

A Usability Evaluation of an Electronic Health Record System for Nursing Documentation Used in the Municipality Healthcare Services in Norway

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Abstract. The paper presents a usability evaluation of the Graphical User Interface (GUI) of an Electronic Health Record System (EHR). The topic of interest was to explore the system's usability in the context of nursing process documentation. A cognitive walk through approach was used. The data were analyzed with content analysis and the results show that challenges identified were related to navigating and finding information in the system. Even though there were problems in progressing from one phase to another in nursing process documentation, the system represented some types of predictability and consistency in the functions. Education, training and support are needed to be able to use the EHR for nursing documentation. Mandating standardization regarding format, content and terminology to improve the EHR systems functionality regarding facilitate nursing process documentation is recommended.

Keywords: Electronic Health Record, Usability evaluation, Nursing documentation, Nursing process.

1 Introduction

Information technology (IT) systems are developed for the purpose of supporting quality by facilitating work and information flow. Electronic Health Record Systems (EHRs) are IT systems developed and implemented in the healthcare services over the last twenty years. According to Norwegian law, the EHRs have to contain information related to the patient's need for healthcare and the background for the needs including the health care given to patients [1]. Healthcare professionals are obliged to document these in the EHRs [2]. The main purpose of the EHRs is to support the information flow and working processes and reduce costs in healthcare and welfare services [3-5]

IT systems are implemented with varying success [5-7]EHRs included [8, 9]. The implementation success depends on several factors [6, 10]. System quality in terms of usability is one of these critical factors for success [6].

Usability refers to the interactive products, capacity to enable users to perform their tasks in a safe and efficient manner[11, 12]. Usability objectives are that the system is effective, efficient and safe to use, and that it has good utility, is easy to

learn and easy to remember how to use [12]. Usability engineering methods are essential for conducting evaluations in order to improve the system's usability [13]. Usability seems to be an important factor for adoption of computer-based nursing documentation systems [14, 15].

This study examines the usability of one of the most widespread EHRs used in municipalities in Norway [16]. The data are compiled and summarized according to a qualitative approach in order to highlight the effects on nursing process documentation [11].

2 Aim

The aim of this study is to evaluate the usability of the Graphical User Interface (GUI) of an EHR in order to explore the system's usability regarding nursing documentation.

3 Background

Nursing documentation was imposed by Norwegian law in 2001 [2]. Knowledge about the importance of systematic documentation represented to support quality in individual nursing care has its history back to when modern nursing evolved in the late 1800s [17]. According to Kärkkäinen et al. (2005), nursing documentation should contribute to make individualized patient's care visible [18]. EHRs represent expectations of improved healthcare service, but several factors impact and challenge the outcome of electronic nursing documentation [5, 19, 20]. The GUI of the systems, design quality, feature functionality as well as project management, procurement, users' and the end users' previous experience are factors of importance [14]. Different requirements from different professional users adapted to different areas and marketed from different vendors, impact development of the EHRs. This complex picture challenges a national EHR implementation project [21].

Häyrynen et al. (2010) stated that although EHRs may facilitate standardized nursing documentation based on the nursing process,¹ use of the nursing process varies across patients. Häyrynen et al. (2010) found that there was a lack of continuity, and nursing process systematics in the documentation [9]. Vabo (2013) noted similar findings in a Norwegian study [22]. Clinical decision support systems (CDSSs) integrated in the EHR have the potential to significantly improve the quality of nursing care and documentation [19]. Fossum et al. (2011) found that lack of training, resistance to use computers and limited integration of CDSS, created difficulty in using the CDSS within the EHR and the poorly designed GUI represents barriers.

According to Kellermann et al. (2013), the efficiency of implementation of healthcare systems is not in proportion to what was expected. This is largely due to poor adoption connected with systems that are neither easy to use nor interoperable [5]. Kellermann et al. (2013) highlight the need for standardized systems that are easy to

¹ The nursing process defined by four phases; 1. Needs assessment, includes the patient's health data, 2. Determining of nursing diagnoses and nursing care aims, 3. Planning and delivering nursing interventions, and 4. The evaluation of outcomes [8].

use and interoperable, as well as promoting accountability of health care providers to reengineer processes to benefit from the efficiencies offered by health IT [5]. Keenan et al. (2013) recommend standardization of format, content and words used in nursing documentation. Further, they recommend usability testing to ensure that tools in the EHRs facilitate a shared understanding of the patients' care plan [23]. There is also a need for an international terminology in EHR development to support semantic interoperability [21]. The business issues by comparing vendors may be contributing to the development of standardization of EHRs delay [24].

There may also be a predefined goal that implementation of EHRs should contribute to increased time for patient care by decreasing time for documentation. A systematic literature review concludes that this is not realized [25]. An important factor for user acceptance of computer-based nursing documentation systems is how the systems' functionality is able to support nurses' workflow [26].

4 Method

The usability evaluation method used in this study is based on the cognitive walk-through (CW) approach. This approach is a task analysis focusing on how well a task can be completed while using the system, and how easy it is to learn and use the system. The method investigates how the system's cues assist the users in performing tasks by exploring and learning, rather than knowing how to use the system [11, 27]. The method identifies sequences where typical users will succeed or fail with the aim to systematically identify and characterize failure situations [28].

4.1 Sample

Eight participants were included in the test panel. According to Nielsen and Landauer [27], eight participants is an appropriate number in a small project to explore usability [27]. The sample contains eight registered nurses (RNs) in the municipal healthcare services. Electronic literacy refers to the ability to use the advantages inherent in electronic tools for reading and writing [29], and it is important to aspire to avoid the participants individual electronic literacy's impact on the evaluating test. Inclusion criteria were that the participants used IT daily, and that they were using another EHR system as a tool for their daily documentation of nursing and to provide statutory demands for documentation in their daily practice.

4.2 Procedure

The test is a synchronous remote usability evaluation [30]. The test was performed in a test laboratory with a one-way mirror. The test persons were asked to think-aloud while performing the tasks according to the presented nursing scenario. A moderator was sitting next to the RNs, reminding the RNs to think-aloud. A researcher in the observation room observed the RNs' actions, reactions and the screenshots. The entire usability test was videotaped. A small survey was used to measure the user satisfaction at the end of the session supplied by a free text questionnaire.

The test scenario used was a typical situation where they should document nursing care for a patient currently living in a nursing home. The scenario focuses on nutrition and a dehydration health problem. The situation was logically arranged according to use of the nursing processes in four phases: Assessments, including the patient's health data. Determining of nursing diagnoses and nursing care aims. Planning and delivering nursing interventions. Evaluation of outcomes [9].

To avoid bias regarding attitudes toward the system, the participants were told not to talk to each other about their experiences while performing the test.

The participants were logged onto the system when the test scenario started. The first task described was: Go to the patient's journal. Further steps were to find the information regarding the patient's nutrition status. Where would you intuitively go to find it? Determine the nursing diagnosis and determine aims relevant for the patient. Enter the intervention; "measure the consumption of drinking". Enter data about what the patient ate and drank for supper (evaluation outcome). Store the data that has been entered. Finally, navigate out of the patient journal, and go to another patient journal.

4.3 Ethical Considerations

The test scenarios were fictitious. The participants in the test gave written consent to participate, and had the option to decline to participate at any time without consequences. It was of importance that the participants felt well under the test situation. To avoid pressures of performance, it was emphasized that this was not a knowledge or a skills test.

5 Analyze and Results

The video records, screenshots, survey and results from the free text questions were transcribed and analyzed with qualitative content analysis [31]. The analyses focuses on the manifest content, meaning that the transcribed text is analyzed to describes the visible and obvious components [31]. The data from the survey were analyzed using descriptive statistics.

The video files were transcribed and analyzed according to three perspectives: what the participants said and how they interacted with the system. Which movements the participants made in the GUI, and what help and guidance the participants needed to accomplish the tasks. Time, from start to the end, was measured and calculated. The coding categories according from which data were analyzed were classic aspects of Human Computer Interaction (HCI), and are described as: information content that concerns whether the information system provides too much or too little information; comprehensiveness, graphics and text which concerns whether a computer display is understandable for to the subject or not; problem of navigation is an aspect that concerns whether the subjects have difficulty finding the desired information or computer screen; and the last aspect is overall system understandability that concerns whether the icons, required computer operations and system messages are understandable [11]. All participants considered themselves as experienced IT users. Further they considered themselves as experienced users of EHRs, two of whom stated to be experts.

5.1 Information Content

All participants, except one, reported that there was too much information in the main GUI and referred to toolbars, buttons and menus. On the other hand, they found there to be a lack of information about their functions in the system. They found it confusing that toolbar buttons were presented both vertically and horizontally, and the explaining text induced by the cursor was considered to be imprecise.

Finding information where it was expected to be found, was rated low by the participants (table 1). When looking for information about the patient's nutrition status, no such information was found. In this purpose, all participants were looking for a tab providing access to the patient's care plan where information about the patient's health data was obviously expected to be. None of the participants was sure where to move, and they had three different suggestions where information of the patient's health data was expected to be found. Two tabs in the screen were denoted with the word "plan" in a combination, and it was not clear which should be selected for the current purpose.

Information in the system that promoted clinical decision support was considered as positive by all the participants. Some of the participants were surprised by achieving this type of information. It was expressed that this contributed to saving time, and was regarded as a manual or reminder about what was to be written in the current area.

5.2 Comprehensiveness, Graphics and Text

Whether the functions were organized in a logical way was ranked rather low by the participants (table 1). The participants needed guidance to progress from one step to another in documentation according to the test scenario. The problems seemed to be both selecting the correct level in the three structures and then selecting the correct tab for the current phase in the nursing process.

Which levels or tabs should be selected was not clear to the participants when entering data into the system, or when retrieving data from the system. Some tabs' titles in the same GUI was imprecise regarding the text term; hence, this made it difficult to know which options to choose for the given task. For example which of two tabs to choose; "report" or "evaluation" in order to document according to phase four in the nursing process. One of the participants said: "This was not easy. I like to enter evaluation report, but do not understand how to do it. This is what makes nurses with less IT literacy than me confused".

5.3 Issues of Navigation

According to the survey, issues in navigation are rated high by the participants (table 1). The size of the letters, the text and the button were considered to be too small. This result corresponds to the video and screenshot data where the participants are striving to find the function that they need to accomplish the tasks. They tried different icons along the toolbar and the menus.

When performing the task, Looking up the patient journal, all participants failed by trying to enter the patient's name, using the cursor and searching over the GUI.

All participants except one need guidance to find the patient’s journal. The average time to locate the patient’s journal was 2 min. 40 sec. The one who found the patient’s journal without guidance used 1 min and 45 sec. The patient’s journal was found by using the icon “patient journal” on the toolbar. This function allowed access to the patient’s index file.

To complete the test scenario, the participants used average 17.58 min. (min 14.14, max: 23.14).

Table 1. How the participants answered their perceived user satisfaction (n=8)*

	1	2	3	4	5	6	7
The features of the system supported my needs	0	2	2	0	1	2	2
The features of the system worked as I expected	0	1	3	2	1	0	1
The available features of the system were satisfactory	0	0	2	3	1	1	1
The system was easy to use	2	1	1	3	1	0	0
The system was pleasant to use	0	3	3	1	1	0	0
The system was flexible	0	1	4	2	1	0	0
It was easy to navigate the system	2	3	1	2	0	0	0
Letter size was appropriate	1	2	2	1	0	2	0
The font was appropriate	1	0	0	2	1	3	1
The headings that describe the features of the system were meaningful	0	1	3	2	1	0	1
I found the information I needed, where I expected to find it	2	1	3	2	0	0	0
The organizations of the features are evident	1	3	0	1	3	0	0
I found the functionalities of the system where I expected to find them	1	3	3	1	0	0	0
The amount of information was appropriate (not too much or too little)	0	1	2	2	1	2	0
I could complete the documentation by using the main menu	2	2	3	4	0	0	0
I could easily document the nursing using the system	0	2	0	3	1	2	0
They presented the measures in the system were relevant to the issue of patient	0	1	1	1	1	2	2
It was easy to find the data I needed	2	3	0	1	2	0	0
The system supports the work process in relation to the documentation of nursing	0	1	0	3	1	2	1
The system supports all steps of the nursing process	0	0	2	3	0	2	0
Overall I am satisfied with the system's usability in relation to planning and documenting nursing	1	1	1	1	2	2	0

* Distributed on a Likert scale from 1; totally disagree agree to 7; totally agree was used

5.4 Overall System Understandability

Two of the participants expressed explicitly that this system and functions were completely different from the EHR system that they regularly used.

Table 1 shows that the participants, to a limited extent found the functions in the system to be indicatively organized. All participants had problems finding the patient’s journal. The observation shows that they all expected to find the journal by writing the patient’s name in the presented box, but were not able to find the button to accomplish this. Six of the participants tried the “Enter” button, without results.

All participants had problems entering information into the system, and they all needed guidance to find the function. They had to activate an icon on the toolbar

named “new row”. This designation was not perceived as descriptive of the function it served. This “new row” button was used by the participants in order to complete the further tasks in the test scenario without guidance. Five of the participants stated that they needed some more time and training to be able to use the system.

The survey shows that the participants to some extent, were positive toward the system’s usability regarding facilitating nursing care planning, and nursing process documentation (table 1).

6 Discussions

The usability problems that challenges the participants in this usability evaluation study correspond to findings in other studies described [5, 14, 19]. The participants were not able to accomplish the tasks presented in the test scenario without guidance from the moderator.

As reflected in the literature, the EHR may be a facilitator regarding continuity and nursing process documentation [9]. Despite the opportunities that information technology entails, Häyrynen, et al. (2010) found a lack of continuity in nursing documentation. The authors suggest that one of the reasons may be due to EHRs systems not supporting the nurses’ work flow[9]. The participants in this study could not find information regarding the patients’ health data, and it was not intuitive where this information should be found. The lack of logical organization of functions in the system caused problems selecting the correct function for a given task. Further, the participants had problems navigating in the system and the comprehensiveness challenged the documentation in the different phases of the nursing process. Required by Norwegian law, EHRs have to contain information related to the patients need for healthcare and the background for the patient’s needs, including the healthcare given to patients. As the literature describes, nursing documentation may be deficient in many situations [9]. Incomplete nursing documentation and imposition of the law challenge the vendors to develop EHRs that facilitate nursing documentation according to the law. This is currently not the case according to this usability evaluation supported by the literature [24].

Even though the participants stated to be experienced IT and EHR users, they were only to a small extent able to use previous experiences in accomplishing the tasks. Some of the participants explicitly stated that this system worked very differently from the one they knew. This may be a result of the different vendors developing the EHR solutions, and an absence of general demands of standardization according to user interface, functionality, text terms and terminology as the literature suggest [21]. One way to improve the system might be to impose mandated standardized terminology, format and content. Standardization is recommended in the literature in order to both improve ease of use and to facilitate semantic professional terminology. Standardization will also improve communication and understanding among health professionals regarding patient care, and interoperability among healthcare systems [5, 21, 23].

What the participants found to be positive using the system was the information in the system that promoted some type of professional decision support. They consider it as contribution to save time, and to support documentation quality. Previous research

indicates that implementation of EHR is not likely to save time in documentation [25]. These findings may be due to the limitations the current generation of EHR represents. According to the literature, CDSSs integrated in the EHRs, have the potential to improve significantly the quality of nursing care and documentation. Even though the findings in this evaluation study indicate a positive contribution to facilitate nursing process based documentation, there are still some challenges to overcome before it becomes effective [19, 32].

Comparing the finding in the survey (table 1) with the findings in the video and screenshot, it does not completely correspond. Overall, the findings from the survey are more positive regarding the system's usability than the observations from the test laboratory. This might be due to the participant's previous experience with EHRs, by not been used to an intuitive user interface [5, 14]. Even though the observation in this usability study suggests that the system is learnable by representing some type of predictability and consistency in the functions, education and training is required to learn to use the EHRs.

7 Conclusions

This usability evaluation shows that poor usability and lack of intuitive user interfaces makes the system difficult to use without knowing the system. According to the literature, it is likely that usability is important to discuss according to other EHR systems. The need for proper education, training and support to be able to use the EHR in the best manner, so that documentation required by law might be safeguarded, is important. To improve the EHR system's functionality regarding facilitating nursing process documentation, it might be necessary to mandate standardization regarding format, content and terminology.

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