

The Need to Optimize the Electronic Health Record: Usability Issues in Legacy Systems Can Compromise Patient Safety

Rebecca A. Meehan

School of Information, Kent State University, 1125 Risman, Kent, OH, U.S.A.

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Abstract: It is imperative that usability issues affecting patient safety continue to be fixed in the electronic health record (EHR), especially in legacy systems that may not be updated or replaced for years to come. EHR developers and vendors are partners with hospital systems and clinicians in identifying, prioritizing and fixing problems in the EHR that may adversely affect patient safety. Many of these issues are identified by clinicians as issues of poor usability. This presentation discusses current processes for identifying, prioritizing and fixing usability issues as they arise in the implemented or legacy system by both vendors and hospital groups. Strategies for how to improve processes moving forward are discussed.

1 INTRODUCTION

As we strive to improve health care by leveraging advancements in health information technology, it is imperative to fix usability issues affecting patient safety in the electronic health record (EHR) both in new system implementations and in existing legacy systems. This addresses the recommendation by the American Medical Association (AMA, 2014) when it recommended strategies for improving care by improving EHR usability. Among eight recommendations, the AMA report calls for methods to expedite user input into EHR design and to gather post-implementation feedback. Usability fixes recommended by end-users are part of the post-implementation feedback but may be stymied by an organizational culture or infrastructure that is not prepared to offer feedback, or at least timely detailed feedback. There can be propensity for organizations to justify enduring with their existing EHR, despite poor usability because of competing priorities, or other flawed justifications such as the team can find workarounds for the issue, or they should just wait and the issue will be corrected in a new system. However, the new system might be years away. And, for usability issues that are impacting patient safety outcomes, there is no time to wait.

This paper describes the foundational pieces to an on-going research project examining the current processes and strategies for improvement for identifying, prioritizing, and fixing usability issues as they arise in the implemented or legacy system by two

major stakeholder partners: EHR developers/vendors and hospital groups. These issues can be seen as part of EHR optimization, or the timing in the EHR implementation cycle of making the EHR the most effective, efficient, and supportive it can be. (Romero & Staub, 2016). This includes identifying processes and elements that have poor usability, resulting in harm or the potential to harm patients. The steps to examine the practices of how errors and usability issues related to the EHR are resolved include the following:

Step 1 How are issues identified: who reports the issue and to whom (a supervisor, information technology (IT) representative, EHR vendor representative).

Step 2 How are issues prioritized: what is the process for collecting the list of issues and assigning them with high priority or low priority (committees, unit supervisor, IT department, EHR vendor, CMIO).

Step 3 When these EHR usability problems compromising patient safety are indeed fixed, how long does it typically take and what is the process for getting the fix implemented into the system, and communicating the fix to stakeholders, especially the original reporter.

These process components of addressing usability issues in the built legacy EHR from the perspective of both the EHR vendors and the hospital/ health provider stakeholder groups are critical to improving patient safety.

2 BACKGROUND

2.1 Rapid Adoption of the EHR

In the United States (US), the Health Information Technology for Economic and Clinical Health (HITECH) Act, as part of the American Reinvestment and Recovery Act (2009) provided financial incentives for eligible providers and hospitals to adopt EHRs and use them meaningfully. As a result, there was a rapid increase of EHR adoption from 9% of all hospitals with a basic EHR in 2008 to over 96% of all hospitals using a certified EHR in 2017 (<https://dashboard.healthit.gov/quickstats/pages/FIG-Hospital-EHR-Adoption.php>). This rapid adoption and implementation cycle have been criticized (Schulte & Fry, 2019) for how it likely created risk for EHRs to be implemented that met requirements, but also had some usability issues that may result in unintended consequences compromising patient safety.

2.2 Benefits of the EHR

The EHR is used worldwide to maintain health records, transforming the way clinicians and patients interact with health information. The EHR contributes to improved quality of health care through improved visibility of data, allowing for a more complete health record to be stored, accessed and shared. The EHR has transformed healthcare in that it enables clinicians to have more information about a patient's medical history, diagnosis, allergies, medications, imaging and lab results, etc. in order to inform the best care possible. Beyond these advantages, the EHR also brings challenges and unintended adverse consequences associated with poor EHR usability.

2.3 What Is Usability?

Usability is defined as how useful, usable and satisfying a system is for the intended users to accomplish goals in their work (Zhang & Walji, 2011). In order for the EHR to have good usability, the software should be intuitive, and easy to use so that clinicians and other stakeholders to get their jobs done, without the stress of not understanding how to use the system. For clinicians, this means getting the right information, for the right patient at the right time, so that information about the patient's health history, medications and current status can inform the best care possible. In today's digital health environment, so much more information can be

presented to the clinician in the care process (e.g. medication information, imaging, social determinants of health, allergies, prior health status, etc.). The numerous data sources have the potential to provide a more comprehensive view of a patient's health. However, poor usability can, not only jeopardize this ability for the clinician, but it also can lead to patient harm. For example, the clinician may choose to prescribe a medication. These medications are often presented in the EHR using a data field or drop-down selection box. So, in this example, it is critical for the drop-down box to show the full name and dosage amount, and not have that view obscured or shortened so that the wrong medication or dosage is selected accidentally. Obviously, by selecting the wrong dosage or medication, the patient could be harmed. Not only are there compromises to patient safety, but poor usability affects the clinicians who use them. The EHR system needs to be easy to use, in order to minimize the fatigue of end users, and to allay clinician burnout (Gardner, et al, 2019). Poor usability in the EHR, being used in the context of a stressful health care setting has resulted in unintended consequences compromising patient safety (Howe, et al, 2018) and new unintended consequences (Sittig, et al, 2016).

2.4 Unintended Consequences

Campbell and colleagues (2006) describe several unintended adverse consequences of computerized provider order entry (CPOE) systems a few of which include more/new work for clinicians, changed communication patterns, unfavourable workflow issues, generation of new kinds of errors, unexpected changes in power structure, and overdependence on the technology. These issues continue to shape the efficiency and effectiveness of the EHR by virtue of the effect on the end users, both individually and as part of organizational culture. As a result, work patterns, expectations and satisfaction levels change. Despite tremendous progress in EHRs, unintended adverse consequences of the EHR have evolved over the years. Sittig and colleagues (2016) described new unintended adverse consequences of the EHR, some of which include complete clinical information unavailable at the point of care, inadvertent disclosure of large amounts of patient-specific information; a decline in the development and use of internally-developed EHRs, and lack of innovations to improve system usability leading to frustrating user experiences. This evolution of unintended adverse consequences is indicative of the exponential growth

in the use of EHRs, as well as the tremendous capability of the systems.

Substantial increases in the amount of time required to interact with the EHR by clinicians and other hospital staff is changing clinical care patterns and interactions with patients. Clinicians are reporting lower levels of job satisfaction and early burnout (Gardner, et al, 2019). This experience can be made worse by poor EHR usability, disrupting workflow and creating workarounds. Staff burnout continues to be an issue, and strategies to ameliorate this call for technology solutions to be improved by clinician-vendor collaboration in design and deployment (*The Lancet*, editorial, 2019).

2.5 Legacy System

A legacy EHR system is one that has been implemented and used by a hospital system or provider office for over three years. A legacy system is not brand new, but it is one that the organization is living with or has lived with for quite a while. As technology evolves, EHRs are delivered and maintained on different technological platforms, each with different ways in which they can offer updates to health care provider and hospital clients. These platforms include local on-site servers, software as a service, and cloud-based systems. Regardless of platform, fixes to the software can be delivered in a few different ways. 1) Software fixes delivered as “patches” are made available with the most frequency and can offer a temporary fix to an error, until the code is incorporated into the new upgrade base code. 2) Fixes to high priority issues to live systems that need immediate attention can be delivered as “hotfixes.” 3) A “system update” to the software occurs with some regularity but can be less frequent and tend to include several fixes or enhancements to a system. The time it takes for a usability issue with the EHR to be identified, prioritized and fixed will vary widely. Because of this, communication back to the original person reporting the usability issue can be inefficient and ineffective.

2.6 Communication

Communicating the details of these fixes is important so that the clinicians who originally called for the fix can see that the change has been made. If there is too much time that elapses between the original request and the fix, the danger is that inefficient workarounds will continue to be used. Moreover, it slows down progress and improvements. Any type of fix to the EHR software is typically communicated with some

form of release notes, so that when the client applies the fixes, other stakeholders can read what changes are being addressed in the fix. Mis-communication issues can arise when the release notes are not readily available, or if clinicians on site at the hospital or health provider do not read the notes, and hence may not be informed until they use the system and see that it is running differently. This communication is important so that clinicians can stop using workarounds and start using the EHR as intended.

2.7 EHR Optimization in Legacy Systems

EHR implementation has been the focus of efforts by vendors, hospitals, consulting groups, and both government-based and independent organizations for health care quality over the past several years. Now that, as of 2017, 96% of hospitals in the US have implemented certified EHRs (<https://dashboard.healthit.gov/quickstats/pages/FIG-Hospital-EHR-Adoption.php>, accessed 11-9-19), stakeholders have an opportunity to make these systems more effective and efficient as part of an EHR optimization phase (see Figure 1).

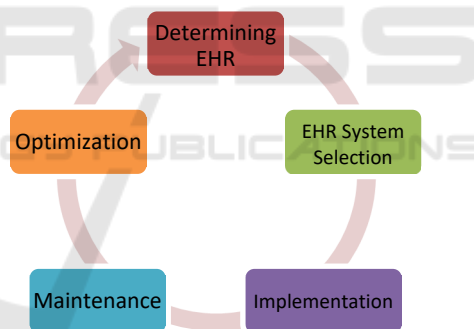


Figure 1: Cycle of EHR Implementation and Optimization.

EHR optimization is the process that takes place after implementation to maximize the benefits and utility of the system (Moon, et al, 2018). Others have described EHR optimization as ongoing, and necessary to be incorporated into each organization’s structure and culture (Blavin, et al, 2013). In a like manner, system maintenance is continuing, and can facilitate optimization. Overall, it is in the phase of EHR optimization that usability issues compromising patient safety can be identified, prioritized and fixed. This ongoing vigilance about how the system should be working is critical. To that end, it is important to identify best practices to support optimization and to make improvements in care and patient safety outcomes.

3 CURRENT STRATEGIES

When hospital end users encounter a problem with the usability of the EHR, leading to potential for patient safety concerns, they need to have an organized way of getting it fixed. Part of this can be addressed by voluntarily completing a patient safety report on site in the hospital to give others visibility to the issue. Another part of the process involves taking necessary steps to bring the issue to the attention of the EHR developer/ vendor. This process not only requires an efficient and effective process on the health care provider/ hospital side, but also with their EHR vendor/ developers. A partnership between the hospital and the vendor is a necessity in order to facilitate post-implementation feedback and to optimize the EHR by fixing the system to avoid errors that may compromise patient safety.

3.1 EHR Developers/ Vendors

There is little to no literature on the best practices of EHR optimization from the EHR developer/ vendor stakeholder group. Still, developers and vendors have processes in place for continuous improvement including the timely fixes made as the EHR product is supported and given new modifications under standard maintenance. Fixes to the system or improvements to the system are typically driven by product enhancements or additional functionality that did not make it into the first release of the product, but, instead were planned as part of future releases, in which clients would be able to take an upgrade to their system for these new pieces of functionality. Changes by the developer/ vendor to the EHR are also driven by enhancement requests and fixes/ tickets requested by the hospital / health provider client. These requests need to be prioritized and decisions need to be made on if and when they will be fixed for the client's EHR system. Moreover, decisions are made on how the clients will be able to take and apply these fixes to their system: will it be a patch made available immediately for one client or more clients, part of a routine update to the software, made available at the next release, or will these changes be incorporated into a new product release altogether, and available for an additional cost to existing clients? These decisions about priorities are typically made by the product team and may not be uniformly applied. Many usability related requests often make it onto the product backlog, waiting for a time to be incorporated into the system. And many of these backlog issues have a hard time seeing the light of day. Many EHR vendors/ developers have talked

about struggles with moving items from the backlog and into the current sprint (for an agile development process) and into the product.

Inevitably, product teams and usability experts need to advocate for these usability changes to be made to the existing system. This can be difficult to prioritize these fixes over delivering new functionality or working around ever changing regulatory requirements for the EHR. This is a continuing cycle, and one that needs attention in order to understand best practices. In a like manner, hospitals/ providers need to have an efficient and effective way of fixing usability problems in legacy EHR systems.

3.2 Hospitals/ Clinical Provider

Hospital systems need to find efficient processes to identify these usability issues that need to be fixed within the EHR, because organizations typically "live with" these systems between 7-10 years before new and updated systems are implemented. There are occasional updates to the EHR, but those are typically made on individual components and are not comprehensive. These processes are part of EHR optimization, the continuous process of assessing the system for ways to improve efficiency (Romero & Staub, 2016).

There is a limited literature on work done in this area, however, Moon and colleagues (2018) used a qualitative approach to conduct interviews and focus groups with high performing health care organizations in the US. Results from their study describe relevant issues that arise during the optimization process, including the exponential uptick in software enhancement or change requests after the product go-live. There was no associated process of efficiently addressing these concerns. Recommendations from the study include that hospitals/ health providers should dedicate resources to addressing optimization issues going forward.

4 STRATEGIES FOR MOVING FORWARD

4.1 Partnership between Vendors and Clinical Providers

Moving forward, the way to optimize the EHR to protect patient safety outcomes stemming from usability fixes may be to rely on a partnership between EHR vendors / developers and clinical or

hospital providers. Both stakeholder groups play a role in the organization of a strategy and commitment to the continuing process of identifying, prioritizing, fixing and communicating fixes on the EHR back to all stakeholders.

4.2 Future Research

In order to evaluate the current status and practices for identifying, prioritizing and fixing patient safety issues related to poor usability in legacy EHR systems, Kent State University (USA), led by the author, is conducting survey research among both EHR vendors and hospital systems in the United States. Key metrics include:

- descriptors of the size and type of hospital or EHR vendor;
- number of patient safety related fixes to the EHR reported vs. number of fixes made;
- descriptors of platform types of EHR products used or made (e.g. cloud based, local install);
- identification of where fixes are made (on-site at the hospital IT department or at the EHR vendor site);
- description of current process to identify, prioritize and fix patient safety issues related to usability;
- description of what in the current process is working well and what needs to be improved.

This study will be divided into two phases, one for each stakeholder group: 1) EHR developers and vendors, and 2) hospitals/ clinical providers. Data collection is ongoing. Implications for patient safety outcomes related to EHR optimization processes will be discussed.

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