Electronic Health Record Use a Bitter Pill for Many Physicians

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Abstract

Electronic health record (EHR) adoption among office-based physician practices in the United States has increased significantly in the past decade. However, the challenges of using EHRs have resulted in growing dissatisfaction with the systems among many of these physicians. The purpose of this qualitative multiple-case study was to increase understanding of physician perceptions regarding the value of using EHR technology. Important findings included the belief among physicians that EHR systems need to be more user-friendly and adaptable to individual clinic workflow preferences, physician beliefs that lack of interoperability among EHRs is a major barrier to meaningful use of the systems, and physician beliefs that EHR use does not improve the quality of care provided to patients. These findings suggest that although government initiatives to encourage EHR adoption among office-based physician practices have produced positive results, additional support may be required in the future to maintain this momentum.

Keywords: electronic health record (EHR); technology adoption; office-based physician practice; interoperability; meaningful use; physician perception; health information technology

Introduction

Over the past two decades, electronic health record (EHR) adoption among office-based physician practices in the United States has increased from 18 percent in 2001 to 78 percent in 2013.[1] The increase in EHR adoption was bolstered in 2009 by passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act. The HITECH Act allocated $30 billion to encourage adoption of EHRs throughout the US healthcare system by 2014, with a specific focus on assisting office-based practices that lacked an EHR system to implement and use a system that facilitates meeting the criteria for meaningful use.[2-4]

Despite this progress, many physicians, particularly those in smaller office-based practices, continue to struggle with implementing an EHR system and using the technology meaningfully in providing care to patients.[5] The challenges of implementing and using EHRs have resulted in growing dissatisfaction with the systems among many of these physicians.[6,7] For example, in a recent survey of more than 600 physicians, 67 percent of respondents reported dissatisfaction with their EHR system's functionality.[8] Another survey conducted by the American Academy of Family Physicians found that 31 percent of EHR users were considering replacing their EHR system because of dissatisfaction with it.[9]

The purpose of this qualitative multiple-case study was to increase understanding of physician perceptions regarding the value of using EHR technology. Specifically, the aim was to capture physicians' perceptions regarding their experiences in adopting EHR technology, and physician views about the impact of these systems on healthcare delivery in these settings. The relative paucity of qualitative research in this area and a desire to deeply explore physician beliefs regarding EHR adoption led to the use of qualitative methods for this study.

Background

The transition from paper to electronic systems for managing and documenting care has been driven by suggestions that EHRs have the potential to affect the delivery of healthcare by reducing costs, enhancing patient safety, increasing quality, and improving efficiency.[10-13] Despite this promise, physicians and hospitals in the United States were slow to embrace the

technology initially. In 2009, following a decade of relatively slow growth in EHR use, President Barack Obama signed the HITECH Act, allocating funds to encourage adoption of EHRs and to assist office-based practices in implementing and using EHR systems.[14-16]

The HITECH Act provides financial incentives to hospitals and healthcare providers making meaningful use of EHRs in their practices. *Meaningful use* is defined by the Department of Health and Human Services (HHS) as using an EHR system in "a manner that improves quality, safety, and efficiency of healthcare delivery, reduces healthcare disparities, engages patients and families, improves care coordination, improves population and public health, and ensures adequate privacy and security protections for personal health information."[17] Medical entities able to attest to meaningful use according to the guidelines in the act were eligible for incentive payments from the Centers for Medicare and Medicaid Services through 2014. The act also provides for financial disincentives in the form of reduced Medicare reimbursement for healthcare entities not using EHRs by 2015.

The support and incentives provided by the HITECH Act achieved success in stimulating EHR adoption in both hospitals and office-based practice settings. For example, EHR adoption in hospitals in the United States increased from 11.9 percent in 2009 to 59 percent in 2014—a nearly fivefold increase.[18,19] During roughly the same period, EHR adoption in office-based physician practices rose from 48 percent in 2009 to 78 percent in 2013.[20]

Along with significant growth in EHR adoption by physicians is a rising level of dissatisfaction with this technology. A recent study revealed that the use of EHR systems is a contributing factor to professional dissatisfaction among physicians.[21] Usability problems, lack of interoperability, and diminished quality of documentation were sources of frustration for physicians in this study. Bodenheimer and Sinsky (2014) suggest that dissatisfaction with EHRs, specifically the amount of time required to be spent interfacing with the EHR, is a major contributor to physician burnout in the United States.[22] In a survey of 561 Massachusetts physicians, 30 percent believed that using EHRs introduced new opportunities for errors in providing patient care.[23] Dissatisfaction with EHR technology is trending upward, with 12 percent more physicians expressing unhappiness with their EHR system in 2012 than in 2010.[24]

The rising levels of EHR adoption and the commensurate increase in physician dissatisfaction with the systems represent a dilemma for all stakeholders in the US healthcare system and generate important questions regarding the impact of this situation on patient satisfaction, quality of care, healthcare costs, efficiency of healthcare delivery, and provider satisfaction. This study focuses on understanding physician perspectives regarding the value and challenges of using these systems in an office-based practice. Using a qualitative multiple-case study design facilitated examination of a number of cases representing this phenomenon and comparative analysis of physician perceptions regarding EHR use.

Methods

Study Design and Sample

This study used a multiple-case study design to examine three contexts for EHR adoption: office-based physician practices in which an EHR system has been adopted (adopters), office-based physician practices that were using an EHR system only partially in the delivery of patient care (partial adopters), and office-based physician practices that have yet to adopt an EHR system (nonadopters). In the adopter context, practices had procured and implemented a commercial EHR system, were using the EHR in the day-to-day business of patient care, were no longer using paper charts for the documentation and delivery of healthcare services, and were qualified to apply for incentive funds under the meaningful use requirements of the HITECH Act. In the partial adopter context, practices had procured a commercial EHR system and had implemented the system to some extent, but were not fully using the system to document the process of patient care. In the nonadopter context, practices were not using an EHR system and relied on paper charts to document and manage patient care encounters.

The research setting for this study was metropolitan San Antonio, Texas, which has approximately 1,775 primary care physicians (including family practice, general practice, general internal medicine, and general pediatric specialties), 71 percent of whom either own or belong to an office-based group practice.[25,26] The office-based physician practices included in this research consisted of 10 or fewer providers (including physicians and physician extenders such as nurse practitioners or physician assistants). The unit of study was individual physicians who work in an office-based practice and either had responsibility for technology implementation decisions or participated in a significant manner in the decision-making process.

Potential participants were identified using the physician locator website Healthgrades.com[27] and the Health Providers Data website.[28] Healthgrades.com is a consumer-focused website containing pertinent information about physician practices in the local area, including office addresses, telephone numbers, specialty, size of practice, and patient satisfaction data. The Health Providers Data website is a national data bank of medical providers that allows searches based on National Provider Identification (NPI) codes, specialty, provider name, state, city, or zip code. Through these websites, 1,181 office-based primary care physician practices in the San Antonio metropolitan area were identified as the target population for this study. A total of 23 practices responded to the mailing indicating a willingness to participate in the research. One practice opted out of participation prior to data collection. During data collection, three of the practices were determined to fall outside the scope of research because of corporate ownership, and one practice was determined to be a specialist provider. Of the remaining 18 practices, 2 practices were used in a pilot study and the remaining 16 practices formed the final sample population for the research.

The sample for this research consisted of 8 practices representing the adopter context, 4 practices in the partial adopter context, and 4 practices that had not adopted an EHR system, for a total of 16 office-based physician practices. Data were collected using semistructured interviews. Interviews were conducted using the case study protocol (see Appendix A). Questions contained in the case study protocol were developed using information from the literature review pertaining to implementation of EHRs in office-based practices. The questions permitted the interviewee broad discretion in formulating his or her response, but were focused enough to guide a meaningful discussion of the phenomenon. An audio recording device was used to record the interviews, with verbatim transcriptions of each interview completed to facilitate analysis. Field and observation notes were used to supplement the recordings, ensuring a full, rich description of each case. A succinct nine-question survey administered to each participant prior to the interview assisted in gathering the physician's demographic data and current technology use practices (see Appendix B). Researcher observations contributed insights into the exploration of these contexts and corroborated and enhanced the data collected through the interviews and surveys.

Data Analysis

Using proven qualitative techniques, data collected from interviews were analyzed in two phases: a within-case analysis and a cross-case synthesis. Data analysis included use of NVivo 10, a qualitative analysis software tool, which assisted with organization, deconstruction (coding), manipulation, and storage of the data. The use of NVivo 10 facilitated the management and organization of the large amount of narrative data resulting from the 16 semistructured interviews conducted during data collection. Analysis of interview data consisted of an iterative, sequential progression of reading, reflection, categorizing, describing, and documenting the parsed data, grouping related and pertinent words and phrases. These word clusters or patterns were distilled into relevant themes describing the participant's experiences or perspectives. Themes were further synthesized by cross-checking their context in each case study transcript to validate findings against the recorded perspectives of the participants.

During the within-case analysis, each case was regarded as a complete context and evaluated independently. Cases were placed in their appropriate adoption context on the basis of this analysis prior to cross-case synthesis. In the cross-case synthesis, data were aggregated, compared, and contrasted across all cases to produce a synthesized narrative for each context. The within-context and cross-case analyses of patterns and themes produced a rich description of similarities and differences among the research contexts that led to the findings of this research.

Results

The analysis included 16 office-based practices: 8 practices that had adopted an EHR, 4 practices that were partially using an EHR system, and 4 practices that had not yet adopted an EHR system.

Descriptive Analysis

Table 1 displays the characteristics of the physicians participating in this study, including gender, age, years in clinical practice, the size of their practice (total number of providers, including physicians and physician extenders), type of practice, practice setting, and the number of years the practice had used an EHR system. All practices included in the analysis were independently owned, and the majority of physicians in the sample had practiced medicine for 15 years or more. Seventy-five percent of practices currently using an EHR system had used it for five years or longer.

Table 1: Characteristics of Office-based Physicians in the Study (*n* = 16)

Characteristic	Percentage of Participants
Gender	
Male	56.25
Female	43.75
Age (years)	
25–35	6.25
36–45	25.0
45–55	37.5
56+	31.25
Years in practice	
0–9	6.25
10–14	25.0
15–20	25.0
21–29	37.5
30+	6.25
Practice size	
Solo	25.0
2–4 physicians	68.25
5–7 physicians	6.75
Practice type	
Family practice	81.25
Pediatrics	18.75
Practice setting	
Rural	31.25
Urban	68.25
Years using electronic health records	
0	25.0
1–3	18.75
4–6	18.75
7–10	25.0
11+	12.5

Cross-Case Synthesis

The three sources of evidence gathered in this study—interview data, qualitative survey data, and informal researcher observations—were integrated into a single document for each participant, creating a complete representation of each case. Cases were placed in the appropriate adoption context on the basis of this analysis prior to cross-case synthesis. During the cross-case synthesis each case was treated as a separate study, with findings aggregated, compared, and contrasted across all cases to produce a synthesized narrative. The following sections describe the key results of this process. Table 2 summarizes these results across the three EHR use contexts included in this study.

Table 2: Summary of Study Results by Electronic Health Record (EHR) Adoption Context

Study Result	EHR Adopters (*n* = 8)	EHR Partial Adopters (*n* = 4)	EHR Nonadopters (*n* = 4)
Workarounds used to overcome barriers to adoption	100%	100%	50%
Lack of interoperability frustrates EHR users	88%	75%	100%
Using an EHR increases physician workload	88%	100%	75%
Physicians do not believe EHR use results in improved quality of care	75%	100%	50%
Physicians believe EHR use may negatively affect quality of care	25%	50%	50%
Physicians believe that EHR use both increases and decreases efficiency	100%	50%	50%

Physicians Use Workarounds to Overcome Adoption Barriers

Participants in this study described concerns with system costs, workflow disruption, reduced productivity, and usability of the systems as the primary obstacles confronting office-based physician practices in successfully adopting EHRs. Although approaches to overcoming obstacles to adoption were fairly diverse, a common tactic was to find a workaround for the aspect of using the EHR that did not fit the participant's work paradigm. For example, the most common workaround for documenting care in both the adopter and partial adopter contexts consisted of the physician not interacting with the EHR during the patient encounter and instead completing required documentation sometime after treating the patient. To facilitate this process, physicians often made notes on a paper pad during the patient visit and used this information to complete EHR data entry later. Although this workaround assisted in mitigating EHR interference with the doctor–patient interaction, it also contributed to workflow disruption and added work for the physician. Another frequently used workaround was to simply not use the EHR system for certain processes or procedures. This approach was most commonly found in the partial adopter context. For example, one partial adopter practice did not use the EHR system for acute visits, because documenting these episodes of care in the system required too much time and did not fit the practice's paradigm of high-volume, short-duration visits. In this instance, the practice maintained paper records of acute visits.

Lack of Interoperability Frustrates EHR Users

Lack of interoperability among different systems and the resultant inability to share clinical data between medical entities was highlighted by 88 percent of study participants as a significant barrier to meaningful use of these systems. Among the 12 participants currently using an EHR system, only one practice reported sharing clinical information routinely with other medical entities using EHRs.

Participants expressed frustration with this aspect of EHR use, and most were also skeptical that this issue could be addressed successfully in the future. Physician skepticism regarding interoperability was rooted in their experience that EHRs from different vendors could not communicate with one another, a belief that the growing number of vendors in the market further exacerbated the issue, the perceived lack of interoperability standardization among vendors, and the failure to date of industry and government to develop a reliable and sustainable technical and economic solutions for electronic exchange of information.

Using EHRs Increases Physician Workload

Physicians in this study believed that using EHRs in office-based practice adds significant time to the physicians' workday and that this increased workload is a major disadvantage of the technology. Ninety-two percent of adopters and partial adopters said that using EHRs added time to their workday, with the majority indicating that the use of the systems required significantly

more administrative time than that required for documentation in paper charts. Several participants indicated that their administrative time doubled because of EHR requirements.

Physicians Do Not Believe EHR Use Results in Improved Quality of Care

Participants acknowledged that using EHRs enhanced availability and access to health data, improved legibility, and increased efficiency in delivering care; however, a majority did not believe that using EHRs improved the quality of care they provided patients. Although it may seem logical that improved availability of the medical record would result in improved quality of care for the patient, most physicians in this study did not make this connection. Only 17 percent (2 of 12) physicians using EHRs believed that using the system improved the care they provided to patients. When participants were asked if they agreed with the HHS perspective that using EHRs in a meaningful manner improved the quality of care, 63 percent said no. Further, 75 percent of participants in the study characterized the HHS definition of meaningful use as either impractical or unattainable in an office-based setting.

Some Physicians Believe EHR Use May Negatively Affect Quality of Care

Physicians in this study believed that the use of EHRs can result in extraneous and erroneous information in the health record that may negatively affect the quality of care. Participants reported receiving consultation reports on patients from physicians using EHRs that contained erroneous data and extraneous information that detracted from the report's value and usually resulted in additional effort to clarify or correct the information. Some participants also characterized the EHR consultation reports as excessively lengthy compared to the notes or telephone calls used in the past that succinctly described consultation results. Among all participants, 38 percent (6 of 16) reported this issue as a disadvantage of EHR use.

Physicians Perceive That Use of EHRs Both Increases and Decreases Efficiency

Among EHR users in this study, 83 percent (10 of 12) believed that using EHRs both increased and decreased efficiency in their offices. This finding suggests that using EHRs can have the effect of improving certain aspects of healthcare delivery while decreasing efficiency in other areas. For example, improved availability and access to records was mentioned by 75 percent of participants as an enhancing the efficiency of their practice. Conversely, 92 percent of EHR users in the study indicated that their office experienced decreased efficiency because of EHR adoption. Increased administrative workload for the physician, workflow disruption, and the need to develop workarounds to mitigate limitations of the EHR were the primary causes of the perceived inefficiency.

Discussion

Consistent with findings in the literature, the results of this study indicated that implementation costs, lack of interoperability, workflow disruption, fear of reduced productivity and revenue, security and privacy concerns, and usability of the systems were barriers affecting the adoption of EHRs in office-based physician practices.[29-33] Practices successful in implementing EHRs overcame many of these barriers through a variety of approaches. Although no single approach emerged as the best practice for overcoming barriers, the development of workarounds seemed to be a predominant tactic among practices in this study.

Flanagan et al. (2013) defined workarounds as "non-standard procedures typically used because of deficiencies in the system, workflow design, or real or perceived limitations in a technical system."[34] For example, 50 percent of adopters and all partial adopters developed workarounds for documenting care in the EHR to avoid what the physicians perceived as interference with the doctor–patient relationship. The most common workaround for documenting care consisted of the physician not interacting with the EHR during the patient encounter and instead completing the required documentation sometime after treating the patient. To facilitate this process, physicians often made notes on a pad of paper during the patient visit and used this information to complete EHR data entry later. Although this workaround may assist in mitigating the EHR interference with the doctor–patient interaction reported in the literature, it also contributes to workflow disruption and adds work for the

physician.[35-38] Ramaiah et al. (2012) also suggested that this delay in documentation could lead to inadvertent omissions and mistakes in charting patient care.[39]

The lack of interoperability among different systems and the resultant inability to share clinical data between medical entities remains a significant barrier to meaningful use of these systems. The majority of study participants (irrespective of adoption status) expressed frustration with this aspect of EHR use, and many indicated skepticism that this capability would ever exist. This finding is consistent with a national survey that revealed that only 30 percent of hospitals and 10 percent of ambulatory practices participate in health information exchange, despite the fact that operational health information exchange organizations had increased from 75 in 2010 to 119 in 2012.[40] Other recent studies suggest that the lack of interoperability and the inability to exchange health information with other entities impede the usefulness and effectiveness of EHRs.[41-43] As noted above, the lack of success in using current systems to exchange information, their experience that EHRs from different vendors could not communicate with one another, a belief that the growing number of vendors in the market further exacerbated the issue, the perceived lack of interoperability standardization among vendors, and the failure to date of industry and government to develop a reliable technical and economic solution for electronic exchange of information all contributed to physician skepticism among participants in this study regarding the prospects for interoperability.

A third theme that emerged from the data relative to adoption barriers was the belief among physicians that using the EHR system added to their work burden. In the adopter context, seven of eight participants (88 percent) reported working longer hours because of their EHRs. All of the participants in the partial adopter context said that EHRs added time to their workday. Among participants in the nonadopter context, 50 percent believed that adopting an EHR system would add administrative time to their day because of documentation requirements. The nonadopters who expressed this concern were planning to implement an EHR system in the future. This perception may act both as a barrier to adoption and as a source of dissatisfaction for physicians using the systems. Consistent with recent literature, this study found that physicians attributed the additional work requirement to the amount of time required to complete documentation in the electronic record.[44-46] Additionally, Makam et al. (2013) reported that nearly half of the 146 primary care physicians in their study were spending more than nine hours a week beyond their normal clinic time completing EHR documentation.[47]

When those in the adopter and partial adopter contexts were asked if they believed that using EHRs improved the quality of care provided to their patients, 83 percent said no. This sentiment was underscored by participants' views of meaningful use as defined by HHS.[48] When asked about their views regarding this definition, the majority of participants characterized meaningful use as "unattainable," "a good academic description, but not practical," or "pie in the sky." Physicians in this study believed that achieving meaningful was unrealistic in practice because of the time required to complete required data entry in the EHR, and the majority believed that the added documentation was not worth the investment of time and effort. These views are similar to the findings of a recent study conducted in Washington State and Idaho, in which participants also doubted the efficacy of meaningful use requirements and voiced concern relative to the return on investment versus level of effort required in documentation.[49] Participants in this study perceived that use of EHRs may improve the quality of documentation, but they did not believe that meaningful use of EHRs would improve the quality of care. Supporting this perspective is a recent study of 860 physicians in which researchers assessed meaningful use criteria across seven Stage 1 quality measures and found that meaningful use was associated with lower quality in two measures, was related to marginal improvement in two measures, and had no impact on the remaining three quality indicators.[50] Kellerman and Jones (2013) suggested that although the adoption of health information technology (such as EHRs) has increased over the past decade, "the quality and efficiency of patient care are only marginally better."[51] Classen and Bates (2011) suggested that the literature contains no evidence that the HHS meaningful use standards improve the quality of care.[52] Classen and Bates also reported that recent studies suggest that achieving these meaningful use standards may be harder than originally expected.[53] The views of participants in this current study corroborate this belief.

In contrast to the belief that using EHRs will improve the quality of care is the perception among some study participants that EHRs produced clinical information that is either erroneous or not relevant to patient care. Although not specifically questioned about the phenomenon, 38 percent (6 of 16) participants volunteered this belief. Participants reported receiving consultation reports on patients from physicians using EHRs that contained erroneous data and extraneous information that detracted from the report's value and usually resulted in additional effort to clarify or correct the information. Some participants also characterized the EHR consultation reports as excessively lengthy compared to notes or telephone calls used in the past that succinctly described consultation results.

During interviews, some participants described how they also made mistakes in seemingly mundane data entry areas that resulted in erroneous clinical information. This finding is supported by a study in which providers in 11 primary care clinics made inaccurate entries in EHRs that produced erroneous clinical data.[54] Additionally, in a large survey of primary care providers, Makam et al. (2013) reported that structured documentation required by EHR templates may promote oversized notes containing redundant or extraneous data.[55] Graetz et al. (2014) reported similar problems with EHR data interfering with physicians' practice and coordination of care.[56]

This research has several potential limitations. First, the sample for this study consisted of independent, primary care physicians in small office-based practices in San Antonio, Texas, which may limit transferability of study findings to other geographic regions of the country. The size and ownership of the practices in this study (independently owned office-based practices consisting of 10 or fewer providers) may limit transferability of findings to larger office-based groups and practices that are owned by a corporate entity. That the focus of this research was on primary care physicians (e.g., family practice, pediatrics, and internal medicine) practicing in independent office settings may also limit transferability to physicians in other specialties and settings (e.g., surgical specialists and hospital-based physicians). Second, the sample for this study was relatively small (n = 16), thereby limiting transferability. The size of the sample also limits conclusions that can be drawn regarding the statistical significance of personal characteristics such as gender and age on EHR adoption. Although this small sample was from a specific geographic location, it did facilitate the exploration of a range of perspectives and experiences from a variety of participants, including male and female physicians in a broad age range from both urban and rural settings. Third, data collected in this study were self-reported, which results in limits due to potential biases in memory, beliefs, and idiosyncratic style. Fourth, research literature suggests that asking study participants to review and comment on findings can strengthen construct and internal validity. Although this step was considered, the fact that participants were active physicians with busy practices (and limited time for research activities) precluded their involvement in the study beyond their interviews. In fact, many participants' willingness to participate in the study was contingent on their involvement being limited to a single, concise interaction.

Conclusion

This study achieved its aim in capturing physician perceptions regarding their experiences in adopting EHR technology, and their views about the impact of these systems on healthcare delivery in these settings. Specifically, physicians in this study believe that EHR systems need to be more user-friendly and adaptable to individual clinic workflow preferences. Additionally, the lack of interoperability among EHR systems is hampering the electronic exchange of health information and is causing both frustration and skepticism among physicians relative to the value of EHRs. The dichotomy of EHR usefulness portrayed by these data may provide important insight into how successfully this technology is integrated into the US healthcare system. Given that improved efficiency is credited with motivating physicians to adopt EHRs, it stands to reason that perceptions of inefficiency stemming from EHR use may serve to deter or interrupt adoption in some instances.[57] Finally, more evidence supporting the assertion that EHR use leads to improved quality of care is needed to counter physicians' ambiguity or uncertainty regarding the perceived usefulness of this technology. Additionally, this research suggests that a significant gap exists between policy makers' vision of meaningful use of EHRs and the reality of office-based physicians experiencing the complexities of EHR use in practice.

Previous research has extensively explored the potential improvements in the US healthcare system that may result from adoption of EHR technology. To realize this potential, EHR use must become routine throughout the healthcare system, including the setting in which the majority of Americans receive their healthcare—office-based physician offices. This research contributes to the body of knowledge regarding EHR adoption by assessing the perceptions of office-based physicians. Although EHR adoption has accelerated in recent years, this study highlights the ongoing challenges and issues facing small, independent physicians in transitioning to and using this technology. These findings are important because they underscore the need for federal, state, and industry leaders to continue efforts in providing encouragement and assistance to these small healthcare businesses.

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Notes

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Appendix A: Case Study Protocol

Research Title: A Qualitative Case Study of Electronic Health record Adoption in Office-Based Physician Practices

Interviewer: Steve Meigs

Date/Time/Location of the Interview:

Participant Demographics	
Organization code:	Years in practice:
Participant identification code:	Years' experience with EHR:
Role in practice:	Specialty:

Project summary (read aloud to participant): First, thank you again for your participation in this study. Before we begin the interview, I will provide you some background about myself, this research project, and your rights as a participant.

As a healthcare administrator, I have been committed to providing support to physicians and other clinical staff in facilitating the process of health care. In my role as an administrator I frequently addressed issues regarding documentation of care and the protection of patient information. As the industry started moving toward electronic health records, I became acutely aware of the impact on physicians and patient care processes resulting from the transition from paper records to electronic systems. I have observed this transition process firsthand in large health care organizations and, although challenging in this environment, typically a support infrastructure exists that attempts to mitigate or resolve barriers to EHR implementation. From the literature I have learned that most office-based physician practices do not have resources available to support transition from paper to electronic records. The literature also suggests that although many perceive EHRs as contributing positively to the delivery and quality of care, adoption of these systems, especially in office-based settings has been slow. The purpose of this qualitative case study is to explore why primary care physicians working in office-based practices have been slow to adopt EHR technologies.

This interview will last approximately 30 minutes. I will ask several open-ended questions prompting you to reflect upon your experience with technology and with your decision to implement EHRs in your practice. You have the right to refuse to answer any question. Before beginning the interview, I have a very brief survey for you to complete regarding your personal and professional information technology use.

With your permission I will use a tape recorder to document your answers; however, you do have the right to refuse my use of a tape recorder during this interview. To protect your privacy and ensure confidentiality of your contribution to this study, your name and any other personal identifying information will be omitted from the interview transcript, as well as all presented and published documents resulting from this study. Your participation in this study is voluntary and you have the right to withdraw from the study at any time.

Should you desire, I will provide you a summary of the results of this study. Would you like to receive this summary? Yes No

(Explain the voluntary nature of the participant's participation in the study and the requirement for informed consent. Explain how data collected during the study will be held in confidence, and that the participant's name and

organization will not be identified in the research. Have participant review and sign the informed consent document; ask the participant for his/her permission to tape record the interview. Provide the participant the survey instrument [Demographics and Technology Use Survey] and pen and ask them to complete.)

Questions for participants in office-based practices:

INTRODUCTION: In 2009, as part of the American Recovery and Reinvestment Act, Congress passed and the president signed the Health Information Technology for Economic and Clinical Health (HITECH) Act encouraging adoption of EHRs throughout the United States health system by 2014.

1. How would you describe your beliefs regarding the adoption of electronic health records in the United States health system?
2. How has the experience of others influenced your practice's adoption of an EHR?
3. How would you characterize your attitude toward using health information technology in healthcare?
4. How do you perceive the support of external organizations (e.g., the federal government, state agencies) in assisting you in implementing an EHR for your practice?

    4.1. Follow-on: How do you perceive the support of external organizations (e.g., the federal government, state agencies) in assisting your practice post EHR implementation?
    4.2. Probe: How well do you feel external organizations have communicated their programs and resources for assistance to you?

5. Do you have a sense for the degree to which your peers in other practices have successfully implemented EHR systems?
6. Follow-on: Why do you believe they have been successful/unsuccessful (depending on answer)?

TRANSITION: Many studies have identified barriers to EHR adoption such as cost, lack of interoperability with existing systems, need to redesign workflow processes, fear of reduced productivity, lack of security of patient information, and reduced revenues.

7. How would you describe your practice's approach in addressing potential barriers that resulted in your successful adoption of an EHR?

    7.1. Follow-on: Do you have specific examples where your practice identified a barrier (e.g., lack of interoperability, lack of technical expertise, cost, etc.) and developed a successful mitigation strategy?

8. How do you believe integrating an EHR into clinic workflow affects the practice?
9. In what ways has using an EHR affected the care you provide your patients?
10. How easily has your practice been able to share health information with other health care entities using your EHR?

TRANSITION: According to the United States Department of Health and Human Services, meaningful use of an EHR is using the system in "a manner that improves quality, safety, and efficiency of healthcare delivery, reduces healthcare disparities, engages patients and families, improves care coordination, improves population and public health, and ensures adequate privacy and security protections for personal health information."

11. How would you describe your perspective of meaningful use as defined by HHS?

    11.1. Follow-on: How would you characterize the degree of difficulty in achieving meaningful use?
    11.2. Follow-on: Do you believe using the EHR in a meaningful manner improves the quality of care you provide to your patients? Why or why not?

12. How would you describe your use of technology outside of work?

    12.1. Follow-up: How did/does this personal use of technology influence your use on an EHR?

13. How has your decision to adopt an EHR affected your practice?
14. How satisfied have you been with your decision regarding EHR adoption?

14.1. Follow-on: Why? (Focus on understanding underlying reasons for either satisfaction or dissatisfaction)

15. How do your patients perceive your decision to use an EHR?

    15.1. Follow-on: Do you believe using an EHR changes your doctor-patient interaction? If so, how and why?

Appendix B: Demographics and Technology Use Survey

1. What is your primary specialty? _____
2. How many years have you been practicing medicine? _____
3. How many years have you used computer systems (e.g., practice management system) in your practice? _____
4. How many years have you filed claims electronically? _____
5. Do you use an electronic system for prescribing? Yes No
6. How many years have you used an electronic health (medical) record in your practice? _____
7. Do you electronically share medical information about your patients with other health care entities? Yes No

   If you answered Yes to Question 7 – Do you share information using (circle appropriate responses):
   EHR E-mail Fax Phone

8. Do your patients have access to you electronically (e.g., e-mail, patient health portal)? Yes No

   Please circle all devices/technologies/services you currently use outside your medical practice:

   Personal computer/laptop
   Smart phone (e.g., Android, iPhone, Blackberry)
   Computer tablet (e.g., iPad) / Electronic reader (e.g., Kindle)
   Online banking/shopping
   Social networking sites (e.g., Facebook, LinkedIn, etc.)

9. What is your age: 25–35, 36–45, 45–55, 56 or older

Article citation:
Meigs, Stephen L; Solomon, Michael. "Electronic Health Record Use a Bitter Pill for Many Physicians" *Perspectives in Health Information Management* (Winter, January 2016).
