TOWARD THE DESIGN OF AN ENGAGEMENT TOOL FOR EFFECTIVE ELECTRONIC HEALTH RECORD ADOPTION

Posted on December 6, 2018 by Administrator

Category: Electronic Records

Tag: electronic health records; consolidated framework for implementation; intervention; adoption

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Abstract

As healthcare systems continue to expand their use of electronic health records (EHRs), barriers to robust and successful engagement with such systems by stakeholders remain tenacious. To this effect, this research presents the results of a survey tool utilizing both original and modified constructs from the Consolidated Framework for Implementation Research to assess key points of engagement barriers and potential points of intervention for stakeholders of EHRs in a large-scale healthcare organization (500-bed level II regional trauma center). Based on the extensive assessment, the paper presents recommendations for the utility of engagement process modeling and discusses how intervention opportunities can be used to mitigate engagement barriers.

Keywords: electronic health records; consolidated framework for implementation; intervention; adoption

Background and Introduction

The integration of technology into healthcare systems presents a complex narrative. While technology use in healthcare settings (clinical and nonclinical) has been touted as an asset for healthcare providers, healthcare consumers, and other relevant business stakeholders,[1–3] resistance to technology implementation and the subsequent failure of health information systems are well documented.[4, 5] A more realistic perspective on the implementation of technology would be one that views implementation as an iterative process that must continually take into account the variability of complexity[6] and context in healthcare settings. However, the substantial resources involved in implementing a technology-based system into a healthcare setting (financial, human, time, and risk management) necessitates early implementation success and full engagement on the part of all stakeholders to maximize the benefits of using the system. The use of electronic health records (EHRs) is an illustrative case, as the benefits of use may greatly depend on the engaged interactions of patients, healthcare providers, and other healthcare system professionals.[7–9] The term *engagement* may be most often used to reflect interest in and access to a technology. However, for purposes of this study, the term is applied to a broader context encompassing the range of practices and processes of stakeholders from adoption to integration of EHRs.

As part of a continuation of work on leveraging the cloud for EHR access,[10] the researchers developed a process for engagement modeling. A key component of this modeling approach was the construction of a survey tool based on constructs of the Consolidated Framework for Implementation Research (CFIR) to investigate barriers to full engagement of the technologies

involved in EHR access and implementation. The CFIR is one of several emergent models from the field of implementation science.[11–13] Despite psychometric measurement challenges,[14] the CFIR has shown great promise as a highly adaptable model for investigating the implementation of technology in healthcare settings.[15–18] The CFIR presents a set of holistic and well-defined implementation construct categories stemming in large part from its parent theory, Roger's Diffusion of Innovations theory,[19] and subsequent work conducted by Damshroeder et al.[20] and others.[21] In summary, the CFIR explores how characteristics of the intervention, the inner and outer settings of where an intervention will be deployed, the characteristics of the individuals who will interact with the intervention, and the functional processes involved with implementing the intervention are all key assessment domains.[22, 23] Information gleaned from the variables within each of the main construct categories[24] can be leveraged to benefit all stakeholders and potentially minimize barriers to successful EHR engagement.

Tool Design and Methodology

Barriers to the implementation of healthcare technology in clinical settings include a wide and diverse continuum ranging from human-related factors (e.g., resistance by healthcare providers) to technical factors (e.g., failed system design).[25–27] While external policies like those of the Meaningful Use program can spur adoption and initial implementation, long-term implementation requires committed engagement by all relevant stakeholders (healthcare providers, information technology staff, and, to some extent, patient end users). Developing a stakeholder engagement model process may be advantageous for organizations to maintain successful implementation by highlighting priority areas where stakeholders have either concordance or discordance on barriers and benefits of the technology.

This research identifies the CFIR as a beneficial framework for engagement modeling because of the comprehensive and holistic nature of the constructs, as detailed in Table 1. These constructs allow for domain flexibility and a thorough investigation of perceptions of benefits and barriers. Although the CFR includes numerous constructs, it includes only five primary areas to investigate. The categories are defined here in context of the current research.

- Intervention characteristics: the attributes and qualities of the intervention (in this case the EHR system)
- Outer setting: the external forces shaping adoption and implementation of the EHR system
- Inner setting: the internal organizational forces shaping adoption and implementation of the EHR system
- Characteristics of the individual: attributes of the stakeholders and end users of the EHR system

- Process mandates: the contextual specificities of the implementation process of the EHR

Using these five categories, one can develop a broad perspective on the "why or why not" of stakeholder engagement and can drill down and focus on specific constructs under each category.

Maximizing the opportunity for successful implementation requires identifying and recommending pivotal attributes to improve engagement outcomes for any given healthcare organization. The current research leverages the CFIR to this effect. The proposed research identified three primary groups of participants for the study: the medical/healthcare staff of a large sized federally recognized healthcare organization, the IT staff at the healthcare organization, and the core in-hospital patients at the organization. The key to a successful healthcare engagement is the focused and directed participation of the stakeholders of the healthcare technology. The three phases, as discussed below, identify the operational process used to design an effective engagement tool across the stakeholder groups.

The first phase of the study (construct identification) included a set of targeted interview sessions conducted to gather qualitative data about the most relevant CFIR constructs for the evaluation study. The interviews were conducted anonymously with the key stakeholders of the healthcare intervention and implementation process. Note that a new iteration of the construct identification process can be conducted if the application domain and/or the patient service environments are modified. Furthermore, our study indicates and recommends that to ensure effective adoption and implementation, the organization should conduct periodic assessments of the construct identification to provide a seamless integration of the developing technology landscape.[28] Figure 1 details the overall interaction diagram, which leverages the CFIR framework for the design of the proposed EHR engagement model.

The construct identification phase lays out the qualitative interviewing process and aids in the instrumentation of the tool to help guide the choice of the constructs. The steps followed in this phase include stakeholder vetting and unique stakeholder identification (this process is done in an anonymous fashion, preserving only the type/experience level of the stakeholder); stakeholder engagement process establishment and verification; and, finally, the controlled study of the process with the target group/community.

After the targeted interview sessions, the researchers used a concept mapping approach (proprietary tool) to identify the CFIR variables[29] (i.e., variables under each of the main construct categories previously identified) that are most relevant to the pilot healthcare organization. These variables were then integrated with the authors' previous work on EHRs to augment (add to or modify) the construct categories to yield an integrated construct domain tailored to the specific healthcare IT environment.

The next phase of the tool design process is the data collection and analysis phase. This phase is

important to review the appropriate feedback on the identified constructs and assimilate stakeholder input to provide accurate metrics and priorities for the appropriate interventions. The steps followed in this phase include data collection, priority selection, and data analysis (via interview sessions to determine metrics for tool development). The constructs are iteratively modified on the basis of stakeholder feedback to ensure that they are mapped to the appropriate implementation domain.

The next phase of this process is the tool implementation phase, which is based on the feedback from the previous phases. The implementation phase included a targeted functional review of the tool and an iterative evaluation and analysis prior to dissemination. The tool was designed and implemented with a modified set of CFIR constructs identified for the domain-specific study. It also included an augmentation of additional constructs necessary for the specific domain of assessment, such as accountability, interoperability, and organizational compliance. The detailed definitions and mapping of the constructs for the engagement modeling are stated in Table 1.

The final phase is the dissemination of the designed tool over the three vital stakeholder domains, namely medical staff, IT staff, and patients. The survey was disseminated over a 500-bed Level II certified regional trauma center at stage 6 of the HIMSS Analytics Electronic Medical Record Adoption Model, managing more than 500,000 patient admissions per year. The healthcare organization houses a large data center that caters to three medium-scale auxiliary hospitals and 20 participating specialized clinical practice centers. The tool included an intuitive tiered numerical mapping for the survey. The participants were advised by the tool to identify, with a score of 0 (no relevance), 1 (positive relevance), or −1 (negative relevance), each construct's influence on EHR healthcare technology adoption and their role's mandate to achieve the goal. The data collection was conducted over six months through an online secure anonymous survey tool, with only limited role identification required from the participants.

Evaluation

The survey instrument was successful in retrieving more than 60 responses from the participants. Participation was mainly targeted toward the medical staff who provide clinical services, to assess their views on the factors necessary for effective EHR adoption.

Table 2 details the summative score for each construct based on their response. For example, for the construct "complexity," 20 of the 35 medical staff participants responded that the construct is a relevant factor for addressing and improving effective adoption. Similarly, for the construct "engagement," none of the 15 patient participants responded that the construct has no relevance to their role to enforce and/or promote adoption. For participants in the IT staff role, constructs such as "adaptability," "trialability," "complexity," "client needs/requirements," and "regulatory policies and incentives" hold the highest relevance for effective implementation of technology interventions.

Note that the negative relevance identified by some participants in a given group has the potential to reduce the summative rank and score of the construct for that particular category. The survey tool enabled the researchers to analyze the data collected and identify interventions for each stakeholder group. Table 3 details the engagement barriers with priority rankings for each such group. The priority levels designed for each group are proportional to the participation ratio.

The survey tool and the analyzed results enabled the development of the five-step engagement process identified in Figure 2. Each step identifies the barriers to engagement and prompts output to design the appropriate engagement implementation. An iterative feedback loop is integrated to ensure periodic assessment of the outcomes and provide feedback for use in the tool design and analysis phase. The proposed engagement process is portable and can be applied in both inpatient and outpatient healthcare settings.

Discussion and Recommendations

On the basis of the areas identified as the highest priorities, the researchers developed the EHR engagement barrier model (see Figure 1). The model stratifies participant groups, highlights the areas of highest priority to support robust engagement with the EHR system, and notes preliminary recommendations to begin the process of addressing the barriers within the organization. While all the identified barriers hold importance, the focus on the shared highest-priority areas may yield the most benefit in time- and resource-limited environments; therefore, the researchers chose to leverage those specific constructs for the model.

Recommendations for Shared Engagement Barriers across All Stakeholder Groups (Adaptability, Complexity, and Barriers and Needs)

Perceptions of adaptability, complexity, and barriers and needs were noted as significant engagement barriers across stakeholder groups. Both adaptability and complexity correspond to the "intervention characteristic" domain of the CFIR. In this context, the intervention would be the EHR technology innovation purchased and/or built and utilized. Possible interventions include ensuring that all stakeholders have early input on vendor-based or in-house EHR projects via demos prior to adoption. End users (patients and medical staff) sometimes are not included in these decisions until later stages, if at all. Perceptions of complexity can be mitigated via training opportunities, particularly peer-to-peer trainings. The modified "barriers and needs" construct aligns with the CFIR "outer setting" domain. The outer setting domain frames the importance of external variables in the implementation of new processes and products. While barriers and needs may be considered end-user issues, the survey results highlight how important these issues are perceived to be from the perspective of the IT staff as well. In effort to better understand and communicate the landscape of barriers and needs, an iterative rather than a static process of needs assessment and

usability testing may be a preferred approach. Additionally, greater understanding of the technology products that end users interact with regularly outside of the organization may give IT staff valuable information regarding barriers, preferred interfaces, and features to support fuller engagement.

Recommendations for Other High-Priority Engagement Barriers

Other engagement barriers of note may be those mentioned by at least two of the three stakeholder groups. The other high priority barriers noted in the current study were interoperability (patients and medical staff), intervention source (medical staff and IT staff), trialability (medical staff and IT staff), client requirements (medical staff and IT staff), resource availability (medical staff and IT staff), and location (patients and IT staff). The intervention source and trialability constructs correspond to the "intervention characteristic" domain of the CFIR, and the aforementioned recommendations to address intervention characteristics also apply. Resource availability applies to the "inner setting" domain of the CFIR. The inner setting domain encompasses the internal organizational characteristics that affect implementation of an innovation. Of note, the CFIR emphasizes resources beyond the fiscal. To enhance EHR engagement, it may be worthwhile to clarify with stakeholders which categories of resources are most important. Interoperability, client requirements, and location align most closely with the process and outer setting domains, respectively. While the focus of the current research was a fairly large suburban hospital system, the resource challenges faced when the hospital interacts with rural and distant care partners remain a concern. A lack of interoperability of EHR systems further exacerbates perceptions of the location barrier. Ensuring that health technology systems in place meet federal and regional recommendations for interoperability would mitigate this barrier. Meeting these guidelines may require federally based support resources (financial and training).

Conclusion

The researchers formulated a multistakeholder EHR engagement process model by identifying and mapping the CFIR and modifying the relevant constructs for the domain of healthcare technology. The goal was to illustrate an effective process and engagement modeling tool that could be used to quantify EHR engagement barriers. The survey results identified the focus of each participant group and informed the appropriate stakeholders of the need to provide resources to address the high-frequency constructs. The results also aided in the data-driven process of requesting external (federal and/or state) support and funding opportunities, which are needed to provide a sustainable and construct-driven iterative intervention action plan for the healthcare system. The proposed process and tool can be seamlessly replicated in any healthcare organization.

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