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Evaluation of a Clinical Simulation-based Assessment Method for EHR-platforms

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Abstract. In a procurement process assessment of issues like human factors and interaction between technology and end-users can be challenging. In a large public procurement of an Electronic health record-platform (EHR-platform) in Denmark a clinical simulation-based method for assessing and comparing human factor issues was developed and evaluated. This paper describes the evaluation of the method, its advantages and disadvantages. Our findings showed that clinical simulation is beneficial for assessing user satisfaction, usefulness and patient safety, all though it is resource demanding. The method made it possible to assess qualitative topics during the procurement and it provides an excellent ground for user involvement.

Keywords. Clinical simulation, eHealth, Human Factor, Procurement, Assessment

Introduction

Qualitative aspects such as human factors and interaction between technology and end-users are generally challenging to assess. In a public procurement process (PPP) one further have to follow strict rules, where the assessment must be quantitative in order to equally and precisely compare the offered information systems. Typically, assessment in a PPP is done by structured assessment of the vendors' textual descriptions of the offered solutions and their written replies to the requirement specification. Assessments of textual descriptions however, are insufficient in order to fully assess human factor issues [1]. Clinical simulation is a well-known qualitative method for evaluating clinical information systems; the method is useful to illuminate the interaction between technology and human factors [2-6]. While the literature is comprehensive regarding descriptions of how clinical simulation can be used in evaluation of a single information system, literature is limited on how simulation can be used to systematically assess and compare several information systems and their support of clinical work processes in a PPP.

In connection with a large PPP of an EHR-platform in two large regions in Denmark, covering 40.000 clinicians, 20 hospitals serving 2.5 mill citizens, we have developed and evaluated a clinical simulation-based method for assessing and comparing human factor issues [7]. The method was developed to support assessment of qualitative aspects such as user experience, usability and patient safety. While the method

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draws upon existing and well documented practices of evaluation of human factor issues [4,8-10] it was necessary to make some adjustments to these practices because of the rigid nature of a PPP. The PPP implies several challenges to the use of a qualitative assessment approach: 1) assessment results must be comparable, 2) assessment of the different EHR-platforms must be done uniformly, 3) the process has to be transparent, 4) the results have to be easily collected and rapidly analyzed. The size of the actual PPP further adds a couple of challenges 1) all aspects of the EHR-platform should be covered, 2) all clinical specialties and professional needs should be dealt with, 3) all possible types of users should be considered and preferably included in the assessment.

The assessment method was developed based on our previous experience with simulations [4, 9-12] and applied in practice in the PPP process. The aim of the simulation set-up was primarily to assess the three EHR-platforms in case and secondarily to actively involve clinicians in the PPP. The aim of this paper is to describe the evaluation of the method, its advantages and disadvantages. The evaluation of the method is described according to the three aspects of human factor issues that the method was designed to cover; 1) user satisfaction, 2) usefulness and 3) patient safety.

1. Methods

The purpose of the evaluation of the assessment method was to answer the following questions: 1) what is the eligibility of the method, 2) what are the advantages/disadvantages compared with other assessment methods, and 3) reveal possible issues to be improved. The assessment covered 12 clinical scenarios and 18 health professionals from various specialties and professions. Three EHR-platforms were assessed during a period of 10 working days. The clinicians had a full day of training in each of the three platforms followed by two days of clinical simulation [7], after accomplishment of a simulation scenario the clinicians assessed how the tested platform supported the task. The testing was scheduled in three subsequent three-day periods, where the clinicians would scrutinize all the platforms.

The evaluation of the assessment method was qualitative, including observations and semi-structured interviews of key actors and participating clinicians. Observations were conducted during 10 days of assessment, and on the last day all clinicians were interviewed in three groups. Subsequently 15 interviews were conducted with project and legal managers, health informatics, vendors, patient safety experts, and observers during the clinical simulations. The qualitative approach enabled us to conduct the evaluation without interfering with the assessment process, and concurrently obtain a thorough insight in user experiences and perceived benefits and challenges of the method. All interviews were transcribed, and analyzed using a qualitative approach of content data analysis.

2. Results

There was a high level of concordance among the interviewees in the study. The results from the interviews supported the findings from the observations in the study. Generally, the use of ‘patients’ in the simulations supported fidelity of the scenarios and facilitated a smooth flow in the simulations. The clinicians however expressed that the patient cases lacked complexity; there were fewer patients than in every-day work, the

working environment was less stressful than normal. Furthermore, they found it difficult to learn a complete new EHR-platform in the short time given. The evaluation results in table 1 below reflect the three themes the method was designed to address.

Table 1 Results from evaluation of assessment method.

User satisfaction
• Subjective evaluation of user satisfaction is easily done by clinical simulation followed by questionnaires, but objective assessment of user satisfaction is difficult, due to the close correlation to work practice and clinical tasks. • It was difficult to assess minor variances in ease of use. • Clinical simulation supports user involvement, but it is difficult to assess other aspects than the end-user aspect in the assessment. • Use of all the tested EHR-platforms during the testing period made it possible to reflect on and assess each of the platforms and their differences. • There were a lot of interruptions during the simulations, which affected the fidelity and realism and made it difficult to observe the usability on the spot. • The standardized assessment questionnaires supported the clinicians in assessing each single system and their diversity.
Usefulness
• Clinical simulation was an efficient way to exhaustively examine the vendors' textual descriptions of the platforms. • The assessment method made it possible to gain deep insight in the EHR-platforms and how they provided support of work practice and needs and consideration concerning organizational implementation • Clinicians perceived clinical simulation as a good way to be involved in the PPP • Assessment across specialties and healthcare professions were made possible and differences in clinical requirements became obvious. • Structured training provided insight in other parts of the EHR-platforms, than users would have obtained if they were to explore the platforms on their own. • Scenarios covered most standard procedures and daily work practices and made it possible to gain insight in how the EHR-platforms supported patient encounters. • Functional fidelity was high even though the EHR-platforms had not been configured according to the local work practices and the clinicians were fully capable of distinguishing between clinical tasks and system functionality.
Patient safety
• Assessment of patient safety issues lies in the detail and is difficult to define in general requirements that most often are truisms of little significance. • Explicated patient safety requirements and a mention of patient safety assessment issues in the procurement material would legalize patient safety questions in questionnaires and use of patient safety experts as observers during clinical simulation. • Clinical simulation may reveal safety aspect not evident from textual descriptions. • The method could have benefitted by using patient safety experts as observers.
General
• Assessment criteria should be defined early in the PPP and clear requirements regarding human factors and patient safety should be part of the requirement specification. • Vendors found they were treated equally and fair, but would have preferred to use their own test data as implementation of scenario test data was resource exhausting.

3. Discussion

Regarding the eligibility of clinical simulation as a method to uniformly assess human factor issues in PPP's, we found that the method is indeed useful and makes it possible to assess qualitative aspects that are otherwise difficult to specify and assess [3]. Careful attention is however essential in order to develop textual requirements that can provide a solid foundation for the assessment criteria.

Clinical simulation is a sufficient method for assessing user satisfaction as it gives the users firsthand experience with the EHR-platforms in a close to real-life setting focusing on the interaction between technology, users and work practice. Although it was hard for the clinicians to obtain proficiency with the EHR-platforms within the short assessment period, they were able to state the reasons for good and bad user experiences in each of the three EHR-platforms. Training the simulation facilitator more extensively in the EHR-platforms, to enable comprehensive guidance on platform functionality during the simulations, might compensate for the lack of proficiency. Compared to other methods like heuristic inspection and low fidelity usability evaluation, clinical simulation has an advantage in taking into account the clinical context where other methods tend to focus at just one or two topics without the clinical context. Heuristic inspection focus only on the user interface and low fidelity usability test focuses on technology, and specific task for single users. These methods may however complement the clinical simulation in making a rigorous assessment of the user interface.

Regarding usefulness the clinicians found that the clinical simulation facilitated an understanding of how well the assessed EHR-platforms could support daily clinical work practices. At first there was some reluctance to work in interdisciplinary groups but this proved to be essential in facilitating a richer understanding of the functionality of the EHR-platforms in collaborative work situations. This would not have been possible in a low fidelity usability test where a single user solves a single task.

Patient safety issues proved to be especially hard to assess due to the fact that many patient safety challenges lies in the details and are triggered by unintended incidents and disturbances. It can therefore be hard, or nearly impossible, to pinpoint these challenges beforehand, instead they need to be explored along the way. Clinical simulation is however an appropriate method for assessment of patient safety aspects as it provides a comprehensive view on the IT-system taking into account the correlation between IT, work practice and unintended incidents. It is our recommendation though that in order to gain in depth views on patient safety issues this should be done in close collaboration with patient safety experts.

It is a difficult balance to make the assessment process transparent and uniform and to ensure that the scenarios are realistic and relevant for the customer and at the same time let the vendors into the decision on scenarios, test data and configurations. The assessment was not blinded, and by involving users there is a risk of mutual influence. This may be dealt with in the design of the simulation set-up. We however found that the benefits of involving users across specialties and professions were superior to these challenges.

Clinical simulation makes it possible to assess qualitative aspects that are otherwise difficult to measure, like patient safety and human factors [3]. In the requirement specification one try to specify something that is superior to what you already have, in return you get a textual description from the vendor that you try to assess by marks. Use of clinical simulation in the early phases of the procurement process may improve assessment of the offerings and make it possible to expose and assess qualitative as-

pects such as human factor, patient safety and support of work practice [4;5]. Patient safety issues are difficult to describe in sufficient detail and assess without involving clinical context and work practice either in real life or in a simulated set-up. In PPPs assessment in real life is seldom possible, whereas clinical simulation is a very suitable substitute. To set up a clinical simulation-based assessment in a PPP is a huge task, but in on our experience it should be done hence the impact of the procured platform on the healthcare organization is immense, so the value of making the procurement on a thoroughly enlightened base cannot be overestimated. The assessment may further be applied as a basis to discuss future challenges and possibilities in the implementation of the platform [12].

We can conclude that clinical simulation based assessment in a PPP is beneficial for gaining insight in user satisfaction, usefulness and patient safety. Traditional methods focus on the relation between users and user interfaces without involving the clinical context, whereas clinical simulation illuminates the relation between users, technology and work practice and hereby provides deep insight in the offered system. The applied assessment process made it possible to systematically assess each of the platforms and their differences. Clinical simulation is eligible in PPP of clinical information systems as supplement to other assessment activities. Clinical simulation is a recommendable method for assessing user satisfaction, usefulness and patient safety and provides an excellent ground for user involvement and giving voice to the users. We recommend clinical simulation to be supplemented with low fidelity usability evaluation and heuristic evaluation for assessment of minor variances in ease of use.

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