

Usability Improvements to Electronic Health Records

Finding Realistic Paths to Success

Rebecca A. Meehan

School of Library and Information Science-Health Informatics, Kent State University, 1125 Risman, Kent, OH, U.S.A.

Keywords: Electronic Health Record, Usability, Information and Communication Technologies.

Abstract: There is a need to develop more effective strategies for improving usability within information and communication technologies, specifically, electronic health record (EHR) systems. Usability incorporates the ease of use, learnability, efficiency, effectiveness and satisfaction of a system by the end user. When an EHR incorporates principles of usability, the system does a better job of meeting the needs of the end users intuitively, resulting in fewer errors and better quality outcomes for patients. Health systems and governments have been urging the widespread adoption of EHR systems to help lower costs and increase efficiency, putting themselves and vendors under pressure to develop and implement the best solution quickly. Too often stakeholders rely on future releases and enhancements to fix issues not originally planned for in the initial release of the product. Hospital system end users and vendors need better strategies for improving usability in EHR solutions. Poor usability can result in frustrated end-users, inefficient and more costly processes, and, at worst, compromises to patient safety. Proposed strategies and areas for future development are discussed.

1 INTRODUCTION

Problem statement

There is a need to develop more effective strategies for improving usability within information and communication technologies, including electronic health record (EHR) systems. Each stakeholder involved in developing and using the EHR has an opportunity to improve its usability. This position paper focuses on ways to learn and understand more from EHR vendors about the best ways to improve usability. Many EHR vendors that incorporate user centered design and usability principles into their software development lifecycle (SDLC) are generally among the most successful solutions. Because of the impact of usability on quality of care and patient health, it is important for all EHR vendors to have strategies for incorporating usability into the built product. Too often, there are communication barriers among a vendor's internal stakeholder groups of product development, usability/user experience, product management, sales, support and implementation. It is critical for the executive team to prioritize usability in the EHR

product roadmap, and to facilitate communication among the internal vendor stakeholders. Some techniques and processes are better than others for making the products more user-friendly. And as SDLC processes change, so too, must the strategies for incorporating iterative feedback on usability.

All EHR stakeholder groups (e.g. hospitals, clinicians, vendors) need to identify the most effective and affordable ways to incorporate usability principles into their EHR products. This paper focuses on the vendor as a stakeholder, and helps to identify ways to incorporate usability into the SDLC. To address the issue, vendors can turn to usability consultants, or have their own staff implement best practices outlined in professional reports. These reports that help to identify usability best practices and design heuristics stem from efforts made in the academic, industry standards, government, non-government organizations, and professional associations. Some of these include HIMSS, HL-7, NIST, EHRA of HIMSS, AMIA, and IHE. Likewise, there are many academic efforts and studies focused on identifying best practices in usability standards. The challenge is that these groups, as well as HIT software development

organizations tend to present information in “siloes.” That is, the best practices tend to stand alone, and do not easily find their way into the EHR product. Central to this issue is a lack of a common language. Because standards groups or academic usability experts are not typically on site or embedded with product developers or product managers, it is challenging to find the most effective ways to communicate about usability problems, and to collaboratively solve problems that arise. This barrier makes it difficult to implement the expert advice into the SDLC and overall process. While the “silos” may be unintended, they prevent the exchange of pertinent information. What is needed is a common language and common purpose to integrate usability guidelines and user centered design into EHR systems. It is essential that each of the groups mentioned here continue to do the hard work they are currently doing in advancing usability principles and their incorporation into EHR systems.

This position paper proposes a strategy to evaluate vendor strengths, and to identify common goals and obstacles. This paper proposes a pilot study to explore ways to facilitate best practices for integrating usability principles into EHR systems. While the proposed study focuses on vendors, the collective stakeholder group, comprised of EHR clients (e.g. hospitals, clinicians), standards organizations, caregivers, patients, and payers, is critical in identifying optimal solutions for improving usability, and ultimately improving patient health outcomes. Findings from this study will serve as a foundation for identifying a common language and goals that each stakeholder group has in common. The goal of the study will be to work specifically with EHR developers and vendors to understand how usability is considered and handled in their existing strategies and work to build best practice techniques going forward.

2 BACKGROUND

The U.S. healthcare system is undergoing a technological transformation fueled in large part by the wide spread adoption of electronic health record (EHR) systems. The implementation and use of EHR systems has been accelerated by financial incentive programs initiated in the American Recovery and Reinvestment Act –Health Information Technology for Economic and Clinical Health Act (HITECH) (2009) as well as the

expanded innovative care delivery and payment models specified under the Affordable Care Act (2010). Eligible hospitals and providers are seeking to implement EHR systems in a timely fashion, enabling them to take advantage of the financial incentive programs of “meaningful use.” This market demand for EHR systems and rapid pace of adoption and implementation leaves little time for improving usability.

2.1 What Is Usability?

The International Organization for Standardization (ISO) defines usability as the effectiveness, efficiency, and satisfaction with which the intended users can achieve their tasks in the intended context of product use (ISO/IEC, 1998). The TURF (Toward a Unified Framework of EHR Usability) initiative (Zhang and Walji, 2011) defines usability as how useful, usable, and satisfying a system is for the intended users to accomplish goals in the work domain by performing certain sequences of tasks. The TURF approach advances the practical science of usability in that it proposes a unified scientific framework under which usability can be considered. Moreover, it is a method by which usability can be measured objectively and systematically. A few common examples of usability problems include a) patient identification error: actions intended for one patient are documented in the record of another patient; b) data availability error: decisions should not be based on incomplete information, because the user does not have pertinent information on the screen (e.g. allergy to medication), and the user would need to take extra navigation steps to find the pertinent information; and c) match: the system should follow the users’ language with words, phrases and concepts familiar to the user and not system based (e.g. labels should convey meaningful actions to the users).

Usability testing will not be effective if conducted by only one stakeholder. A collaborative model is necessary. The client or hospital system implementing the EHR should participate in product design and iterative testing throughout the SDLC. Ideally, the client would participate in both early stage (formative) usability tests and in later stage (summative) testing. Formative usability testing occurs early during the formation of the software to inform and verify design decisions and to understand what is not usable (www.usability.gov). It tends to be qualitative feedback from end users about the

functionality and behavior of the software. At early stages, users are generally asked to identify workflows, evaluate information architecture, language, and icons. Ideally, formative testing is iterative, and done frequently within the software development lifecycle. In contrast, summative usability testing evaluates the user interface of software in its current form. Different usability evaluation techniques are used in summative testing. For example, efficacy tests, or time task tests (the time it takes a user to complete a certain task), and user satisfaction can all be evaluated at this stage. The goal of summative testing is to identify and rate the usefulness of the interface, while providing quantitative and qualitative feedback to the vendor or internal engineering team on elements that need to be fixed or enhanced. Some outcomes may be issues of configuration, in which the implementation team can work with to refine the parameters of configuration, as opposed to a product change.

2.2 Why Is Usability Important?

Systems incorporating a user centered design, with high levels of usability have been shown to support clinician users in their workflow and help to increase quality outcomes for patients (Garg, et al, 2005; Chaudry, et al 2006; Bates, 2005). Conversely, a lack of usability in the EHR has been associated with unintended consequences, including harm to patients (Campbell, et al, 2007).

EHR usability is a common complaint heard among clinicians from hospital systems and practices. HIMSS (2009) reports that usability is one of the primary reasons, “possibly the most important factor” hindering widespread adoption of EHRs (http://www.himss.org/files/HIMSSorg/content/files/himss_definingandtestingemrusability.pdf).

The HIMSS article describes that usability has a strong, often direct relationship with clinical productivity, error rate, user fatigue, and user satisfaction, all important factors for EHR adoption. Days spent for EHR training, while necessary, put clinicians in a position to lose productivity. Moreover, the months after a new HIT adoption, clinicians need to adapt to the new tools and workflow.

2.3 Market Demand

Despite the challenges of working with new EHR systems that have improvements to be made in

usability, the “meaningful use” financial incentives in the U.S. have kept the market demand high for implementing an EHR system. In 2013, nearly six in ten (59%) non-federal acute care hospitals had adopted at least a basic EHR system with clinician notes. (Charles, et al, 2014). This represents a 5-fold increase in EHR adoption among U.S. hospitals from 2008- 2013. Moreover, Charles and colleagues (2014) report that 93% of hospitals possessed a certified EHR technology, increasing 29% from 2011. Office based providers are also quickly adopting EHR systems. A 2014 National Center for Health Statistics report indicates that in the U.S. in 2013 over 78% of office based physicians used any type of EHR system (Hsiao and Chung, 2014). This statistic is up 18% from 2001. Further, the report indicates that 69% of office based physicians plan to participate in meaningful use incentives. This rapid acceleration of EHR adoption in hospital systems and physician offices puts a strain on end users, implementers, and vendors to increase EHR usability. At worst, the delay for EHR usability enables increased medical error and unintended consequences for patient outcomes. At best, as EHR usability lags behind, so does the opportunity to promote the end user experience, enabling the EHR to be a catalyst for improved patient care and wellness. We need to find better strategies for usability to make it into the built EHR system.

2.4 Influence of the Organization

As we discuss the challenges to incorporating usability into the EHR systems, in a fast-paced high market-demand environment, it is important to provide a context into which the systems will be implemented and utilized. According the U.S. government’s website “HealthIT.gov” (www.healthit.gov), Peter Drucker, called health care workplaces “the most complex human organization[s] ever devised.” Interactions between the complex environments of health care workplaces and increasingly complex EHRs can result in subtle unintended consequences of EHR implementation. The interactions between the EHR and the work environment or between the EHR and the technical and physical infrastructure can result in problematic consequences, but not necessarily from any product malfunction. The flow of interactions between the HIT and the healthcare organization’s sociotechnical system—its workflows, culture, social interactions, and technologies can result in unintended and

undesired consequences of HIT (Harrison, et al, 2007). This research by Harrison and colleagues (2007) delineates a conceptual model of the Interactive Sociotechnical Analysis (ISTA), that captures common types of interaction with special emphasis on recursive processes, i.e., feedback loops that alter the newly introduced HIT and promote second-level changes in the social system. Usability design strategies at the vendor level need to be informed by how the product will be implemented, utilized and transformed when it is used in the hospital or clinician office. As vendors prepare their usability strategies for both formative and summative usability testing, the ISTA model provides a context to interpret user feedback for both fixes in the short term and future release enhancements in the long term.

3 A PROPOSAL FOR SOLUTIONS

Before a recommendation for improvement on usability practices can be made, it is important to understand how vendors currently define and work with usability. Specifically, it is important to know how internal stakeholders in product development are communicating about usability. In order to understand how EHR software developers and product managers currently incorporate usability into their products, I am proposing a study to interview a representative sample of EHR developers and product managers. Methodologically, the study will use a Delphi process. Hsu and Sanford (2007) describe the Delphi technique as a widely used and accepted method for achieving convergence of opinion concerning real-world knowledge solicited from experts within certain topic areas. Their work describes the technique is used as a group communication process that aims at conducting detailed examinations and discussions of a specific issue for the purpose of goal setting and policy investigation. The Delphi technique is used as a method to identify among experts in a field, what 'should' be (Miller, 2006).

The proposed study will use a mixed method approach. The Delphi process will facilitate identifying what should/could be in the future as far as best practices. This will be combined with a semi-structured 1:1 interview of product developers and managers to understand current practices, language and communication processes.

Specifically questions will be asked in the following areas:

- a. How do you define usability?
- b. How do you currently prioritize usability?
- c. Are principles of usability part of the non-functional requirements for the product?
- d. Does anyone discuss or email about how to incorporate usability or why it is important? Who? How often?
- e. How would you like to/ should you prioritize usability?
- f. How do you currently incorporate usability principles into your product set?
- g. How would you like to/ should you incorporate usability?
- h. If yes, then what is the timing or at what point in the software development lifecycle it is incorporated?
- i. If yes, then how could you like to/should you modify the timing of when usability is incorporated?
- j. What would you recommend in terms of strategy for incorporating usability into their products?
- k. In terms of your internal process with usability, what is working, what is not working, what can be improved?
- l. What is the biggest challenge you have in incorporating usability?
- m. When did this work well? Why?

Findings from this study will be used to identify best practices for EHR vendor product development teams. Moreover, findings will be used to help improve communication and strategies between vendors and their clients for evaluating usability to improve the product, implementation and overall experience.

4 CONCLUSIONS

It is imperative to find new, more realistic, strategies of incorporating usability into EHR systems. This project focuses on one of the EHR stakeholder groups, and proposes a way to improve usability strategies among the people who literally build the product: product developers within EHR vendors. The EHR provides tremendous opportunities to improve efficiency and effectiveness for health care providers. Ultimately, the advances created in the EHR systems allow for better medical care and

better health outcomes for patients. These improvements will be incremental, and they will not be without complexity. In order to realize the potential of EHR systems, it is critical that the EHR employs user center design and usability strategies in the early parts of the software development lifecycle. This will result in a system that is easier to use and intuitive. In order to improve usability in EHR systems, all stakeholders need to make efforts to break down the silos of information and identify and use a common language toward achieving a unified goal of optimal health outcomes for patients. Only then can a realistic solution be achieved. The proposed project represents an effort to identify that common language and shared vision among EHR developers and users.

Assessment Research and Evaluation, 12(10). Available online: <http://pareonline.net/getvn.asp?v=12&dn=10>.
 ISO/IEC. 1998. 9241-11 Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) – Part 11: Guidance on Usability. Geneva, Switzerland: ISO/IEC.
 Miller, L. E. 2006. Determining what could/should be: The Delphi technique and its application. Paper presented at the meeting of the 2006 annual meeting of the Mid-Western Educational Research Association, Columbus, Ohio.
 Zhang, J. and MF Walji. 2011. TURF: Toward a Unified Framework of EHR Usability. *J Biomed Inform.* 44(6):1056-67.

REFERENCES

- Garg A, Adhikari N, Heather M, Rosas-Arellano M, Devereaux PJ, Beyene J, et al. 2005. Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review. *JAMA*, 293(10):1223-1228.
- Chaudhry B, Wang W, Wu S, Maglione M, Mojica W, Roth E, et al. 2006. Systematic review: impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med*, 144(10):742-752.
- Bates D. 2005. Computerized physician order entry and medication errors: finding a balance. *J Biomed Inform*, 38(4):259-261.
- Campbell E, Sittig D, Ash J, Guappone K, Dykstra R. 2007. In reply to “e-Iatrogenesis: the most critical consequence of CPOE and other HIT.” *J Am Med Inform Assoc*, 14:389-390.
- Harrison, M., Koppel, R. and S Bar-Lev. 2007. Unintended Consequences of Information Technologies in Health Care—An Interactive Sociotechnical Analysis. *J Am Med Inform Assoc*, 14(5): 542–549.
- Charles, D., M. Gabriel, and M. Furukawa. 2014. Office of the National Coordinator for Health Information Technology. *ONC Data Brief*, (16), 1-9.
- HIMSS Usability Taskforce. 2009. “Defining and Testing EMR Usability: Principles and Proposed Method of EMR Usability Evaluation and Rating.” http://www.himss.org/files/HIMSSorg/content/files/himss_definingandtestingemrusability.pdf.
- Hsiao, C. and E. Hing. 2014. Use and Characteristics of Electronic Health Record Systems Among Office-based Physician Practices: United States, 2001–2013. *NCHS Data Brief*, (143).
- Hsu, C. and Sandford, Brian A. 2007. The Delphi Technique: Making Sense of Consensus. Practical.