DEVELOPMENT OF AN ELECTRONIC PATIENT RECORD SELECTION INSTRUMENT

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Selecting an effective electronic patient record (EPR) system is a challenge for both large and small medical organizations. As a result, significant investments are often wasted or fail to meet expectations. This paper presents the development of a survey instrument that assists medical providers to review EPRs and to identify how well each one matches their organization’s needs, preferences and workflows. Five stages were conducted. First, the academic and applied literatures were reviewed for issues of importance in the selection process. Existing EPR systems were benchmarked to identify baseline levels of functionality and performance and identify gaps with the expectations found in the literature. A prototype survey instrument was developed to cover the requirements that were identified, specifically focusing on common deficiencies of existing EPRs. Contextual interviews were conducted with administrators, doctors, nurses, and health IT experts to review the content, wording, and format of the prototype instrument. Finally, the prototype was revised to reflect the results of the interviews. The focus of this project was the development of a survey that covered the EPR’s comprehensiveness, customizability, and usability. The result is an effective tool that medical organizations can use to better select an appropriate EPR system.

INTRODUCTION

McKinsey & Company’s technology research group described the current state of health care information technology (as of 2010) as at a critical state in its development (Pawan and Pietraszek, 2010). According to their survey, the health care insurance industry alone had 350 companies and IT spending of $13 billion. Integrating the technologies from hundreds of vendors to create a useful technology is a huge challenge (Cantrill, 2010). Recent legislation, such as The Patient Protection and Affordable Care Act will complicate the industry still further. Previous legislation, in the form of the American Recovery and Reinvestment Act and others, now mandates that health care players use electronic health care records to support and improve the delivery of services. But the billions of dollars that will be invested in the development of new IT systems will be wasted if they don’t satisfy the complex user requirements and unique workflows inherent in the health care domain (Armijo, McDonnell, and Werner, 2009a). Health care has a distinctive culture, with a complex interaction of legal, financial, cultural, and socio-technical dimensions (Bagnara, Parlangeli, and Tartaglia, 2010; Carayon, 2010; Wilson, Pavlas, Sharit, and Salas, 2010). Each of these populations has a different level of expertise, need for information, and usability requirements. This has limited the use and effectiveness of EPR systems and often caused outright failure (Cantrill, 2010; Wilson, Pavlas, Sharit, and Salas, 2010).

Reece (2011) summarizes his experience with EPRs and shares the experiences of other medical practitioners with whom he has interacted. He cites many deficiencies in existing EPR products, including that they commonly raise costs, decrease doctor-patient communication, constrain the doctor’s diagnostic process and therefore prevent them from thinking outside the box, they can’t handle vague and uncertain symptom descriptions, don’t account for patient’s body language, and distract from time focused on the patient. There are also technology problems. They are complex to maintain, often incompatible with other health IT, and can risk patient privacy.
The Importance of Usability

McDonnell, Werner and Wendell (2010) cite several extensive studies which found that usability is one of the key factors that drives the adoption of electronic health care records (EHR). Belden, Grayson, and Barnes (2010) also report that many healthcare organizations are reluctant to integrate electronic patient record systems (EPRs) because of their history of failure and their lack of support for the organization’s natural workflows and practices. Unfortunately, they also report that many health IT vendors do not adequately address usability issues in their product development processes. These vendors claim that they have a “deep commitment” to usability, but they fail to integrate formal usability testing and user-centered design and often do not have usability experts involved in product development. This leads to IT systems that fail to meet user requirements despite the significant advantages that more usable systems can provide, such as eliminating unneeded tests, improving communication between patient and caregiver and among caregiving teams, improved patient safety and quality of care, and many other possible benefits (Cantrill, 2010). The potential cost savings of usable systems is extensive. The expert panel organized by McDonnell and colleagues (McDonnell, Werner, and Wendel, 2010) supports the development of tools that evaluate EPRs in terms of their ease of learning, effectiveness, and satisfaction using both qualitative and quantitative measures. To this list can be added other usability metrics such as fault tolerance (Cantrill, 2010), quick and accessible patient views (Jun, Ward, and Clarkson, 2010), explorability (Armijo, McDonnell and Werner, 2009b), customizability (Bagnara, Parlengeli, and Tartaglia, 2010) and socio-technical metrics (Wilson, Pavlas, Sharit, and Salas, 2010).

Limitations of Existing Systems

The litigious nature of the healthcare domain makes these organizations particularly sensitive to system error, reliability, and how well their natural workflows are supported by any information technology they use. This is particularly critical for systems such as EPRs that have a direct influence on patient care. Without a usable, user-friendly, and customized system, the integration challenges make the risk not worth taking. Healthcare organizations need tools to help them identify health IT systems such as EPRs that can be effectively integrated into their particular environment.

Unfortunately, instruments for this purpose do not yet exist in the Health IT domain. Instruments that can effectively evaluate IT systems need to satisfy several requirements. They need to cover all of the functional and performance requirements that users may have [Bagnara, Parlengeli, and Tartaglia, 2010; Cantrill, 2010; Carayon, 2010]. They should provide a mechanism to facilitate structured observations that allow subject matter experts to evaluate the system without significant usability or technical expertise (Armijo, McDonnell and Werner, 2009a). They should facilitate the comparison of competing IT solutions to identify the one that best meets the particular needs of a user group and application context (Armijo, McDonnell and Werner, 2009b; McDonnell, Werner, and Wendel, 2010). Because of the uniqueness of the health care domain, instruments must be customized specifically for health care users and cater to their diverse requirements.

THE DEVELOPMENT OF A NEW ELECTRONIC PATIENT RECORD SYSTEM

Objectives

This project begins the development of a comprehensive Health IT System evaluation instrument. The overall objective is to create an instrument that is sufficiently customized for the health care domain, but sufficiently generalizable to adequately support a variety of health care IT applications, including patient histories, examinations, assessments, diagnosis, treatments, and progress notes. It should also cover complementary functions such as pharmacy and lab tests. It must be appropriate for organizations that are private or public, large or small, and inpatient, outpatient or some combination of these two. This is necessary because hospitals often don’t ask the right questions or make the right demands to get usable products from EPR vendors (Van Sonnenburg, 2011). They need a tool to help them communicate their specific needs.

An early attempt to use a survey instrument to match EPR systems with medical practices was conducted by Eden (2002). He found that surveys that compare multiple systems and consider prior user testimony increased perception and acceptance of the EPR that was eventually selected. However there was no verification of whether this was a result of increased buy-in or because it improved the actual match between doctors’ needs and the system capabilities.

Hawkins et al. (2010) report on an early effort to create a Health IT evaluation instrument. They focused on two specific dimensions: presence and interactivity. Presence was further divided into physical presence and social presence. They recruited 661 breast cancer patients to validate the instrument. While this effort was extremely limited in scope and applicability, it can serve as a launching point for further development and
provides insights into the most effective methods to develop a Health IT evaluation instrument.

Step By Step Activities

Requirements Compilation. The first step was an extensive review of public and private sources to identify functional and performance requirements for each major category of healthcare stakeholder. The relevant academic and practitioner literature was surveyed to identify both health care related requirements and usability issues that must be included to ensure an effective instrument-organization match. Subject matter experts in health care and human factors were surveyed for both domain requirements and usability issues. Representative members of each major healthcare stakeholder group were queried to determine how current Health IT Systems fail, and the functionality that they would like to see included in these systems. An extensive set of requirements was compiled. The size of this list made it clear that the instrument would have to be selective in how it presented questions, either through customization based on the type of healthcare organization or by prioritizing the questions and eliminating those that were viewed as less important by the healthcare community, if such a list existed.

Electronic Patient Record Benchmarking. The major products on the market from vendors such as Allscripts, GE, NextGen, and eClinicalworks (four leading vendors) were benchmarked for functionality, performance, and usability to establish baselines of performance. These were used to design the scales for the instrument.

Prototype Development. A prototype evaluation instrument was developed based on the results of the requirements, benchmarking analysis, interviews, existing health IT interface design principles and guidelines from the AHRQ and HIMMS studies [Armijo, McDonnell and Werner, 2009a; Armijo, McDonnell and Werner, 2009b; Belden, Grayson, and Barnes, 2010] and general usability best practices for survey design. Figure 1 displays an example of one section of this prototype.

Contextual Interviews. The prototype was tested through a series of contextual interviews. A range of health care practitioners, including doctors, nurses, pharmacists, technicians, and medical device vendors were recruited through personal contacts and extensive networking. Each interview lasted one to two hours and focused on reviewing each question for its validity, wording, and importance in EPR selection. General questions were also asked regarding the importance of customizing the instrument for different categories of healthcare organization, and if so, which differences were of most importance.

The interview transcripts were analyzed to identify the underlying themes and requirements and as an input to the improvement and refinement of the instrument. The results showed that a branching instrument was needed so that a large set of criteria could be included but not all organizations would review each criterion. Some criteria were discarded as unimportant to all stakeholder groups, but most were important to at least some. There was consensus among respondents that inpatient and outpatient organizations would need to review significantly different criteria and the practitioners “in the trenches” would have different requirements than insurance companies and hospital administrators, but for inpatient systems both would be important during the evaluation process.

It was also determined that each criterion needed to be reviewed in two ways consecutively. First, the organization needed to determine how important the criterion was for them, given their specific needs, preferences, and workflows. This could be completed once in advance of reviewing actual EPR candidates. Then for each system being reviewed, the ability of the EPR to satisfy this specific level of requirement needed to be evaluated. A comparison between the two would determine if an EPR system was a good match and/or to compare the quality of match between competing vendor products.

Instrument Development. Based on the insights gained from these interviews, the prototype was significantly updated. A section of the resulting instrument is shown in Figure 2. This is not a tool that can be implemented in the field as yet, but is a design prototype that can be used to develop customized and branching instruments for various health sectors.

Further development should follow avenues suggested by Halamka (2011). He predicts that EPR systems will move to the cloud so doctors and small practices don’t have to manage the IT in-house. He suggests private clouds at first because of the privacy requirements of HIPAA. But he predicts that these will evolve into regional data exchanges. He also predicts that the hardware will move to a portable format such as a tablet with separable modules for each stakeholder. Each of these advancements will alter the requirements of medical practices and therefore the questions that should be addressed in a survey instrument such as the one developed here.
ACKNOWLEDGEMENTS

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REFERENCES


Software Usability Questionnaire

Software Usability Questions

Finally, we seek to learn about the impact the software has had on your practice. I will read to you several statements. For each statement, please give me a rating of agreement ranging from “strongly disagree” to “strongly agree”. If the stated impact is not pertinent to your practice, please respond with “not applicable”.

The computer software has created a more accurate and timely billing process. Would you …

- Strongly disagree
- Slightly disagree
- Neither agree or disagree
- Slightly agree
- Strongly agree
- Not applicable

The software has improved the scheduling of patients for routine, preventive and urgent appointments. Would you . . .

- Strongly disagree
- Slightly disagree
- Neither agree or disagree
- Slightly agree
- Strongly agree
- Not applicable

The practitioners have reduced the amount of time and effort needed to complete patient records.

- Strongly disagree
- Slightly disagree
- Neither agree or disagree
- Slightly agree
- Strongly agree
- Not applicable

The practitioners have an improved ability to access accurate patient information from multiple sites.

- Strongly disagree
- Slightly disagree
- Neither agree or disagree
- Slightly agree
- Strongly agree
- Not applicable

Figure 1. Sample questions from the prototype survey instrument
## Software Usability Questions

<table>
<thead>
<tr>
<th>Software Usability Questions</th>
<th>Does the proposed EHR system create a more accurate and timely billing process to meet your needs?</th>
</tr>
</thead>
<tbody>
<tr>
<td>How important is it for the EHR system to create a more accurate and timely billing process?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to improve the scheduling of patients for routine and urgent appointments?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to reduce the amount of time and effort needed to complete patient records?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to improve the ability to access accurate patient information from multiple sites?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to improve the accuracy of practice documentation, helpful in reducing malpractice costs?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to improve the referral process in sending and receiving referrals quickly?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to improve the ability to communicate with people external and internal to the practice?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to improve the ability to consult professional journals?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to minimize the time to receive lab reports, X rays and consultation reports?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
<tr>
<td>How important is it for the EHR system to improve the tracking and scheduling of general immunizations and screenings?</td>
<td>□ Not at all □ Somewhat □ Very important □ As much as I need</td>
</tr>
</tbody>
</table>

Figure 2. Sample from the revised instrument showing the same question content as Figure 1.