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Usability problems do not heal by themselves: National survey on physicians' experiences with EHRs in Finland

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ABSTRACT

Purpose: Survey studies of health information systems use tend to focus on availability of functionalities, adoption and intensity of use. Usability surveys have not been systematically conducted by any healthcare professional groups on a national scale on a repeated basis. This paper presents results from two cross-sectional surveys of physicians' experiences with the usability of currently used EHR systems in Finland. The research questions were: To what extent has the overall situation improved between 2010 and 2014? What differences are there between healthcare sectors?

Methods: In the spring of 2014, a survey was conducted in Finland using a questionnaire that measures usability and respondents' user experiences with electronic health record (EHR) systems. The survey was targeted to physicians who were actively doing clinical work. Twenty-four usability-related statements, that were identical in 2010 and 2014, were analysed from the survey. The respondents were also asked to give an overall rating of the EHR system they used. The study data comprised responses from 3081 physicians from the year 2014 and from 3223 physicians in the year 2010, who were using the nine most commonly used EHR system brands in Finland.

Results: Physicians' assessments of the usability of their EHR system remain as critical as they were in 2010. On a scale from 1 ('fail') to 7 ('excellent') the average of overall ratings of their principally used EHR systems varied from 3.2 to 4.4 in 2014 (and in 2010 from 2.5 to 4.3). The results show some improvements in the following EHR functionalities and characteristics: summary view of patient's health status, prevention of errors associated with medication ordering, patient's medication list as well as support for collaboration and information exchange between the physician and the nurses. Even so, support for cross-organizational collaboration between physicians and for physician-patient collaboration were still considered inadequate. Satisfaction with technical features had not improved in four years. The results show marked differences between the EHR system brands as well as between healthcare sectors (private sector, public hospitals, primary healthcare). Compared to responses from the public sector, physicians working in the private sector were more satisfied with their EHR systems with regards to statements about user interface characteristics and support for routine tasks. Overall, the study findings are similar to our previous study conducted in 2010.

Conclusions: Surveys about the usability of EHR systems are needed to monitor their development at regional and national levels. To our knowledge, this study is the first national eHealth observatory questionnaire that focuses on usability and is used to monitor the long-term development of EHRs. The results do not show notable improvements in physician's ratings for their EHRs between the years 2010 and 2014 in Finland. Instead, the results indicate the existence of serious problems and deficiencies which considerably hinder the efficiency of EHR use and physician's routine work. The survey results call for considerable amount of development work in order to achieve the expected benefits of EHR systems and to avoid technology-induced errors which may endanger patient safety. The findings of repeated surveys can be used to inform healthcare providers, decision makers and politicians about the

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current state of EHR usability and differences between brands as well as for improvements of EHR usability. This survey will be repeated in 2017 and there is a plan to include other healthcare professional groups in future surveys.

1. Introduction

Healthcare IT (information technology) adoption rates are rapidly increasing along with the expected benefits of system usage. In most modern healthcare organisations IT plays an essential role in care delivery and clinicians' daily work. In the Nordic countries the availability and use of local Electronic Health Record (EHR) functionalities has reached a high level (i.e. close to saturation) [1]. In the EU countries access to basic EHRs is by now nearly universal among general practitioners [2]. In the USA the adoption rates of EHR systems in hospitals have increased from 15.6% in 2010 to 75.5% in 2014 [3].

The effects of the adoption and use of EHR systems have not all been positive. Several studies have revealed that usability problems, technology-induced errors and lack of end-user participation in EHR development are continuing issues that need to be addressed (e.g. [4–11]). Poorly designed user interfaces have been recognized to lead to technology-induced errors and thereby may detrimentally affect patient safety [8,12]. Indeed, many technology-associated adverse events in medicine have been attributed to poor interface design rather than human error alone [13].

Clinicians' acceptance of and attitudes towards EHR systems have been shown to relate closely to system usability, for instance ease of use, integration of the systems into clinicians' workflows and helpfulness of the systems in the care of patients [14–16]. In addition, poor system design, system slowdown and system downtime have been considered the most common factors in influencing clinicians' negative attitudes towards clinical IT systems [15]. Usability and human factors approaches need to be integrated into the design and monitoring of EHR system development in order to overcome the prevailing mismatch between clinical work and IT systems and to support practices that improve patient safety. As a result, there are increasing attempts to understand how systems should and could be improved (e.g. [17,18]).

Currently, survey studies of healthcare IT use tend to focus on availability of functionalities (e.g. [19]) along with aspects of technology adoption and acceptance (e.g. [20,21]). The OECD (Organization for Economic Co-operation and Development) has led an effort to provide member states with reliable data in order to compare information and communication technology (ICT) availability and adoption rates in the healthcare sector [22]. Moreover, pre-implementation and post-implementation surveys have been conducted to investigate clinicians' attitudes, satisfaction and reactions towards systems (and their new releases) (e.g. [23]). By contrast, usability and user experience related questionnaires have mainly been applied during IT development processes. The questionnaires have been used for learning about initial use experiences or to compare two or more versions of differing systems (e.g. [14,24–27]) rather than gathering long-term data on experiences about fully adopted systems after longer periods of use.

In the academic literature on human-computer interaction (HCI) and usability engineering (UE) several definitions have been presented for the concepts of usability and user experience (UX). Commonly cited definitions for usability are given by the ISO 9241-11 standard [28] and Jakob Nielsen [29]. These definitions share similar usability components in common – for instance efficiency, satisfaction and effectiveness—and emphasize the role of context. At a more concrete level, usability has been described as follows: "*A system with good usability is easy to use and effective. It is intuitive, forgiving of mistakes and allows one to perform necessary tasks quickly, efficiently and with a minimum of mental effort. Tasks which can be performed by the software (such as data retrieval, organisation, summary, cross-checking, calculating, etc.) are done in the background, improving accuracy and freeing up the user's cognitive resources for other tasks.*" [30]. Moreover, as usability lies in the interaction of the user and the system [31], quality of use has been described as the object of usability. A quality of use model, described by the ISO 25010 standard [32], includes five characteristics: effectiveness, efficiency, satisfaction, freedom from risk and context coverage. The first three of these components are also part of widely known usability definitions [28,29].

In contrast, UX (user experience) as a concept still remains vague despite dozens of attempts to define it [33–35]. Several of these definitions describe UX as a personal experience including aspects of emotions, beliefs and perceptions that occur before, during and after system use [36–38]. These aspects can be also seen as part of the concept of usability as suggested by ISO 9241-210 standard [36]. Usability should be understood as a contextual property. In the field of health informatics this means that aspects of safety and prevention of medical errors as well as characteristics of healthcare work need to be taken into consideration when designing usability studies. Kushniruk et al. [8] have stated that "*the ability of methods from usability engineering to be able to predict medical errors holds considerable potential for assessing healthcare information systems regarding safety and ensuring that such systems do not inadvertently introduce medical errors*".

In our own studies [4,39–41] we have applied definitions of usability from the HCI field when describing the usability of clinical ICT systems from the viewpoint of different end-user groups with the aim of increasing the understanding of contextual aspects unique in clinical contexts. The objective of designing systems for usability can be described as enabling users to achieve goals and meet their needs in a particular context of use [28,36]. Following from this, we have presented a description for usability of clinical ICT systems from the physician's viewpoint [4]: *The usability of clinical ICT systems refers to the ability of the systems to have a positive impact on patient care by supporting physicians in achieving their goals with a pleasant user experience. In order to support physicians in their daily clinical work, ICT systems need to be compatible with physicians' tasks. At a more concrete level, this indicates that systems should provide physicians with key (context-matching) functionalities, be efficient (especially in terms of record-keeping and information retrieval), and have intuitive user interfaces. In addition, ICT systems should support information exchange, communication and collaboration in clinical work and be interoperable and reliable. Since clinical ICT systems are used in numerous environments, they should also adjust to various user needs and organisational settings.*

The focus of this article is on usability of EHR systems and physicians' experiences in using these systems. Only a few studies have been conducted on a large scale about the usefulness and usability of EHR systems from the end-users' viewpoint over the past few years. National surveys that include usability-related questions have been conducted in some Nordic countries [1,42–44], but the focus of these works has mainly been on adoption and intensity of use. To our knowledge, besides our previous study [4,9,41,45–49], specific national usability surveys have not been systematically conducted among any healthcare professional groups. Longitudi-