Title

Physician champions' perspectives and practices on electronic health records implementation: challenges and strategies.

Journal

JAMIA open, 3(1)

ISSN

2574-2531

Authors

Gui, Xinning

Chen, Yunan

Zhou, Xiaomu

et al.

Publication Date

2020-04-01

DOI

10.1093/jamiaopen/ooz051

JAMIA Open, 3(1), 2020, 53–61
doi: 10.1093/jamiaopen/ooz051
Advance Access Publication Date: 7 January 2020
Research and Applications

Research and Applications

Physician champions' perspectives and practices on electronic health records implementation: challenges and strategies

Xinning Gui,[1] Yunan Chen,[2] Xiaomu Zhou,[3] Tera L. Reynolds,[2] Kai Zheng,[2] and David A. Hanauer[4,5]*

[1]College of Information Sciences and Technology, Pennsylvania State University, University Park, Pennsylvania, USA, [2]Department of Informatics, Donald Bren School of Information and Computer Sciences, University of California, Irvine, Irvine, California, USA, [3]College of Professional Studies, Northeastern University, Boston, Massachusetts, USA, [4]Department of Pediatrics, Michigan Medicine, Ann Arbor, Michigan, USA and [5]School of Information, University of Michigan, Ann Arbor, Michigan, USA

*Corresponding Author: David A. Hanauer, MD, MS, Department of Pediatrics, University of Michigan Medical School, Michigan Medicine, NCRC 100-134, 2800 Plymouth Road, Ann Arbor, MI 48109, USA; hanauer@umich.edu

Received 2 May 2019; Revised 19 July 2019; Editorial Decision 17 September 2019; Accepted 3 October 2019

ABSTRACT

Objective: Physician champions are "boots on the ground" physician leaders who facilitate the implementation of, and transition to, new health information technology (HIT) systems within an organization. They are commonly cited as key personnel in HIT implementations, yet little research has focused on their practices and perspectives.

Materials and Methods: We addressed this research gap through a qualitative study of physician champions that aimed to capture their challenges and strategies during a large-scale HIT implementation. Email interviews were conducted with 45 physician champions from diverse clinical areas 5 months after a new electronic health record (EHR) system went live in a large academic medical center. We adopted a grounded theory approach to analyze the data.

Results: Our physician champion participants reported multiple challenges, including insufficient training, limited at-the-elbow support, unreliable communication with leadership and the EHR vendor, as well as flawed system design. To overcome these challenges, physician champions developed their own personalized training programs in a simulated context or in the live environment, sought and obtained more at-the-elbow support both internally and externally, and adapted their departmental sociotechnical context to make the system work better.

Discussion and Conclusions: This study identified the challenges physician champions faced and the strategies they developed to overcome these challenges. Our findings suggest factors that are crucial to the successful involvement of physician champions in HIT implementations, including the availability of instrumental (eg, reward for efforts), emotional (eg, mechanisms for expressing frustrations), and peer support; ongoing engagement with the champions; and appropriate training and customization planning.

Key words: physician champions, leadership, electronic health records, health information systems, computer user training, EHR customization, implementation science, organizational innovation

INTRODUCTION

Motivated by the potential benefits of health information technology (HIT) and related incentive programs (eg, the Medicare and Medicaid incentive programs, now known as the promoting interoperability programs[1]), U.S. hospitals have increasingly adopted HIT. Over the past decade, most U.S. hospitals have adopted at least basic electronic health record (EHR) systems.[2,3] Despite significant progress, the implementation and adoption of HIT carries substantial risk.[4] Hospitals struggle with challenges which may cause adoption failures and even serious, unintended consequences such as errors that compromise the quality of care and patient safety.[3,5,6] Previous literature has identified numerous challenges including poor HIT system design, upfront and ongoing financial costs, complex implementation of advanced functions, lack of adequate IT support, physician and staff resistance, improper use, and complexity of achieving meaningful use criteria.[3,5–7]

Physician champions—the physician leaders who "facilitate the change necessary to implement a new HIT system within the organization"[4]—are commonly involved in clinical practice and cited in research as important actors who can help overcome the challenges and enhance the chances of successful implementation and adoption of HIT.[4,8–14] However, prior research only discusses the impact of physician champions in general terms.[4] Little attention has been paid to physician champions' practices during implementation and adoption processes,[15] such as their strategies for addressing perceived challenges. Understanding these practices is critical to cultivating best practices for involving physician champions.

We address this gap by conducting an email interview study focused on physician champions' perceived challenges and corresponding strategies to overcome these challenges before, during, and after the implementation of a commercial EHR system that replaced a homegrown EHR at a large academic medical center. In the context of our study, physician champions were clinical subject matter experts who assisted in customizing the new EHR system to meet the local workflow and documentation requirements for their clinical areas, and who assisted their peers in adopting and using the EHR during the implementation. They wore 2 hats—one being the promoter of the EHR selected by, and on behalf of, the implementation team and the other being the representative of end users (peer physicians and other clinicians), ensuring that these voices were heard.

Our study makes 2 main contributions to clinical informatics. First, we add a detailed, in-depth analysis of physician champions' perspectives and practices to the limited empirical literature on physician champions, which yields evidence-based insights regarding how to optimally involve and support physician champions. Second, our study highlights a sociotechnical perspective which considers not only the technical features of the HIT, but also the human, social, and organizational factors (eg, people, workflow, communication, policies) that interact with the HIT.[16] Our study captures the collective wisdom of physician champions and reveals a set of sociotechnical factors that HIT system implementation needs to consider, through highlighting important lessons learned based on their experiences and perspectives with respect to physician champions' engagement, institutional planning, system design and use, training, and communication and coordination. Our findings have important implications for understanding and improving HIT system implementation and user adoption.

METHODS

Research setting

This study took place at Michigan Medicine (MM), a large, tertiary academic health center. MM is an integrated provider of care for patients of all ages and includes 3 hospitals, 6 specialty centers (eg, Cancer, Cardiovascular, Depression), and more than 120 offices and clinics located throughout Southeastern Michigan.

From 1998 to 2012, all providers used the same homegrown EHR system, CareWeb. CareWeb was a central component of a "best-of-breed" strategy that also integrated multiple other homegrown and commercial systems including commercial outpatient e-prescribing, inpatient computerized provider order entry, and obstetrical management systems, among others. In August 2012, all ambulatory care providers switched from CareWeb to Epic (Epic Systems, Verona, WI, USA), a commercial EHR system adopted at other academic medical centers (locally renamed "MiChart"). The switch occurred as one large "big bang"; that is, all providers switched on the same day, and adoption, like use of the prior EHR, was mandatory. At the time this had been described as the largest single-day go-live in the history of the EHR vendor. The implementation occurred in 2 major stages, with ambulatory clinics first (the focus of this analysis) followed by inpatient areas about 2 years later.

In planning for the implementation, physician champions were recruited from multiple ambulatory clinical areas (eg, Dermatology, Adult and Pediatric Emergency Medicine, Cardiology Division of Internal Medicine). Recruitment was at the discretion of each clinical area, but generally involved a physician being nominated and then invited to be a champion. In many cases, the selection was based on physicians' knowledge of the clinical area requirements and workflow, as well as their ability to effectively participate in HIT decision-making. The leadership also aimed to recruit physicians who were enthusiastic about the new system, as champions were expected to promote a positive attitude toward the implementation and encourage adoption of the system. Smaller clinical areas generally had only 1 physician champion whereas larger areas (eg, General Pediatrics, Obstetrics & Gynecology) had more than one.

Physician champions were involved with configuring and customizing the EHR for their respective clinical areas. This included development of document templates as well as preference lists of frequently used orders, diagnoses, and other elements. Physician champions were usually distinct from "super users", the latter of whom were not typically physicians but had additional training in system use to assist others during the go-live process. This distinction was due to the fact that additional training for the physician champions would have been both more expensive and logistically challenging due to their primary obligation to see patients. Outside consultants were also hired to provide advice and hands-on training to some units. Ethical approval for this study was obtained from the University of Michigan Medical School Institutional Review Board (IRB# HUM00064595).

Data collection

Eighty-eight physician champions participated in the ambulatory EHR implementation that replaced the homegrown EHR. We sent an e-mail interview request with 3 open-ended questions to the physician champions 5 months after all users switched to the new system to elicit feedback regarding their perspectives about successes,

failures, and lessons learned regarding the implementation. The questions were:

1. What is your biggest regret with the way MiChart was implemented despite your best efforts? If you have any thoughts about why this still occurred, or what could have been done to prevent the issue, please elaborate.
2. What is the biggest success with how MiChart was implemented that you believe was a result of your efforts? Any details would be appreciated.
3. Please describe anything else you would like to let us know about your thoughts regarding the planning for, implementation of, or post go-live optimization of MiChart that you think would be important for others to know when undertaking similar implementations. This can include "lessons learned" as well as any insights you have.

Those who did not respond to the initial e-mail were sent a single follow-up message approximately 2 weeks later. No incentives were provided to the respondents.

The time point (5 months after all users switched to the new system) was chosen to allow for each participant to have had the chance to gain experience using the EHR in their everyday clinical care practices and because most of the severe "break-fix" issues had been addressed by our Medical Center Information Technology team. Additionally, the subsequent "optimization" period for dealing with requests for changes that were desired but not essential was winding down. At this point, the focus was shifting toward preparing for the upcoming inpatient implementation. The physician champions were heavily involved not only in the initial customization but also in both the "break-fix" and "optimization" tasks and thus had deep insights regarding the issues that arose during the implementation and subsequent use of the system.

The initial e-mail survey to the 88 physician champions resulted in 27 responses and the follow-up e-mail 2 weeks later yielded 18 additional responses for a total of 45 physician champion participants (51% overall response rate). Of the 54 clinical areas with one or more physician champions, 36 were represented among our respondents (67%). Most of the 36 clinical areas were represented by one physician champion participant; however, Hematology/Oncology was represented by 4 respondents and the following clinical areas were represented by 2: Dermatology, Family Medicine, Geriatric Medicine, Neurosurgery, Adult Orthopedic Surgery, and General Pediatrics. The entire corpus of responses contained 12 910 words.

Data analysis

Four of the authors (XG, YC, XZ, and DAH) participated in data analysis. We first removed identifiers and entered interview responses into NVivo 6, a qualitative data analysis software. We then employed a grounded theory approach to analyze the data inductively.[17] As a systematic approach and one of the most widely-used methodologies, grounded theory requires researchers to not pre-define theoretical frameworks, and analyze qualitative data in a bottom-up fashion, in which they first assign basic codes to each piece of data and then refine and aggregate codes to generate larger categories until a satisfactory categorization scheme is reached.[18,19] We chose this methodology because existing literature has not established frameworks for understanding physician champions' experiences and strategies, and a bottom-up methodological approach is suitable for our research questions. Following the steps in this methodology, we first read all interview scripts and conducted *open coding* to develop an initial set of codes (eg, categories, concepts) independently. In this step, the coders independently coded the interview transcripts, and compared their codes by establishing a mutual understanding of what a data record meant and how to code it through discussions until an agreed set of codes emerged. We then returned to the data to conduct a systematic *axial coding* to refine and consolidate open codes into categories.[17] In this step, we used discussions to iteratively group codes with similar ideas, and clarify codes with ambiguous meanings. We also went back and compared the codes against the interview data to make sure the codes fit with the data.[17] After several iterations of coding, we identified and categorized themes that emerged naturally, which we present in our findings. We report quotes exactly as they were written by participants, retaining the original orthography.

RESULTS

Our analysis revealed 2 major themes: (1) *challenges physician champions faced*, and (2) *strategies they developed to tackle the problems*. In this section, we elaborate on these 2 themes.

Challenges physician champions faced

We identified 4 main types of challenges that physician champions encountered throughout the implementation and adoption process: inappropriate training prior to go-live, insufficient at-the-elbow support after go-live, communication challenges with builders and the vendor company, and system design flaws after go-live. These are discussed more below and are summarized in Table 1.

Inappropriate training prior to go-live

All of the physician champions perceived issues with the training, especially prior to go-live—specifically, with the training's timing, content, methods, trainers, and availability. First, they felt that the timing of training and specific sessions were suboptimal. Champions had hoped that training would take place before they were asked to customize the system; however, this was not the case. They also felt that the tips-and-tricks session should have come later after they had grasped a basic understanding of the system. Second, physician champions found that the training was too generic, and that it needed to be tailored to departmental contexts (eg, to fit different workflows). Third, they were disappointed that the training did not provide a live or simulated environment for practice. Fourth, champions felt that trainers did not have sufficient understanding of the system or clinical workflows to answer their questions or to tailor the responses to their needs. Finally, although some champions had positive experiences with the post-implementation optimization training, they felt that this type of training should be offered to all end users rather than just physician champions.

Insufficient at-the-elbow support after go-live

The majority of physician champions reported that at-the-elbow support after the system went live was insufficient. They hoped for more, continuous support after the HIT implementation.

Communication challenges with builders and the vendor company

To obtain more support, physician champions tried to communicate with the system builders and support team, which usually turned out to be ineffective. According to our participants, the support team often distributed information to champions unidirectionally (ie, through mass emails), while seldom directly answering physician champions' questions in a timely manner or correctly.

Table 1. The challenges physician champions faced

Challenges	Representative quotations
Inappropriate training prior to go-live	
Inappropriate training timeline before go-live	• The training we received was disjointed—we were asked to create SmartSets when NO ONE (unless they had previously used EPIC) had any clue on how it would work.(surgery) • The initial learning curve is high and tips and tricks should come later.(pediatrics)
Lack of personalized training before go-live	• More time spent on examples of our own workflows would have been more useful.(dermatology) • The pre-rollout training was much too general, and almost no thought appeared to have been given to customizing the training for specific clinics.(internal medicine) • There seemed to be little effort to understand the needs and workflows of our clinic and group. . .(surgery)
Lack of a live or simulated environment for practicing before go-live	• It would have been better to have brief classes, then mock patient visits with over-the-shoulder experts helping, then regrouping for role-specific classes.(pediatrics) • We need an ongoing robust practice environment populated with a lot of data, to see how things look.(internal medicine)
Trainers did not have sufficient understanding of the system and workflow before go-live	• The instructors had very little knowledge of what we do and how things work for us in clinics.(internal medicine) • . . .when we asked the trainers about issues perhaps unique to our own needs, seldom was the answer readily available.(radiology) • . . .the trainer said "I don't really understand inbasket so we'll only cover that briefly" which she proceeded to devote 5 min to the entire section. Inbasket training was terribly inadequate.(internal medicine)
Not enough training for users after go-live	• I strongly urge you to offer the recent Epic personnel led optimization sessions (4 h total) to all users. To offer it only to the Michart champions is a huge mistake, only 5–10% or so would take you up on the offer and it would be a true optimization step.(internal medicine) • I feel that everyone should have the opportunity to attend a similar class a couple of months after implementation. . . everyone should have a chance to learn to make this complex system (which is poorly designed and confusing) work better.(internal medicine)
Insufficient at-the-elbow support after go-live	
Poor at-the-elbow support	• The at-the-elbow people were variable in their utility. . .some didn't have a handle on UM's system or what was allowed/encouraged in terms of workflow. . .(surgery) • I really think on-site help a month or two after go-live would help solidify what people are doing.(psychiatry)
Communication challenges with builders and the vendor company	
One-way and belated responses	• My major disappointment has been the inefficiency of MiChart support in answering specific questions correctly in a timely fashion and in communication about questions in general. (surgery) • Communication between the MiChart team and the Physician Champions was poor. It's all one way- from the Michart team to the masses. Tickets often go into black holes. This led to delays in addressing problems ranging from serious to minor.(internal medicine)
System design flaws after go-live	
Workflow problems	• This system is designed for a solo practitioner and little thought was placed toward teaching. . .(oncology) • We were absolutely unprepared for the mess that the inbox creates. Simple tasks like replying to a phone note in the inbox are unnecessarily complex.(internal medicine)
Issues of functionality	• Many elements are still missing and data review is very poor in EPIC.(pediatrics) • In general, there has a been a feeling in my department ([clinical area redacted]) that the system does not easily support many of our basic functions. . .(clinical area withheld)

System design flaws after go-live

Physician champions also found that the system was poorly designed overall. They felt that the system did not consider clinical workflows and the particular needs of an academic medical center (eg, teaching needs). Moreover, there were issues regarding functionality (eg, missing elements). A 2-year longitudinal assessment[20] of physician's perceptions conducted by 2 of the authors (DAH and KZ) and their collaborators has also demonstrated that physicians showed low satisfaction of the system overall.

Strategies physician champions developed to overcome the challenges

Physician champions devoted a great deal of time and effort to developing strategies to manage the challenges and to ensure the system was implemented and adopted effectively. We identified 3 main types of strategies: overcoming problematic training before go-live, obtaining more at-the-elbow support after go-live, and adapting sociotechnical context to make the system work better. These are summarized in Table 2 and discussed more below.

Table 2. The strategies that physician champions developed to tackle the challenges

Strategies	Representative Quotations
Overcoming problematic training before go-live	
Creating own training programs in the live/simulated environment before go-live	• We spent a large amount of time developing training scenarios and helping faculty and staff run through them. I believe having our entire faculty and staff run through training together in a live but simulated environment together was invaluable.(family medicine) • Our clinic admin. . . created her own training program. . . Far superior to what we got from the official training program because she knew our unit, our needs and our flow patterns. She organized a field trip to the Cleveland Clinic where they have used EPIC for about 10 years. This allowed us to actually see a working clinic—and it was a real eye-opener. . ..(surgery) • Ran personalization sessions for our department prior to go live, really was just another pseudo training but was well received.(family medicine)
Adapting and customizing the system to their own workflow before and after go-live	• Doing the workflows at a round table before go-live was most helpful at ferretting out the issues and educating our local users about those issues and workflows. • I think the education we provided regarding the adaptation of our workflow (eg, how letters to referring physicians can be created in this system) might have been helpful.
Obtaining more at-the-elbow support after go-live	
Looking for additional help	• Our nurse coordinators who served as superusers. . . really knew the system and were adept at helping their colleagues and physicians.(surgery) • Finding a tech savvy "teenager" who needed a part time job, who problem solved and sat with the nurses and physicians one on one and coached them through.(surgery)
Physicians volunteering to provide timely and inclusive help	• I spent a week in the clinics helping individuals optimize our approach and ultimately formulated a standardized way for our clinic to utilize MiChart that would be consistent among residents and attendants.(surgery) • Biggest success was my department clearing time for me to walk around to clinics and help people in clinic as they were getting used to using it. People knew they could call me and I'd talk them through things.(internal medicine) • Being there as we went live. I worked a lot of extra hours but it showed support. . .. • Establishing a routine of answering any emailed questions by the end of the half day (allowing for decreased disruption of clinical activities): responses went to the entire clinical staff in an attempt to give as many as possible the information, rather than only the questioning individual. Timeliness of response went a long way in getting "buy in" to the system.(pediatrics)
Facilitating peer support	• The team work within our clinic with every one trying to help each other out.(anesthesiology) • We make the best of things and try to help each other out. Units which have greater cohesiveness—they get along well, know each other, and work well BEFORE implementation probably did the best because the implementation process stressed the social links of the units. Stronger groups would usually do better.(surgery) • We did several sessions with multiple types of providers, and were able to identify several crucial problem areas that we were able to define some kind of work-around.(internal medicine)
Adapting sociotechnical context to make the system work better	
Changing practices/workflow after go-live	• A critical component of this approach was to accept changes in our practice and work flow to allow the new system to work efficiently for us, rather than rigidly holding on to our old practices and "force feeding" it through Epic.(dermatology) • We held 3-4 dry runs with the MA's, PA's, nurses, and faculty so everyone had a better idea of the workflow. Everyone's had to adjust to MiChart to some degree, but I think it's working well in most aspects.(surgery)
Optimizing the system before and after go-live	• I think having a smartset and smartphrases that I helped generate has provided templates for new patient notes, and progress notes for different types of [clinical activities].(internal medicine) • It was important to have myself and [Administrator Name] familiar with the system beforehand and to have many of our templates, smart sets, and preference lists in the system before Go Live.(-surgery) • My familiarity with the system was helpful to troubleshoot problems, know when something 'isn't working as built' or 'not working as desired', when to submit tickets and general moral support.(internal medicine)
Creating a positive and honest atmosphere after go-live	• Positive responsiveness to clinical staff (when making suggestions for design of SmartPhrases, etc. for information capture) enables the staff to feel they are improving the system!(pediatrics) • People sometimes complain for good reasons. It may be important to keep a positive attitude, but we should not try to silence dissenters as they may have the right outlook to prevent problems. Physician Champions are important, but credibility will be lost when people are championing something that doesn't deserve as much merit as it deserves. Honest appraisals of what to expect will be better received and will garner more support in the long run.(pediatrics) • Trying to stay calm so that others stay calm.(area withheld)

Overcoming problematic training before go-live
All the champions developed strategies to complement the problematic training, and to fill the knowledge gap. Many of them spent a large amount of time and effort to create their own personalized training programs in the live or simulated environment before go-live.

Obtaining more at-the-elbow support after go-live
Since the support from and the communication with the vendor was deemed poor, physician champions looked for additional support from others, either by gaining help from internal super users such as nurses or by hiring external tech-savvy people. Most physician champions also reported that they were devoted to providing timely and inclusive help, and that they encouraged peer support for colleagues within their departments.

Adapting sociotechnical context to make the system work better
The system design did not support departmental workflows and some necessary functions. Thus, physician champions developed a set of strategies to adapt their departmental sociotechnical context to make the system work better. This included changing their practices and workflows after go-live to fit the system design, continued efforts to optimize the system, and creating a positive and open atmosphere after go-live so that everyone felt that they were helping to improve the system and that their concerns were taken seriously.

DISCUSSION

Our findings provide valuable insights from the perspective of key actors in a large-scale EHR implementation—physician champions. Despite being a popular and state-of-the-art commercial EHR application, the system and its implementation process in this health organization presented many challenges to the physician champions from a sociotechnical perspective.[16] That is, while the implementation was largely technically-driven, with the underlying assumption that an advanced technology could effortlessly be integrated into and subsequently enhance an existing condition, the lived experiences of physician champions suggest otherwise. The HIT implementation also entailed complex and often unsuccessful interactions with local social and organizational circumstances. Building upon the reported challenges and strategies, we present the following implications centered on the importance of supporting physician champions and specific lessons learned from the physician champion perspective, both of which have implications for future commercial HIT implementations in other institutions.

Supporting physician champions

Physician champions are frequently involved in HIT implementations,[4,8–11] and many prior studies have attributed the successful implementation and adoption of various HIT systems to their efforts.[4,8,9] However, as our study shows, championing is not hassle-free. Although the physician champions were not technology-adverse, and many claimed to be tech-savvy, they *still* had to develop and implement a set of strategies to overcome the sociotechnical challenges posed by problematic trainings, insufficient at-the-elbow support, poor communication with the vendor, and system design flaws. They also had to use their spare time (eg, "worked a lot of extra hours") to provide support to other users. These strategies were reactive efforts to make up for the limitations and breakdowns caused by a technically-driven implementation. Physician champions' experienced challenges and strategies highlight aspects of HIT implementation that might fail and how they could be improved from a sociotechnical perspective.

First, those challenges could have been at least mitigated if the administration communicated and supported physician champions better. For instance, the administration underestimated the amount of training on system functionalities and features needed for physician champions to start customization tasks. As a result, the physician champions had to undertake these tasks without sufficient training, and without an understanding of how the system would work in actual clinical practice. This issue could have been identified and mitigated, or even avoided, if the administration team more comprehensively communicated with and solicited feedback from the physician champions throughout the process.

Thus, the administration should recognize physician champions' burdensome efforts, address the challenges that physician champions perceived related to both the technical and social systems of the organization,[21] and mitigate champions' burden. For instance, the administration should advocate for the physician champions and urge the builders and vendor company to address the technical issues physician champions identified, which will help champions avoid being forced to solve the issues by themselves. Regarding champions' unavoidable or necessary efforts (eg, attending trainings), the administration should recognize the champions' burden and provide instrumental support to champions. For example, the administration could re-allocate additional physician champions' clinical workload and time to championing the HIT and also reward them for any extra efforts.

Second, physician champions also need emotional support from the administration.[22] In this study, physician champions' frustration and emotional reactions toward problematic implementation and adoption procedures were evident across the majority of responses. This implies that the administration might need to provide emotional support to physician champions, as well as to other clinicians, regardless of the level of technical soundness or user-friendliness of an EHR system. This emotional support could include acknowledging physician champions' difficulties and providing formal mechanisms for champions to express their frustrations.

In addition, the administration should foster peer support among physician champions. As evidenced in our study, this would not only lower the burden of individual physician champions, but also encourage collective problem-solving. Engagement with other users could also reduce resistance to the implementation and increase user adoption.[23,24]

Lessons learned from the physician champion perspective

In this subsection, we further highlight lessons learned from physician champions' perspectives that could be useful for future commercial HIT implementations in other institutions, as summarized in Table 3.

Given its importance, in the remainder of this subsection we elaborate on lessons regarding training and customization. The literature has increasingly recognized the essential role of high-quality training to ensure a successful implementation.[25–28] Some studies have found that high-quality training was missing during the implementation, which may have been because there was not enough training or the training did not suit physicians' clinical needs and learning styles.[29,30] However, these works did not document the

Table 3. Lessons learned and associated recommendations derived from the physician champion feedback

	Lesson learned	Recommendation
1	Physician champions needed more hands-on training, earlier on	Physician champions should have adequate training of the EHR prior to their customization work. At a minimum, providing the same training as the "super users" should provide the physician champions with additional background to help improve the customization process.
2	Ensure an appropriate training timeline; extensive customization done too early without sufficient training or context may be wasted effort	Limited customization should be done before the implementation but after physician champions have had sufficient training. Additional customization work should be expected to occur after clinicians have had a chance to work with the live system in real clinical environments.
3	The quality of trainers and the appropriate use of training time are very important	Effort should be made to use only highly skilled trainers with knowledge of local workflows. Time saving tips should come after basic usage has been mastered. A more realistic practice environment should be used to provide a more realistic context for training.
4	At-the-elbow support with peers is valuable	Ensure that at-the-elbow support has the right training and background to effectively meet the needs of clinicians during the implementation period. Peers can provide valuable support.
5	Two-way communication is vital to gain trust in the implementation process, and too many general communication emails may not be effective	Approaches for two-way communication and sharing information should be carefully considered. Involving physician champions in developing and modifying the communication plans as necessary may be more effective. It is important to provide timely and detailed feedback to physician champions so that the process can be trusted.
6	It is important to acknowledge the limitations of the new system to build trust in the implementation process	Leadership should provide their clinicians with a more realistic expectation of potential problems and roadblocks. While advocating for the benefits of the new system, it is also important to acknowledge the system's limitations and display empathy with those struggling to become proficient.

training issues in detail, and few qualitative studies have reported training issues in depth.

Our study addresses this research gap. We found that some clinical areas distrusted and completely abandoned the trainers provided by the EHR vendor, because the trainers did not have a clinical background, did not understand the clinical workflow, or both. Consequently, physicians turned to their peers for help. This finding, together with the inefficient use of training time, provides additional evidence to the earlier studies, and presents further challenges to health care organizations. On the one hand, it may not be administratively or financially feasible to allocate time and resources to train a sufficient number of one's own physicians to be the trainers and to develop effective and efficient training materials for a system-wide big-bang rollout, particularly in a large health care organization. On the other hand, relying on the trainers from the commercial vendor who have no knowledge of actual clinical workflows in medical practice is also problematic.

One study utilized medical students in a training effort for a HIT implementation, and found that these student trainers were given extremely high scores in the post-training evaluation survey.[31] Although encouraging, the study did not report on how the training impacted the quality of the rollout itself. Further research in different organizational settings, and consideration of financial impact on organizations at a large scale, is warranted. At present, quality training (including trainers' qualification and design of training materials) will likely continue to be a challenge. Furthermore, the customization of the system during the implementation is in itself a complex process. Institutions need to carefully consider the types of clinicians who should be chosen to do this work, when it should take place, the way to prepare the champions (technically and psychologically), and the technical limits of adapting the system to local practices. While earlier studies point out the significance of customization and optimization,[32–36] our findings contribute a unique case that a seemingly carefully planned customization effort could be problematic and inefficient in its process (as illustrated by physician champions' comments on the waste of time). In addition, the timing of customization is still debatable, as some literature argues it should be done before a big-bang rollout,[37] while some of our physician champion participants preferred to do it after they had a chance to use the new system in *actual* patient-care settings. Indeed, perhaps customization, along with training and retraining, should be an ongoing iterative process rather than a one-time approach. Further research is warranted to find a best solution and it may, ultimately, depend on the sociotechnical status of the institution.

In summary, most HIT implementation recommendations have cited physician champions as an important facilitator of adoption. However, little research has focused on physician champions' own practices and perspectives. Our study, with a specific focus on the physician champions, provides a rich empirical case and new understanding to the existing literature. In particular, we advocate for more support for physician champions, and we draw lessons surrounding 3 issues: training and trainers, system customization timing and processes, and communication and building trust in the implementation process (see Table 3). These lessons learned may be used by other institutions and vendors to improve the implementation process. Indeed, while the first wave of EHR adoption has already taken place, many organizations with an EHR system will likely transition to another EHR at some point.[6,38,39] Therefore, our analysis of physician champions' experiences and perceptions contribute valuable insights for future EHR, and other HIT, implementations.

Limitation

The scale of HIT implementation may impact the readiness of adopting the new HIT.[40] This study was conducted in a large, tertiary academic health center. The large scale of the institution and roll-out of the HIT might impact the challenges that physician champions faced. Thus, the important categories of challenges identified within this study might not readily apply to other sites (eg, small organizations or a small scale of roll-out).

CONCLUSION

This study focused on the physician champion perspective in one institution during a transition from a home-grown EHR to a popular commercial EHR. Despite physician champions being commonly employed and widely believed to be key personnel in HIT implementations, little research has looked into physician champions' experiences and best practices for involving physician champions. Our study addresses the research gap and provides important insights for ongoing and future HIT implementations, including several crucial factors for the successful involvement of physician champions such as providing instrumental, emotional, and peer support for physician champions, and appropriate training and customization planning. This understanding of physician champions' situated practices, needs, and lessons learned should inform future HIT implementations.

FUNDING

The project described was supported by the National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health, USA (UL1 TR001414).

AUTHOR CONTRIBUTIONS

KZ and DAH conceived of and designed the study. DAH disseminated the email interview to physician champions and collected the responses. XG, YC, XZ, and DAH contributed to data analysis. All authors participated in drafting and revising the manuscript.

ACKNOWLEDGMENTS

We would like to acknowledge and thank our physician champion participants for their time and invaluable contributions.

CONFLICT OF INTEREST STATEMENT

None declared.

DISCLAIMER

The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

REFERENCES

1. Centers for Medicare & Medicaid Services. Promoting Interoperability (PI). 2019. https://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/index.html Accessed July 13, 2019.
2. Henry J, Pylypchuk Y, Searcy T, Patel V. *Adoption of Electronic Health Record Systems Among U.S. Non-Federal Acute Care Hospitals: 2008-2015*. Washington DC; 2016. https://dashboard.healthit.gov/evaluations/data-briefs/non-federal-acute-care-hospital-ehr-adoption-2008-2015.php. Accessed December 4, 2019.
3. Adler-Milstein J, DesRoches CM, Kralovec P, *et al*. Electronic Health Record Adoption In US Hospitals: Progress Continues, But Challenges Persist. *Health Aff* 2015; 34 (12): 2174–80. doi: 10.1377/hlthaff.2015.0992
4. Shea CM, Belden CM. What is the extent of research on the characteristics, behaviors, and impacts of health information technology champions? A scoping review. *BMC Med Inform Decis Mak* 2015; 16 (1): 2.
5. Bowman S. Impact of electronic health record systems on information integrity: quality and safety implications. *Perspect Heal Inf Manag* 2013; 10 (Fall): 1c.
6. Saleem JJ, Herout J. Transitioning from one Electronic Health Record (EHR) to another: a narrative literature review. *Proc Hum Factors Ergon Soc Annu Meet* 2018; 62 (1): 489–93.
7. Adler-Milstein J, Holmgren AJ, Kralovec P, Worzala C, Searcy T, Patel V. Electronic health record adoption in US hospitals: the emergence of a digital "advanced use" divide. *J Am Med Informatics Assoc* 2017; 24 (6): 1142–8.
8. Crosson JC, Etz RS, Wu S, Straus SG, Eisenman D, Bell DS. Meaningful use of electronic prescribing in 5 exemplar primary care practices. *Ann Fam Med* 2011; 9 (5): 392–7.
9. Gagnon M-P, Desmartis M, Labrecque M, *et al*. Implementation of an electronic medical record in family practice: a case study. *Inform Prim Care* 2010; 18 (1): 31–40.
10. Adams JA, Culp LM. Staffing and managing implementation teams. In: Walker JM, Bieber EJ, Richards F, eds. *Implementing an Electronic Health Record System*. London: Springer; 2005: 40–43.
11. DeVore SD, Figlioli K. Lessons premier hospitals learned about implementing electronic health records. *Health Aff* 2010; 29 (4): 664–7.
12. McAlearney AS, Hefner JL, Sieck CJ, Huerta TR. The journey through grief: insights from a qualitative study of electronic health record implementation. *Health Serv Res* 2015; 50 (2): 462–88.
13. McAlearney AS, Hefner JL, Sieck C, Rizer M, Huerta TR. Evidence-based management of ambulatory electronic health record system implementation: an assessment of conceptual support and qualitative evidence. *Int J Med Inform* 2014; 83 (7): 484–94.
14. Nguyen TTH, Saranto K, Tapanainen T, Ishmatova D. A review of health information technology implementation success factors: Importance of regulation and Finance. In: *Proceedings of the Annual Hawaii International Conference on System Sciences*. Piscataway, NJ: Institute of Electrical and Electronics Engineers (IEEE); 2014. doi: 10.1109/HICSS.2014.340.
15. Shaw EK, Howard J, West DR, *et al*. The role of the champion in primary care change efforts. *J Am Board Fam Med* 2012; 25 (5): 676–85.
16. Sittig DF, Singh H. A new sociotechnical model for studying health information technology in complex adaptive healthcare systems. *Qual Saf Heal Care* 2010; 19 (Suppl 3): i68–74.
17. Corbin JM, Strauss AL. *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. 4th ed. Los Angeles: SAGE Publications, Inc; 2015.
18. Bryant A, Charmaz K. *The SAGE Handbook of Grounded Theory*. Los Angeles: SAGE Publications; 2007.
19. Strauss AL, Corbin JM. *Grounded Theory in Practice*. Los Angeles: Sage Publications; 1997.
20. Hanauer DA, Branford GL, Greenberg G, *et al*. Two-year longitudinal assessment of physicians' perceptions after replacement of a longstanding homegrown electronic health record: does a J-curve of satisfaction really exist? *J Am Med Informatics Assoc* 2017; 24 (e1): e157–65.
21. Fox WM. Sociotechnical System Principles and Guidelines: Past and Present. *J Appl Behav Sci* 1995; 31 (1): 91–105.
22. Rhoades L, Eisenberger R. Perceived organizational support: a review of the literature. *J Appl Psychol* 2002; 87 (4): 698–714.
23. Nambisan P. EMR adoption among office based physicians and practices: Impact of peer-to-peer interactions, peer support and online forums. In: *Proceedings of the Annual Hawaii International Conference on System Sciences*. Waikoloa, HI; 2014. doi: 10.1109/HICSS.2014.343.
24. Simon SR, Keohane CA, Amato M, *et al*. Lessons learned from implementation of computerized provider order entry in 5 community hospitals: a qualitative study. *BMC Med Inform Decis Mak* 2013; 13 (1): 67.
25. Zandieh SO, Yoon-Flannery K, Kuperman GJ, Langsam DJ, Hyman D, Kaushal R. Challenges to EHR implementation in electronic- versus paper-based office practices. *J Gen Intern Med* 2008; 23 (6): 755–61.
26. Lorenzi NM, Kouroubali A, Detmer DE, Bloomrosen M. How to successfully select and implement electronic health records (EHR) in small ambulatory practice settings. *BMC Med Inform Decis Mak* 2009; 9 (1): 15.
27. Pantaleoni JL, Stevens LA, Mailes ES, Goad BA, Longhurst CA. Successful physician training program for large scale EMR implementation. *Appl Clin Inform* 2015; 6 (1): 80–95.

28. Fullerton C, Aponte P, Hopkins R, Bragg D, Ballard DJ. Lessons learned from pilot site implementation of an ambulatory electronic health record. *Proc (Bayl Univ Med Cent)* 2006; 19 (4): 303–10.
29. Ajami S, Bagheri-Tadi T. Barriers for adopting electronic health records (EHRs) by physicians. *Acta Inform medica AIM. Acta Inform Med* 2013; 21 (2): 129–34.
30. Holden RJ. What stands in the way of technology-mediated patient safety improvements?: a study of facilitators and barriers to physicians' use of electronic health records. *J Patient Saf* 2011; 7 (4): 193–203.
31. Stevens LA, Pantaleoni JL, Longhurst CA. The value of clinical teachers for EMR implementations and conversions. *Appl Clin Inform* 2015; 6 (1): 75–9.
32. McAlearney AS, Robbins J, Kowalczyk N, Chisolm DJ, Song PH. The role of cognitive and learning theories in supporting successful EHR system implementation training: A qualitative study. *Med Care Res Rev* 2012; 69 (3): 294.
33. Saleem JJ, Flanagan ME, Wilck NR, Demetriades J, Doebbeling BN. The next-generation electronic health record: perspectives of key leaders from the US Department of Veterans Affairs. *J Am Med Informatics Assoc* 2013; 20 (e1): e175–77.
34. Wallace S, Maxey K, Iyer LS. A multi-case investigation of electronic health record implementation in small- and medium-size physician practices. *J Inf Technol Case Appl Res* 2014; 16 (1): 27–48.
35. Adams MB, Kaplan B, Sobko HJ, Kuziemsky C, Ravvaz K, Koppel R. Learning from colleagues about healthcare IT implementation and optimization: lessons from a medical informatics listserv. *J Med Syst* 2015; 39 (1): 157.
36. Pandhi N, Yang W-L, Karp Z, *et al*. Approaches and challenges to optimising primary care teams' electronic health record usage. *Inform Prim Care* 2014; 21 (3): 142–51.
37. Davis C, Stoots M. *A Guide to EHR Adoption: Implementation through Organizational Transformation*. Chicago: Healthcare Information and Management Systems Society; 2013.
38. Reaction Data. *Outpatient EHR Replacement*. American Fork, UT: Reaction Data; 2019. https://www.reactiondata.com/wp-content/uploads/2019/04/OutpatientEHRReplacementReactionDataFreemium.pdf.
39. Penrod LE. Electronic health record transition considerations. *PM R* 2017; 9 (5S): S13–S18.
40. Devlin AM, O'Connor S, Bouamrane M-M, *et al*. Readiness for delivering digital health at scale: lessons from a longitudinal qualitative evaluation of a National Digital Health Innovation Program in the United Kingdom. *J Med Internet Res* 2017; 19 (2): e42.