the functional adaption of the systems to support an efficient infor-

mation flow, without requiring a system update from the vendors. Finally, patients have become a new user group of electronic health records and attention has to be directed to the importance of two-way communication between patients and health care professionals, to develop efficient and satisfactory solutions for the user groups of the future.

To propose further work, a similar study at a hospital located in another health region using the same system might be interesting, for comparing the results of the electronic health records' user experiences and also addressing the patient perspective.

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