

Guideline Development for Optimal Electronic Health Record Adoption in Small Practices

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Abstract

There is a significant Electronic Health Record (EHR) adoption gap between large and small provider practices. The state of Maryland, while not found as having the lowest percentage of providers with an EHR meeting basic system criteria, was one of eight states that was well below the national average. The purpose of this project was to develop evidence based guidelines for implementation of best practices for small size (less than five providers) Primary Care Providers (PCP) to optimize adoption of EHRs to support the National Quality Strategy's three broad aims. This quality improvement (QI) project used the Technology Acceptance Model (TAM) to guide the development of Evidence Based Guidelines for EHR Adoption in PCPs. The sample size was a panel of eleven experts for round one and ten experts for round two, using the Delphi technique. Evidence Based Guidelines for EHR Adoption in PCPs were developed based on the literature and best practices. The guidelines were then submitted for review by an expert panel via the Delphi technique through two rounds of iterative surveys. Results were a consensus of greater than 51% agreement for all guidelines. The Evidence Based Guidelines for EHR Adoption in PCPs seeks to translate best evidence into practice and will assist to standardize EHR adoption best practices for small size (less than five providers) PCPs. Future plans include submission for publication of the guidelines to the Agency for Healthcare Research and Quality (AHRQ) National Guideline Clearinghouse and presentations to global healthcare information technology organizations to ensure dissemination.

Keywords: Electronic Health Record, Primary Care Provider, adoption, guidelines

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Evidence on the utilization of electronic health records (EHR) in primary care practices (PCP) is still emerging. The state of Maryland, while not found as having the lowest percentage of providers with an EHR meeting basic system criteria, was one of eight states that was well below the national average of 48.1 percent (Hsiao & Hing, 2014). Quality improvement and coordination of care can be improved by EHR implementation through process standardization, medication management and safety, coordination of care across the care continuum and adherence to evidence based guidelines for practice (McAlearney, Robbins, Kowalczyk, Chisolm, & Song, 2012). Health Information Technology (HIT) can be utilized to transform innovation into practice. According to Buntin, Burke, Hoaglin, and Blumenthal (2011), policy makers and clinicians are aware of the significance of behavioral factors and translational research on innovation diffusion.

The federal government, through the American Recovery and Reinvestment Act (ARRA) of 2009 and its' Health Information Technology for Economic and Clinical Health (HITECH) provisions has instantiated the foundation for eligible providers and hospitals in the United States to implement EHRs. Primary care providers who meet criteria for meaningful use are eligible for incentive payments through Medicare of up to \$44,000 (Adler-Milstein, Bates, & Jha, 2011). An estimated \$6.42 billion has been paid to eligible providers through the program (Murphy, 2013). HITECH also allocated \$2 billion for the Office of the National Coordinator (ONC) to implement support and infrastructure for the adoption of EHRs. The goals of the program are to improve patient care, reduce healthcare costs and increase overall public health (Blumenthal, 2009). Buntin, Jain, and Blumenthal (2010) note the core of health reform includes the use of

data to change payment structures, control clinical quality, and improve efficiency and public health support.

The Institute of Medicine (IOM) (2012) states, “care delivery has become increasingly fragmented, leading to coordination and communication challenges for patients and clinicians” (p. 11). Use of an EHR can minimize fragmentation through aggregation of a patient’s data and connectivity of numerous sources of information. Realization of the benefits of the EHR is reliant upon a provider’s uptake and meaningful use of the technology (Xierali et al., 2013).

The IOM (2003) identified EHR functionality that is essential to care delivery and promotes safety, quality and efficiency in delivery of health care. Bowens, Frye, and Jones (2010) describe further by noting EHRs benefit patients and providers, as adoption can transform patient care, improve patient safety and outcomes by reducing medical errors and preventing unwarranted procedures. Despite policies, financial incentives and consensus that HIT improves the delivery of healthcare, only the minority of PCPs have implemented a basic EHR (Adler-Milstein, Green, & Bates, 2013) and the adoption rate of EHRs varies from state to state. According to Hsiao and Hing (2014) New Jersey had the lowest adoption rate of EHRs meeting basic system criteria at just 21 percent of PCPs. Due to the low level of adoption, there is a great need for guidelines to provide a framework and harmonized approach to engage PCPs and move them forward on the process to implementation and adoption of the EHR.

Purpose statement

The purpose of this quality improvement project is to develop evidence based guidelines for implementation of best practices for small size (less than five providers) PCPs to optimize adoption of EHRs to support the National Quality Strategy’s three broad aims (U. S. Department of Health & Human Services, 2011). Berwick, Nolan, and Whittington (2008) note hopeful

signs for integrated care and ability to achieve the triple aims related to the arrival of EHRs. Electronic Health Record adoption is complex and disruptive to provider practice. EHR adoption has been slow due to system expense, complex integration with workflows and challenging implementations (Yoon-Flannery et al., 2008).

There are limited studies related to the ambulatory care setting therefore is it difficult to gain a true perspective on the effects of EHR adoption. Conn (2014) blogs that the EHR adoption pace has slowed and providers are struggling to meet Meaningful Use Stage 2 criteria. Also, there is a significant EHR adoption gap between large and small provider practices (Bates, 2005; Hsiao et al., 2013). Further Gans, Kralewski, Hammons, and Dowd (2005) state the adoption gap is an issue that may be related to the challenge of EHR managerial and capital costs for small provider practices. The limited evidence found in ambulatory care settings was mainly concentrated in larger, well established practices; there was scanty evidence available based on small provider practices.

Project significance and anticipated outcomes

Guidelines based on the evidence and best practices will assist small PCPs by providing them a framework for EHR adoption and help in strategizing when navigating the complex HIT environment. Understanding healthcare policy, mitigating barriers, and facilitating champions, improving system workflows and training will promote successful adoption. Data from the 2013 National Ambulatory Medical Care Survey (NAMCS) identify Maryland PCPs adoption rate of 37.1% which is less than the national adoption rate average of 48.1% (Hsiao & Hing, 2014). King, Patel, Jamoom, and Furukawa (2014) note clinical benefits and improved patient care were reported by the majority of PCP's that were EHR adopters.

Evidence based guidelines for implementation of best practices to optimize adoption of EHRs for small size PCPs is essential to assist in overcoming implementation challenges and avoiding the digital divide. Increased accountability for costs and quality of care make EHRs essential in the management of care and sharing of information (Hsiao et al., 2013). The anticipated outcome of the project is the development of guidelines based on the best evidence. Experts will validate the evidence based guidelines and the guidelines will be submitted for publication. A review of available tools reveals they are not designed and developed for the scale of a small provider and their unique circumstances, as most are targeted for large providers, organizations or health centers (Office of the National Coordinator for Health Information Technology, 2014; U.S. Department of Health and Human Services, 2011). The ability of the DNP to utilize guidelines to impact people, processes and technology will promote transformational change for optimal EHR adoption in small PCPs.

Theoretical framework

The Technology Acceptance Model (TAM) uses the Theory of Reasoned Action (TRA) as the theoretical basis to identify casual linkages between perceived ease of use (PEOU) and perceived usefulness (PU) (Davis, Bagozzi, & Warshaw, 1989). Perceived usefulness defines the provider's attitude towards the EHR and reflects as behavioral intention to use (see Figure 1). System quality, use, user satisfaction, individual impacts and organizational impacts are inter-related success measures (Archer, Fevrier-Thomas, Lokker, McKibbon, & Straus, 2011). The concepts of perceived ease of use, perceived usefulness, behavioral intentions (BI) and subjective norms (SN) can be measured and assessed to identify the relationship to EHR and provider engagement. Impacting PU as linked to BI with a constructive approach, such as best practices

education, may be a solution to the practice problem of suboptimal adoption by PCPs of EHRs (see Figure 2).

According to Holden and Karsh (2010) TAM can be used to predict and explain end user's reactions to HIT. TAM as the theoretical basis for acceptance of technology has been widely used as "it provides theoretical linkages among beliefs, attitudes, behavioral intentions and actual usage on how individuals accept a new technology" (An, Hayman, Panniers, & Carty, 2007, p. e41). The ability to examine usage intention and behavior of users is important in understanding how to identify successful deployment of information technology (Tao, 2009). Utilization of TAM can provide insight into PCPs perceptions of EHRs and ability to adopt technology. Evidence based guidelines for EHR adoption in PCPs may impact both behavioral intention to use and provider's attitude towards EHR's; by providing a strategy that uses people, processes and technology components, to assist in navigating a complex environment.

Literature Review

The literature review provides supporting evidence that guidelines for adoption of EHRs for small size PCPs will provide best practice strategies and utility for EHR adoption. The literature on PCPs and EHR adoption demonstrates mixed findings and suggests there is still much work that needs to be done. The majority of studies included in the literature review are non-experimental or qualitative studies. Many of these studies utilize cross-sectional physician survey data which include the National Ambulatory Medical Care Survey (NAMCS), National Hospital Ambulatory Medical Care Survey (NHAMCS) and American Board of Family Medicine (ABFM) (Linder, Ma, Bates, Middleton, & Stafford, 2007; Romano and Stafford, 2011; Shields et al., 2007; Xierali et al., 2013) and National Committee for Quality Assurance

(NCQA) (Garrido, Jamieson, Zhou, Wiesenthal, and Liang, 2005). The five studies that utilized national survey data were varied in results.

Other authors utilized researcher developed survey tools (Conrad, Hanson, Hasenau, & Stocker-Schneider, 2012; DesRoches et al., 2008; Fleurant et al., 2012; Friedberg et al., 2009; Kern, Barrón, Dhopeswarkar, Edwards, and Kaushal, 2012; O'Connell, Cho, Shah, Brown, and Shiffman, 2004). Also, semi-structured interviews, observations, case studies and focus groups were utilized (Crosson, Ohman-Strickland, Cohen, Clark, & Crabtree, 2012; Miller, West, Brown, Sim, & Ganchoff, 2005; Song, McAlearney, Robbins, and McCullough, 2011; Rosenberg, Peele, Keyser, McAnallen, and Holder, 2012; True et al., 2012; Yoon-Flannery et al., 2008). The two systemic reviews included a broad difference in article numbers, 154 and 30 articles respectively. Both were high quality and remark on EHR impact, including benefits and barriers, to primary care practices (Buntin, Burke, Hoaglin, & Blumenthal, 2011; Holroyd-Leduc, Lorenzetti, Straus, Sykes, and Quan; 2011).

The expert opinions are of high quality and expertise is clearly evident. The literature includes a panel discussion for a framework for MU Stage 1 (Kern, Wilcox, Shapiro, Dhopeswarkar, & Kaushal, 2012) and authoritative overviews of health reform including ARRA, HITECH and MU (Blumenthal, 2009; Blumenthal & Tavenner, 2010; Blumenthal, 2010; Buntin, Jain, and Blumenthal, 2010; Lee, Cain, Young, Chockley, and Burstin, 2005). The opinion/perspective literature is found to be of good quality from credible authors. These articles include review of an EHR implementation by organizational mandate (Bero & Lee, 2010); integration of clinical workflow into MU (Bowens, Frye, & Jones, 2010) and lessons learned from pilot site EHR implementation (Fullerton, Aponte, Hopkins III, Bragg, & Ballard, 2006).

Evidence regarding EHR adoption reveals themes related to quality, financial, facilitators and barriers to PCP adoption of EHRs. Studies that reported on quality had mixed findings as some found no association between EHRs and improved quality (Kern, Barrón, Dhopeswarkar, Edwards, and Kaushal, 2013; Linder, Ma, Bates, Middleton, and Stafford, 2007; Rosenberg, Peele, Keyser, McAnallen, and Holder, 2012; Song, McAlearney, Robbins, and McCullough; 2011). These studies have limitations as they lacked statistical power due to small sample size for specific quality indicators.

Identified barriers to PCP adoption of EHRs include lack of capitol for investment, complexities with integration into current systems and potential loss of productivity during transition (DesRoches et al., 2008; Shields et al., 2007, Song et al., 2011). Menachemi (2006) categorizes potential barriers to include: financial, productivity, technical challenges and patient concerns. The author comments that unwillingness to adopt EHRs is related to ongoing maintenance, lack of training and knowledge and a perceived change to the doctor-patient relationship. Uncertainty about a return on investment (DesRoches et al., 2008) and lack of rigor to formulate a formal business case (Song et al., 2011) are also cited as barriers to EHR adoption. Shields et al. (2007) looked at representative Community Health Centers (CHC) and concluded patient-mix and lack of capitol as the main barriers to adoption.

Bates (2005) identifies barriers to EHR adoption to include: reimbursement, interoperability, capital and risk, time concerns, privacy, system maintenance, number and transience of vendors. Providers are ready but overdue to transition to EHRs and the optimal effect for transition will occur when adoption begins in PCPs. In consideration of EHR adoption the migration of current data must be considered as much of this exists as paper or data silos. Providers are concerned about data migration especially for patients with chronic diseases

(Yoon-Flannery et al., 2008) and include failure to capture appropriate data and data storage issues as barriers to implementation (Hummel and Evans, 2012).

Common facilitators to EHR adoption were also noted in the literature review.

According to Buntin et al. (2011), strong leadership and staff buy-in are essential for successful EHR adoption. It is important for leadership to support and communicate the importance of the EHR initiative. Senior leadership and clinical champions are noted by Hummel and Evans (2012) as imperative to successful adoption through their ability to gain organizational support and remove barriers. Clear communication between senior leadership and providers, and from provider to provider is noted as essential to efficiency and quality of implementation of EHRs (Lee et al., 2005; Yoon-Flannery et al., 2008). It is important to identify communication strategies and leverage communication to set correct expectations.

Planning and implementing an effective data migration strategy will give providers access to data that is of value immediately. Hummel and Evans (2012) recommend data such as lab results from a fully functional lab interface, limit scanning of paper records, review new system requirements and have providers supply problem list abstracts for upload into the EHR. Optimizing workflows using tools such as workflow assessments and diagrams can establish procedures to minimize disruption to workflow and productivity during EHR adoption (Bowens, Frye, & Jones, 2010; Hummel and Evans 2012). Being attentive to workflows, task organization and essential resources (Lee et al., 2005) is pivotal to successful implementation.

Identifying training as imperative to the process, timing and understanding learner's needs are essential to successful EHR adoption. McAlearney et al. (2012) identify key components of successful EHR adoption to include: "organizational commitment to invest in training; assessing user skills and training needs; utilizing appropriate trainers; match training to

learners needs; utilize varied training approaches; provide support and optimize” (p. 306). Also, reality based training and practice of major workflows is suggested by Hummel and Evans (2012) to avoid common training issues. Lynott, Kooienga, and Stewart (2012) emphasize the requirement to incorporate communication training during EHR implementation; this will promote comfort for both the patient and the provider as they are using technology while interacting. Training is noted as pivotal to EHR success (Yoon-Flannery et al., 2008) and should be planned, appropriate to the task and workflows and close to implementation (just-in-time).

Financial incentives and payment for use of EHRs are mentioned as levers for accelerating adoption (Bates, 2005; Bero & Lee, 2010; DesRoches et al., 2008). Accessibility to low risk capital, improved interoperability by EHRs and assistance with vendor selection will also promote adoption (Bates, 2005). Expected benefits can occur related to cost savings as well. Thompson et al. (2007) reported benefits to include reductions in cost for dictations and the pulling of chart, decrease accounts receivable days and improved billable data capture. Miller et al. (2005) case studies established financial benefits to be assessed as \$33,000 per full-time provider per year which was gained by improved coding levels for 15% of visits. It was noted in general, the literature did not quantify return on investment.

The evidentiary findings reveal themes of quality, financial, barriers and facilitators to PCP adoption of EHRs. These themes can further categorized into the components of people, process and technology. These components are found to be key when building the evidence based guidelines in order to bring structure and clarity to the process.

Evidence Translation

Health IT can be utilized to transform innovation into practice. According to Buntin et al. (2011), policy makers and clinicians are aware of the significance of behavioral factors and

translational research on innovation diffusion. There has been a steady rise of EHR adoption; however there are documented regional differences (Xierali et al., 2013). In review of the literature, notable organizations appear to possess characteristics of early adopters and innovators and appear successful. Studies have shown larger PCP practices are more likely to adopt EHR's and owners of smaller practices perceive EHR implementation as difficult (Fleurant et al., 2012). Small PCPs may hesitate to deploy EHRs due to financial burden and risk, this may be one reason for Maryland to be behind the national average for EHR adoption.

Regional Extension Centers (REC) were formed to provide a coordinated effort to construct an integrated HIT infrastructure to support technology adoption and improve healthcare (Lynch et al., 2014) by providing individualized assistance to providers (Maxson, Jain, Kendall, Mostashari, & Blumenthal, 2010). One of the RECs primary responsibilities is assisting small providers to overcome barriers for adoption. Maxson et al. (2010) note robust assistance and consultation as having positive results for EHR implementation. The REC program's aim to assist 100,000 providers has been surpassed (Lynch et al., 2014) and the funding has been exhausted. This substantiates further need for evidence based guidelines. The literature synthesis offers valid evidence for best practice guidelines to enable successful EHR adoption by small PCPs. Best practice guidelines, provided via a consultative approach, will be impactful for small PCP EHR adoption and transformation.

Methods

Design, Sample, Setting

The quality improvement project was completed utilizing a descriptive design modified e-Delphi technique to establish the content validity of EHR adoption guidelines. The Delphi technique involves engaging experts in EHR adoption to review the proposed guidelines.

According to Dalkey and Helmer (1963) the Delphi technique relies on a group of experts providing a reliable consensus of opinion. Further, Logue and Effken (2013) note a uniqueness of the Delphi is the ability to provide anonymity and deliver group interaction with organized feedback. Goodman (1987) identifies four distinguishing characteristics of the Delphi to include: anonymity, measured feedback via iteration, expert participation and statistical group response.

The subjects included experts on EHR adoption (see Appendix A for panel experts). Experts were identified using the following inclusion criterion: expertise of EHR and PCP adoption, published on the subject matter in a peer reviewed journal, Master's Degree level or higher, and experience in EHR implementation as a lead stakeholder. Exclusion criteria consisted of lack of current contact information and the inability to complete two rounds of surveys in the appropriate time frame. The sample was comprised of 11 experts in round one and ten experts in round two (refer to Table 2 for response rate by survey round). The setting was remote as the survey data was collected using an internet based electronic survey.

Procedures

Experts were identified from the literature and as recommended by the project champion to participate in data collection. Logue and Effken (2013) recommend interdisciplinary panel stakeholders with appropriate subject experience. Inclusion criteria for the panelists are preparation at the Master's Degree level or higher, publication in peer reviewed journals and experience in EHR implementation as a lead stakeholder.

The sample size included eleven experts in round one and ten experts in round two as panelists. Hsu and Sandford (2007) recommend ten to fifteen panelists as sufficient if the group

is homogenous. While Logue and Effken (2013) note a typical panel size to be from 12 to 20 experts. Homogeneity was obtained through adherence to the inclusion criteria.

EHR adoption experts were invited to participate on the project panel via email in July and August of 2014 (see Appendix B for invitation letter). The invitation letter introduced the research team, explained the study purpose, procedures and included the URL web link for the first questionnaire. Completion of the survey implied consent (see Appendix C for initial questionnaire). An internet-based survey tool was used to collect data. As the panelists were geographically diverse the use of an electronic survey was most convenient and cost effective.

Human Subject Protections

Experts were solicited for participation in the study and consent was implied upon completion of the survey. Institutional Review Board (IRB) approval was obtained from the University of Maryland and identified as IRB HP - 00060288. Survey round two was also resubmitted through IRB for approval prior to completion (see Appendix D for survey two instrument). Expert panelist's names and responses are confidential and limited personal data has been collected. The data has been managed in a password protected and bit locker encrypted computer.

Data Collection and Analysis

The EHR adoption guidelines survey was distributed via email by sending of the survey URL. This email included clear instructions on survey completion as well as how to provide feedback and comments, this was round one of the study. Guideline survey questions were asked using a seven point Likert scale. SurveyMonkey® (SurveyMonkey, 2013), an internet tool, was utilized to gather feedback from panelists. For this modified Delphi, initial information was provided along with open ended questions to elicit comments (Logue & Effken, 2013).

Upon review of the initial responses, themes were identified and the guidelines were rephrased incorporating the expert feedback. The restructured guidelines (refer to Appendix D) were then loaded into the survey instrument. An email requesting participation in round two of the study was then sent to the expert panelists (refer to Appendix E). Two rounds of iteration were completed, approximately four weeks apart, as it is through the iterative process that the Delphi technique facilitates group opinion and consensus (Logue & Effken, 2013). The aim of the feedback is to reach consensus and assess the validity of the evidence based guidelines for EHR adoption in small PCPs.

Data collection included demographic data such as highest level of education and panelist's healthcare profession, as well as Likert scale data and free text comments. Comment data was analyzed for key themes, consistency and consensus. Data was exported from SurveyMonkey® into Microsoft Excel 2013 and also IBM SPSS Statistics (SPSS) version 20.0 for statistical analysis. SPSS was utilized to calculate the mean, median and mode of each statement and the response rate. Consensus is defined as a Likert rating of five (agree somewhat), six (agree) or seven (strongly agree) by greater than 51% of the panelists.

Results

Survey round one included 11 expert panelists and survey round two included 10 expert panelists (refer to Table 3 for demographics characteristics of survey respondents). Round one responses were reviewed and the guidelines were grouped into the following categories: people, processes and technology. Measures of central tendency (mean, median and mode) were completed for each of the guideline related questions. Free text data comments were reviewed and collated into themes and grouped by common terminology. Round one themes were

incorporated into the restructured guidelines. The restructured guidelines were utilized for round two of the Delphi.

Upon completion of two rounds of Delphi, comparison of the quantitative results was completed based on the categories of people, processes and technology. The following are results of the quantitative analysis: in the category of people there was 1 survey item with discrepancy (refer to table 4), in the category of process there were 3 survey items with discrepancy (refer to Table 5), in the category of technology there were 2 survey items with discrepancy (refer to Table 6). To further investigate, the Likert scale data was recoded and a comparison of percent agreement was reviewed (refer to Table 7). Consensus for each of the categories was then evaluated by question as depicted in figures. The graphs are also dissected into the categories of people (refer to Figure 3), processes (refer to Figure 4) and technology (refer to Figure 5) and the findings are consistent with those noted previously. While all questions show agreement, from round one survey to round two survey, there is not improvement in consensus for some questions. The data was then reviewed for qualitative findings and comments were compiled by survey round (refer to Table 8 and Table 9).

There is consistency in the questions that display a reduction in central tendency and also a decrease in percent consensus from round one to round two. In the category of people the question related to stakeholders setting correct expectations for the end users and providing oversight also show a number of comments related to the terms 'imperative' and 'stakeholder'. In the category of processes, question 10 relates to pre-implementation business process work flow redesign and question 13 relates to provider specific training with comments requesting more specific definitions around training and training requirements. In the category of technology, question 18 addresses data available in the system prior to go live and question 19

is about system interoperability. Both of these questions have quite a few comments regarding the availability of data being critical to success and (information) system integration and interoperability being costly.

The comments from round one were incorporated into round two survey questions. Round two saw a noted decrease in comments which validated the guidelines further. Comment count in round one was 66 whereas comment count in round two was 24. For all guidelines there is consensus as previously defined as a Likert rating of five (agree somewhat), six (agree) or seven (strongly agree) by greater than 51% of the panelists. However, for the category of technology, questions 18 regarding data available on startup and 19 regarding system interoperability actually saw no improvement in panelist agreement.

Discussion

The Delphi technique was deployed to a panel of experts that have implemented EHRs in the PCP clinical setting. Two rounds of surveys were completed and quantitative and qualitative data was obtained and reviewed. Feedback from round one was utilized as inputs into round two surveys. Round two feedback was received and incorporated into the final Evidence Based Guidelines for EHR Adoption in PCPs (refer to Appendix F).

The Evidence Based Guidelines for EHR Adoption in PCPs should be implemented with instructions that take into account individual nuances of organizations. Small PCPs may have limited ability of data in the system on startup and may not information systems that are interoperable. Also, cloud computing may not be an offering that all providers are able to find affordable.

Lessons Learned

The study findings validate the evidence based guidelines for EHR adoption in PCPs and offer valuable lessons learned on developing guidelines. Lessons learned include: it is very beneficial to have access to providers that are able to give real-life experiences, interviews are a useful tool to gain practical insight and observations are invaluable for operational exposure. Categorization of guidelines into components of people, process and technology ensure relevance and organizational strategic fit. Also, this process recognizes that small PCPs are similar to healthcare systems in that they are also complex adaptive systems; and that innovation such as EHRs takes a significant amount of effort and resources to deploy.

Other lessons learned include a thorough review of guidelines for how each are written prior to survey round 1. This review would be specific to composition of questions to ensure content adequately framed. Also, as participant anonymity is only of importance within the panel (from expert to expert) it would have been beneficial for the researcher to know which participants completed survey round 1, in order to expedite completion of survey round 2.

Lessons learned deploying the Delphi technique include that even when working with an expert panel, criteria needs to be well explained and key terminology needs to be clearly defined. Also, selection bias must be considered as a potential risk, however as this is a specialized area of practice and a homogenous group, this is considered acceptable in using the Delphi technique (Logue & Effken, 2013).

Future Implications

Implementation of the guidelines will allow further evaluation as to their applicability and efficacy to small PCPs. The ability to further refine the guidelines will enhance and prove their alignment as differentiators in evidence based practice. The guidelines will assist small PCPs overcome the hurdles of implementing EHR by offering them guidance based on the

evidence using a constructive systematic approach. This step by step approach will assist small PCPs in becoming part of the changing healthcare landscape through promotion of EHR adoption.

Further research will include assessment of EHR adoption rates of PCPs utilizing the guidelines versus those who had not used the guidelines. Publication of the guidelines in the Agency for Healthcare Research and Quality (AHRQ) National Guideline Clearinghouse and presentations to global healthcare information technology organizations will ensure dissemination of the guidelines to a broad interprofessional audience.

Timeline

The scholarly project practicum began in January 2014 during which the EHR adoption guidelines were compiled, proposal finalized and IRB process initiated. From May through June 2014, IRB approval was sought and obtained. From July into September 2014 data collection and analysis was completed. Paper completion and presentation completion occurred in October of 2014 (see Appendix G for high level timeline).

Conclusion

The healthcare information technology environment is complex and there are limited studies that are applicable to EHR adoption in small PCP settings. Guidelines were developed based on best practice evidence for implementation for small size (less than five providers) PCPs to optimize adoption of EHRs to support the National Quality Strategy's three broad aims. These guidelines will assist small PCPs by providing them a framework for EHR adoption and help in strategizing when navigating the complex HIT environment.

Promotion of evidence based guidelines requires organizational change as well as an interprofessional and intraprofessional team approach. The validated guidelines are based on best

practices and a step towards assisting PCPs on the journey towards EHR adoption. People, processes and technology are the categories used to ensure the guidelines are applicable to small PCP healthcare environments and can be implemented in a strategic manner. The guidelines provide a framework and harmonized approach that will engage PCPs and move them forward on the process to implementation and adoption of the EHR.

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Table 1.
Individual Evidence Summary

#	Author	Date	Evidence Type	Sample/ Sample size	Results	Limitations	Rating/ Strength
1	Crosson et al.	2012	Observational Study, EHR review	16 EHR using and 26 non-EHR using Practices; assessed 798 Patients	QI trial; Study analysis of data from EHR/non-EHR providers on Diabetes quality of care using guideline adherence in process of care, treatment, outcomes	May not be nationally representative; practices were early adopters	III/A
2	DesRoches et al.	2008	National Survey	2758 physicians	Researcher Survey; Facilitators of adoption are financial incentives, payment for use of EHR. Positive satisfaction with use and barriers identified.	Potential survey response bias	III/A
3	Fleurant et al.	2012	Pre & Post evaluation, implementation on survey	163 physicians pre and post implementation	Pre and post evaluation of 3 communities and implementation of ambulatory EHR (Partners)	Findings may not be generalizable to practices in other settings	III/A
4	Friedberg et al.	2009	Cross-sectional study; Survey	412 PCPs	Researcher Survey; Looks at EHR and requirements for PCMH using HEDIS measures. Notes EHR with strong relationships have better clinical process performance	Data from Mass where HEDIS performance may exceed national average, 1 PCP from each practice was interviewed at random,	III/A
5	Garrido et al.	2005	Retrospective, serial, cross sectional study	367,795 members from CO; 449,728 members from NW	NCQA data set; Study of two KP regions and use of ambulatory services; Found decrease in use of services post EHR implementation	non-representative population could limit findings	III/A
6	Kern et al.	2012	Cross-sectional study	466 physicians; 74,618 patients	Researcher survey; Compare of EHR to Paper PCP based on 4 measures, positive association between EHR and ambulatory quality	Self-reported adoption of EHR; Cross sectional; allocation to study group not random; relied on claims data	III/A
7	Lynott et al..	2012	Ethno-graphy	3 health systems	Observation of training in 3	Limited to 3 health	III/A

#	Author	Date	Evidence Type	Sample/ Sample size	Results	Limitations	Rating/ Strength
8	McAlearney et al.	2012	Qualitative study	6 organizations, 43 interviews; 6 physician focus groups	organizations related to ambulatory care EHR's Review of 6 organizations for best practices to EHR adoption related to training; Established 5 propositions related to training and training best practices	systems in the NW Study not designed to assess linkage b/t training and meaningful EHR, Organizations had successful EHR implementations	III/A
9	Romano	2011	National Survey study	255,402 ambulatory patients	NAMCS and NHAMCS data and quality related Clinical Decision Support (CDS), no consistent association between EHR and CDS to better quality	For some quality measures lacked statistical power	III/A
10	True et al.	2012	Qualitative Study	10 VAMCs	Study included interviews and site visits; impact of readiness for implementation of PCMH	Limited face to face site visits; Follow-up interviews done by 1 person; over stating of the positives	III/A
11	Adler-Milstein.	2013	Survey study	Survey to 6 pilot sites w/ 72% response rate	A survey analysis suggests that electronic health records will yield revenue gains for some practices and losses for many	Cost/benefit calculations; Results + financial impact of EHR, MU incentives may not be enough \$	III/A
12	Gans et al.	2005	National Survey study	Random sample of group practices (3 or more) 2879 respondents	Slow adoption with small providers and they require great support	Self-reported survey; generalizability	III/A
13	Hsiao	2014	National Survey study	NAMCS & mail survey; sample 10,302 physicians	Adoption up from 11% to 48%; Maryland below National average	Does not state % of survey response by state, so not able to understand survey penetration at the state	III/B

#	Author	Date	Evidence Type	Sample/ Sample size	Results	Limitations	Rating/ Strength
14	Linder et al.	2007	National, Retrospective Cross sectional analysis	25288 patient records from 1407 physicians; 25286 patient records from 1121 physicians	NAMCS data of 17 quality indicators, no consistent improvement in quality but for 2 indicators	level. Sample size small for some quality indicators; NAMCS relies on providers for coding accurately; Cross sectional survey	III/B
15	Menachemi	2006	Survey study	14921 physicians	Mailed survey to identify imminent adopters (deploy EHR in 1 year), identification of barriers and suggestions to address	Limited to Florida	III/B
16	Miller et al.	2005	Retro-spective, qualitative case study	14 single/small group PCPs using 2 vendor systems	Semi-Structured Interviews; Retrospective, Obtained data on cost, benefits, quality; Good explanation of financial cost & benefits per provider	Data from limited subset of PCPs and limited vendors, were primary care, used EHR for 1-3 years, full, and stable	III/B
17	Rosenberg et al..	2012	Comparison study	10 primary care sites; 23,900 patients	10 Primary care sites participating in PCMH compared cost, service use, quality. ROI calculated as cost avoidance	Nonrandom study; multiple biases; no site difference control	III/B
18	Shields et al.	2007	National, Survey study	914 fed funded health centers	NAMCS survey, CHC average 6-10 providers, patient-mix a factor in EHR adoption, barriers include capital, integration w/ billing system, loss of productivity	Self-reported survey; generalizability	III/B
19	Song et al.	2011	Qualitative Study, case review	43 informant interviews across 5 US health systems	ROI difficult to measure so inclusion of non-financial benefits is critical to demonstrate positive business case. These include quality metrics and strategic benefits	Included 5 health system chosen based on exemplary EHR adoption; not generalizable	III/B
20	Thompson et al.	2007	Vendor supplied database	19 ambulatory provider orgs	Benefits reported: dictation cost reduction, reduced A/R days, reduced chart retrieval costs,	Inconsistency w/ terminologies b/t orgs; Limited literature to	III/B

#	Author	Date	Evidence Type	Sample/ Sample size	Results	Limitations	Rating/ Strength
21	Yoon-Flannery et al.	2008	review; 3 case studies Qualitative Study, interviews	31 system leaders	increase capture billable data Benefits to EHR include access to data, improved measuring and reporting quality measures. 6 themes to implementation: communication, system migration, IT support, privacy, efficiency and sustainable business plan	compare Academic institution limited generalizability; Survey during planning and early implementation phases	III/B
22	Blumenthal D, Tavenner M.	2010	Expert Opinion	N/A	Overview of MU objectives		IV/A
23	Blumenthal	2009	Expert Opinion	N/A	Overview of ARRA and HITECH		IV/A
24	Blumenthal	2010	Expert Opinion	N/A	Overview of ARRA and HITECH; good table of regulations		IV/A
25	Buntin et al.	2011	Systemic Review	154 Studies fit inclusion criteria	Systemic review following criteria of 2 other SR's for July07-Feb10; discussion on positive and negative findings; Included Inpatient and ambulatory.	Some articles study designs were weak and observational; Potential defining EHR differently	IV/A
26	Holroyd-Leduc et al.	2011	Systemic Review	30 studies met inclusion criteria	Systemic review last 10 years of ambulatory EHR of impact. Looks at healthcare structure, process issues, outcomes	Some articles study designs were weak and observational; Potential defining EHR differently	IV/A
27	Hummel	2012	Expert Opinion	3 clinic vignette's	Identifies most common types of errors during EHR implementation	Includes vignettes of possible scenarios, not generalizable	IV/A
28	Bero	2010	Perspective	N/A	Partners Health Care overview of how EHR rolled out to PCP	Large health care system in the northeast, not generalizable	V/A
29	Fullerton et al.	2006	Opinion	N/A	Description of EHR implementation, best practices, barriers and lessons	Pilot site implementation	V/A

#	Author	Date	Evidence Type	Sample/ Sample size	Results	Limitations	Rating/ Strength
					learned	lessons learned, not generalizable	

Note. Adapted from “Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines.” by R. P. Newhouse, S. L. Dearholt, S. S. Poe, L. C. Pugh, and K. M. White, 2007, p 214. Copyright 2007 by the Sigma Theta Tau International. The study design consists of 21 non-experimental studies, two systemic reviews, six expert opinions and two opinions. Overall quality rating is considered good.

Table 2.
Expert panel response rate by survey round

	Number of participants invited	Round 1		Round 2	
		Number	Response Rate (%)	Number	Response Rate (%)
Expert Panelists	32	11	34.3		
Expert Panelists	23			10	43.4

Note. The number of expert's invited in round two decreased, as exclusion criteria consisted of lack of current contact information and the inability to complete two rounds of surveys in the allotted time frame. Participants were excluded from receiving the second survey email invitation if email bounced back, out of office or email declining participation was received by the study researchers.

Table 3.
Demographic Characteristics of Survey Respondents

	Round 1		Round 2	
	n	%	n	%
Healthcare Profession				
Healthcare Practitioner (MD, NP, RN)	3	30.0	4	40.0
Health Information Technology Professional	1	10.0	0	
Healthcare Education Professional	1	10.0	1	10
Healthcare Leadership Professional (CIO, CMIO, CNIO)	6	60.0	3	30
Researcher	3	30.0	4	40
Highest Degree				
Master's Degree	3	30	1	10
Doctoral Degree (PhD, DNP, Ed.D)	7	70	6	60
Professional Degree (MD, DO)	3	30	3	30
Total	11	100	10	100

Note. The sample total for survey one was 11 participants and for survey two was 10 participants. The majority of respondents had a doctoral degree at 70% and 60% respectively; followed by a professional degree at 30% of respondents for both surveys one and two. With a master's degree being held by 30% of respondents of survey one and 10% of survey two. This was a multiple selection pick list so panelist could make multiple selections, therefore some overlap could occur.

Table 4.

People Category: Comparison of statistical results for measures of central tendency and levels of dispersion

People Category		Round 1 n = 11	Round 2 n = 10
Question 3	Mean	6.4545	6.6000
	Median	7.0000	7.0000
	Mode	7.00	7.00
	SD	.93420	.69921
Question 4	Mean	6.4545	6.6000
	Median	7.0000	7.0000
	Mode	7.00	7.00
	SD	.93420	.69921
Question 5	Mean	5.4545	5.7000
	Median	6.0000	6.0000
	Mode	6.00 ^a	7.00
	SD	1.36848	1.63639
Question 6	Mean	5.9091	5.8000
	Median	6.0000	6.5000
	Mode	7.00	7.00
	SD	1.37510	1.54919
Question 7	Mean	5.6364	5.8000
	Median	6.0000	6.5000
	Mode	6.00	7.00
	SD	1.20605	1.54919
Question 8	Mean	5.7273	6.3000
	Median	6.0000	7.0000
	Mode	6.00 ^a	7.00
	SD	1.42063	1.25

Note. Question 6 is related to business owners that represent their areas as stakeholders noted to have .1 decrease in mean.

a. Multiple modes exist. The smallest value is shown

Table 5.

Process Category: Comparison of statistical results for measures of central tendency and levels of dispersion

Process Category		Round 1 n = 11	Round 2 n = 10
Question 9	Mean	6.3636	6.0000
	Median	7.0000	6.0000
	Mode	7.00	6.00
	SD	.92442	.81650
Question 10	Mean	5.6364	5.2000
	Median	6.0000	5.0000
	Mode	6.00	5.00 ^a
	SD	1.36182	1.54919
Question 11	Mean	4.7273	5.7000
	Median	6.0000	6.0000
	Mode	6.00 ^a	7.00
	SD	2.37027	1.33749
Question 12	Mean	5.8182	6.1000
	Median	6.0000	6.0000
	Mode	6.00	6.00 ^a
	SD	1.53741	.99443
Question 13	Mean	5.8182	5.7000
	Median	6.0000	6.0000
	Mode	6.00	7.00
	SD	1.25045	1.41814
Question 14	Mean	5.6364	6.2000
	Median	6.0000	7.0000
	Mode	7.00	7.00
	SD	1.50151	1.13529
Question 15	Mean	5.1818	5.2000
	Median	6.0000	5.0000
	Mode	6.00	5.00
	SD	1.53741	.91894

Note. Question 9, 10 and 13 show decrease in mean and are related to end user participation in workflow and process redesign and provider specific training during implementation.

a. Multiple modes exist. The smallest value is shown

Table 6.

Technology Category: Comparison of statistical results for measures of central tendency and levels of dispersion

Technology Category		Round 1 n=11	Round 2 n=10
Question 16	Mean	5.3636	5.8000
	Median	5.0000	6.0000
	Mode	5.00 ^a	7.00
	SD	1.36182	1.22927
Question 17	Mean	5.0909	5.4000
	Median	6.0000	5.0000
	Mode	7.00	5.00
	SD	1.97254	1.07497
Question 18	Mean	5.9091	5.0000
	Median	7.0000	5.0000
	Mode	7.00	4.00 ^a
	SD	1.64040	1.82574
Question 19	Mean	5.1818	4.9000
	Median	6.0000	6.0000
	Mode	6.00 ^a	6.00
	SD	1.83402	1.96921
Question 20	Mean	4.4545	5.5000
	Median	4.0000	5.5000
	Mode	4.00	5.00 ^a
	SD	1.69491	1.08012
Question 21	Mean	6.1818	6.4000
	Median	7.0000	7.0000
	Mode	7.00	7.00
	SD	1.16775	.96609

Note. Question 18 and 19 in round two shows decrease in mean. These are questions related to the having adequate data present in the Electronic Health Record on startup and system interoperability.

a. Multiple modes exist. The smallest value is shown

Table 7.

Analysis of survey responses percent agreement post recoding

	Survey Question	Round 1		Round 2	
		n = 11	%	n =10	%
People	Q3: Identify Key Stake holders		90.9		100
	Q4: Clinical Champions		90.9		100
	Q5: C-Suite active engagement		72.7		80
	Q6: Business Owners set expectations		81.8		70
	Q7: End user buy-in		81.8		70
	Q8: Communication strategies effective		72.7		80
	Q9: End user engagement		90.9		100
	Q10: End user in process redesign		72.7		70
Process	Q11: Optimize workflows		63.6		70
	Q12: Essential resources		81.8		90
	Q13: Training workflow specific		81.8		80
	Q14: Training supported by champions		72.7		90
	Q15: Financial incentives		63.6		80
	Q16: Leverage expert assistance		72.7		80
Technology	Q17: Data migration strategy		54.5		80
	Q18: Adequate data on start-up		81.8		50
	Q19: System interoperability		72.7		60
	Q20: Leverage cloud technology		36.4		80
	Q21: Plan decreased work productivity		81.8		90

Note. Survey data recoded where Likert response 1-4 = 0 and Likert responses 5-7 = 1. Shows analysis of survey response percent agreement post recoding of data. People and processes show small decrease of present from round one to round two however technology shows slight decrease in two questions and increase in all other questions.

Table 8.
Round one comments compiled by question

	#	Survey Question	Comments
People	3	Identification of key stakeholders (high level decision maker) is imperative to successful EHR adoption.	<ul style="list-style-type: none"> Will not be successful without strong leadership with their visible support and advocacy throughout the implementation and beyond
	4	Identification of a clinical champion is imperative to successful EHR adoption.	<ul style="list-style-type: none"> Without a clinical champion (or two) success will be very challenging. This is informatics 101! is imperative for both Nursing/Patient Care Services AND and for the Medical Staff/Providers
	5	Identification of a senior leader as champion is imperative to successful EHR adoption.	<ul style="list-style-type: none"> Not sure I understand what is meant by senior leader. If the senior leadership, the C-suite strongly supports the activities they are champions... Will assume you mean the c-suite Differs depending on the organization. Large organizations do not need a senior leader to be a champion, where it may be more important with smaller, and certainly privately owned, practices I believe some institutions, not ours, have suffered as a result of decisions made by senior management. This is an area where younger professionals may have more expert input. Is this someone different than in question #3 above? Yes, very imperative. Senior Patient Care Services AND Medical staff. One cannot do the job of both. Identification is not far enough, those senior leaders must also be engaged. In the case of a multi-facility system, there must be a) overarching champions and b) champions at the facility/hospital level
	6	It is imperative for stakeholders to set correct expectations for the end users, provide oversight and understand and champion the mission and vision of the EHR.	<ul style="list-style-type: none"> I personally do not define the word "stakeholder" in this manner. Also, this is a multi-part statement. How would one respond if one or two criteria are met but not the third? Not sure what you mean by stakeholders.... everyone is a stakeholder including those that are the end-users. If you mean anyone that is helping implement then I would say yes (although not everyone helping implement provides the same level of oversight... So - strongly agree if all supporting implementation. Imperative is a strong word. We would like the above but have dealt with much less for 8 yrs So true. Those not in an IT or informatics field often have unrealistic expectations on how quickly a system can be implemented or changes can be made. It's always more complex than one thinks and having someone available to explain the issues is very important. Transparency is key. And vision of the EHR needs to be tied to goals beyond technology adoption (i.e., quality, safety, efficiency)
	7	It is imperative to ensure end user buy-in, this is facilitated by setting correct	<ul style="list-style-type: none"> It is imperative to ensure end-user buy-in however this is not done by setting correct expectations. Buy-in is obtained by listening to the end users, understanding their needs, identifying solutions that can address their needs and working with them to select and optimize workflow to

		expectations to end users, for successful EHR adoption.	<p>support them. This way they understand what they give up, what is possible and that they helped provide the solution</p> <ul style="list-style-type: none"> • It's important, but sometimes it's just not possible. Maybe "acceptance" is a better word than "buy in". I think care providers go through the stages of grief and grieving (dabda) sometimes and we need to help them get to acceptance which is a bit different than "buy-in" in my opinion
	8	It is imperative to develop effective communication strategies including effective decisions making strategies for successful EHR adoption.	<ul style="list-style-type: none"> • You are combining many different concepts into one. Effective communication strategies is core - keeping people abreast of status, issues, solutions, etc... Transparency. Effective decision making strategies - this is another topic • Depends on size of organization....a small one site practice may have a short communication loop. A large multisite practice would needs strategies developed more so. A large organization may already have the strategies in place and not need them developed. • Oh yes, you cannot over communicate. Even if you think you have - you have not. The more information people have regarding an implementation the better. An informed end user is one that can help communicate with others and help avoid unnecessary calls to the help center during go live
Processes	9	End users should participate in processes to assess current state and future state workflows as this will enhance the end user experience and promote EHR adoption.	<ul style="list-style-type: none"> • Do not like how this is written. the last part should be as this will OPTIMIZE the end user experience.... It promotes EHR adoption in that it ensures buy-in. • This is ideal. Without walking through workflows, you just don't know what pieces of a process will be left out when you transition to a new system. Lots of unintended consequences if this is not done. • That is inclusive of Medical Staff end users...meaning MDs, and DOs along with Advanced Level Providers
	10	Pre-implementation business process redesign of workflows for use of the EHR will facilitate adoption and should include end users.	<ul style="list-style-type: none"> • Ideally evaluating current workflow and optimizing workflow should be done first. The selection of an EHR should be based on which one supports the ideal workflow. Not sure I understand the sentence - too many words that can be interpreted differently by different people. What do you mean workflows for use of the EHR??? • Ideally the business process evaluation and redesign would facilitate the organization with or without EHR implementation, and that the addition of an EHR would complement this • It depends on the software's ability to be configured to support an organizations unique workflows. If it's flexible then I would strongly agree, but this is sometimes not the case: Sometimes the software dictates the workflow.
	11	Post-implementation optimization of workflows should minimize disruption to productivity; will facilitate EHR adoption and should include end users.	<ul style="list-style-type: none"> • Disruption is often unavoidable when there are pervasive changes to workflow. Avoiding disruption is a laudable goal. • Not sure I understand. Once the system is implemented you optimize the workflow? Wouldn't that disrupt productivity? Do you mean pre-implementation optimization and testing before going live? • We agree with this but have had trouble getting the pre- and post-implementation workflow established. We are asking our EHR vendor to help us establish uniform, simple workflows. Workflows also often

		<p>change with upgrades</p> <ul style="list-style-type: none"> • Most organizations do not focus on this. Once live we need to listen to our end users who now become the system experts. They use it every day and can help facilitate changes to improve the support of workflow • Design should be done pre-implementation.
12	<p>Identification and engagement of essential resources needs to be done early and requires adequate communication.</p>	<ul style="list-style-type: none"> • Not sure I understand the sentence. Identification of essential resources and their procurement requires adequate communication and done early to ensure adequate time to complete.... • It is not possible to know which resources are essential early in the process. These resources need to be identified all along the way, even for mature end-users • Many administrators think the costs for EHRs are mainly during implementation. They need to clearly understand the Total Cost of Ownership from acquisition to sun setting. It includes the right people with the right resources to support the system, license and maintenance fees, ongoing education and training fees, and hardware upgrade costs
13	<p>Training needs to be adequate in content and length of time; and occur just in time prior to system roll out.</p>	<ul style="list-style-type: none"> • There are multiple training cycles - those of the trainers, then the end users. • It depends on how you define "adequate". Key concepts are typically taught in training but not granular content. I think training needs to happen in two phases, 1 - near time of implementation and cover all key concepts and workflows. 2 - provider specific training done on site with a preceptor • Training needs to be beyond pointing and clicking to complete the function. The training must be workflow/scenario based upon the role of the user being educated
14	<p>Training needs to be supported by champions as important to success and be optimized for the specific workflows.</p>	<ul style="list-style-type: none"> • Depends on how workflows are measured. • Not sure I understand.... champions are important throughout. • We did not have training that optimized our workflows in 2006, and that resulted in a major setback 5 years later attesting to MU • EHRs are complex and not typically very intuitive. A poorly trained care provider is a safety risk and an annoyance to his/her peers. A well trained care provider is worth the investment. Often this is under resourced and the first thing cut - and the last thing planned
15	<p>Financial incentives (including Meaningful Use) need to be leveraged as an upside to EHR adoption.</p>	<ul style="list-style-type: none"> • Incentives always help. Patient outcomes sometimes have a bigger impact. • Probably some financial incentives to the end user would be beneficial • As well, many bemoan the cost; however, we have experienced return on investment • Not sure what you mean by "upside" but no one is going to look a gift horse in the mouth! (not sure where that expression came from:). It's true money talks but if you weigh out all the cost of implementing an EHR against the incentive dollars or the potential penalty - it is a very costly endeavor. However, with that said, I think the MU program has been very influential in increasing adoption - which gives me job security. LOL Especially with the Providers • Don't understand what "leveraged as an upside" means.
16	<p>Primary Care</p>	<ul style="list-style-type: none"> • Not sure I understand what is meant by leverage available assistance...

	Providers should leverage available assistance during the vendor selection process.	<p>assume expertise to help with the process, assuming they are neutral and expert.</p> <ul style="list-style-type: none"> • Assistance.....financial? Consultative? • We did not have this. I am not sure what assistance would be available. It is a business decision. A request for proposal and site visit are key. If that is what you mean, then change my answer to agree, please. • Absolutely. It's like me trying to do my tax returns all by myself. Bring in the team who has this expertise and does it on a daily basis • In what clinical setting? Not relevant in a hospital but critical in a primary care practice.
17	Identification of an effective data migration strategy is imperative to successful EHR adoption.	<ul style="list-style-type: none"> • Should be seamless to the end user. • It depends. If new practice, this is not necessary. • If lots of data is in paper, then yes as hybrid is a challenge. • Without it there will be errors, maybe even adverse along with issues with revenue generation.
18	It is imperative to have adequate data in the EHR (labs, problems, allergies) to ensure successful adoption.	<ul style="list-style-type: none"> • The more essential clinical data available in the EHR the greater the adoption and the greater utility to the provider. • Need data for value. • The more data you can get in one place, the better. • We are always striving for that "one stop shop". We want to reduce the cognitive workload by configuring as best we can to provide pertinent data in the same system and even the same screen
19	System interoperability including EHR, Scheduling and Billing is imperative to successful EHR adoption.	<ul style="list-style-type: none"> • Depends on which user you are referring to here. Business owner? Clinician? Other? • What is the scope of system interoperability? Remember that EHRs have already been adopted that are not interoperable. • Preferably on one database, with a robust reporting component as well • It definitely makes life much easier
20	Ability to leverage cloud technology will promote EHR adoption.	<ul style="list-style-type: none"> • Assume you are not talking about clinicians? • Cloud technology may make it easier/cheaper for small provider practices to implement. • Cloud is just a new term for thin client. The key is access to EHR remotely and securely. There may be concern regarding cloud and security which may have negative impact. • Depends on connectivity and neurosis of end users. This can help take the burden off of an already overworked IT staff.
21	Consider end user decreased work productivity during rollout period.	<ul style="list-style-type: none"> • The subject of these statements is not clear. Is it clinicians, stakeholders, champions, business owners? Food for thought. • Lost productivity is inevitable with an implementation. Planning for it helps set the right expectations for providers, for patients, and for staff. • Perhaps a better statement would have indicated develop strategies to address the reduction in payments and reduced end-user availability to patients during rollout period.

Note. Round one total 66 free text comments.

Table 9.
Round two comments compiled by question

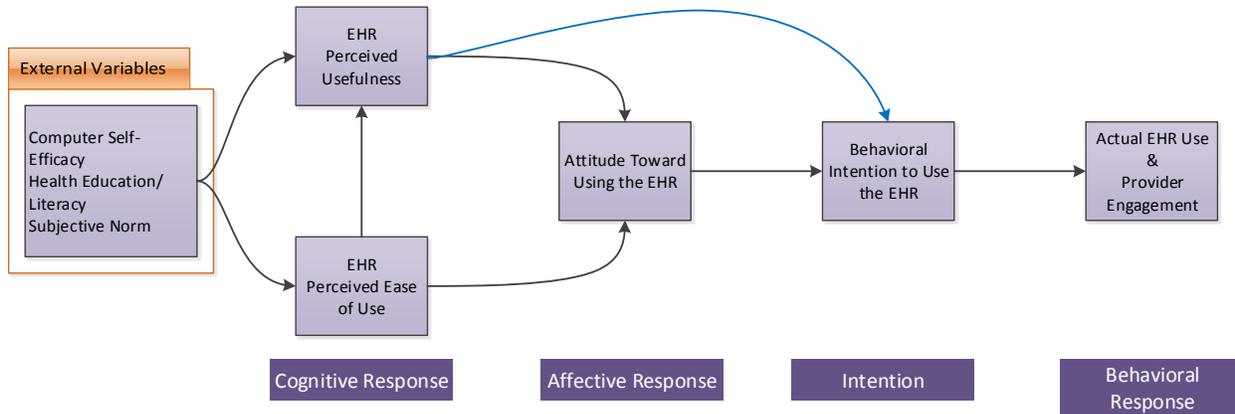
	#	Survey Question	Comments
People	3	Identification of key stakeholders (high level decision maker) is imperative to successful EHR adoption.	
	4	Identification of clinical champion(s) from medical and nursing staff/services is imperative to successful EHR adoption.	<ul style="list-style-type: none"> • A broad cross-section of leaders at all levels is helpful, from charge nurse up to CNO.
	5	Identification of a C-Suite senior leader as champion and their active engagement is essential to successful EHR adoption.	<ul style="list-style-type: none"> • They must be actively engaged, not champion in name only.
	6	Business owners that represent their areas as stakeholders, must set correct expectations for the end users, provide oversight, transparency and understand and champion the mission and vision of the EHR.	<ul style="list-style-type: none"> • Failure to set expectations and to represent the needs of your discipline, not merely your own opinions, is a major contributor to unsuccessful EHR adoption.
	7	It is imperative to ensure end user buy-in, this is facilitated by setting correct expectations to end users, for successful EHR adoption.	
	8	It is imperative to develop effective communication strategies that are transparent, and keep end users informed as strategies for successful EHR	<ul style="list-style-type: none"> • The more different vehicles, though all communicating the same information, the greater the likelihood of reaching all stakeholders. • This is a double-barreled question - or one that equates effective with transparent.

		adoption.	
Processes	9	End users should participate in processes to assess current state and future state workflows as this will optimize the end user experience and promote EHR adoption.	<ul style="list-style-type: none"> • In some rapid implementations current state may not be assessed. While this may be required to go quickly it almost always results in rework post-live. • It is hard to find time for staff to do detailed workflow refinement projects. It would be nice for software developers to have uniform and simplified workflows around certain repetitive pieces like capturing clinical quality measures, etc.
	10	End users need to be involved in process redesign of workflows that are optimized, prior to implementation, in order to facilitate EHR adoption.	<ul style="list-style-type: none"> • I don't know if it is possible to optimize any workflow prior to implementation. This never happened for us
	11	Post-implementation optimization of workflows should minimize disruption to productivity; will facilitate EHR adoption and should include end users.	
	12	Identification and engagement of essential resources needs to be done early and should be ongoing, requires adequate communication and must be considered as part of the total cost of ownership.	<ul style="list-style-type: none"> • I'm not sure what this means. • This question is hard to understand. If you mean staff and equipment, then agree
	13	Training must be provider specific, workflow and scenario based, adequate in feature and functionality, content and length of time; and occur just in time prior to system roll out.	<ul style="list-style-type: none"> • This question has many parts and can't be answered with a single response. • Individual training is mostly unnecessary but groups of staff (i.e front office vs med asst may have special areas for focused training)
	14	Training needs to be supported by	<ul style="list-style-type: none"> • Across our 90 hospital system we require completion of training and demonstration of competency prior to user access to Production by any

		champions, considered as essential to success, and an investment in and for staff.	role, including providers.
	15	Financial incentives (including Meaningful Use) and provider return on investment, need to be leveraged as a positive aspects to EHR adoption.	<ul style="list-style-type: none"> • This depends, at least in part, on the compensation model for providers and how directly they benefit from their Meaningful Use compliance. • ROI does not seem to be realized by many practices, but we have experienced it after 8 years of investment. Our EHR is not one of the highest cost but is high in quality in general. Other incentives, advantages need to be enough
Technology	16	Primary Care Providers should leverage available assistance, including experts, consultative and financial, during the vendor selection process and implementation.	<ul style="list-style-type: none"> • If you don't have those skills
	17	Identification of an effective data migration strategy is imperative to successful EHR adoption and should be seamless to the end users.	<ul style="list-style-type: none"> • Either a seamless migration strategy or a carefully articulated plan to provide access to that day for an extended period. • Most migrations I have been aware of have required end-user work upfront. • The end product should provide easy retrieve and identify prior-to-implementation data - I'm not sure that is what you mean by seamless
	18	It is imperative to have adequate data upon initial startup in the EHR (labs, problems, allergies) to promote value and utility, and ensure successful EHR adoption.	<ul style="list-style-type: none"> • Perhaps the single most critical component of a successful go-live. • This is the upfront work that is usually AFTER start-up. Staff can be involved in input, but I don't think most users have information already there when an EHR launches. Data integration? Availability of old data? Entry of old data in EMR?
	19	System interoperability for internal and external systems, including EHR, Scheduling and Billing which promote ease of use and reporting are imperative to successful EHR adoption.	<ul style="list-style-type: none"> • We implemented successfully without it, but we REALLY, REALLY need interoperability to do the best primary care for our patients; thus, one could not say imperative. Meaningful regional HIE is of the essence for good patient care. To go forward into the future, EHRs need to talk to one another without excess end-user cost, because we can't afford it. • IT can be done successfully without practice management software integration, although it can lead to problems, but I would not use the word "imperative"

20	Ability to leverage cloud technology will enable remote and secure accessibility, which will promote EHR adoption for small provider practices.	<ul style="list-style-type: none"> • Only to the extent that it is cheaper than other options
21	Plan for provider end users decreased work productivity during rollout period.	

Note. Decrease free comments from round one to round two Delphi with round two total of 24 free text comments.



*Figure 1. Modified Technology Acceptance Model. Adapted from “Theory Development in Nursing and Healthcare Informatics: A Model Explaining and Predicting Information and Communication Technology Acceptance by Healthcare Consumers,” by J. Y. An, L. L. Hayman, T. Panniers & B. Carty, 2007, *Advances in Nursing Science*, 30(3), e37-e49. In this model EHR perceived usefulness links to behavioral intentions to use the EHR.*

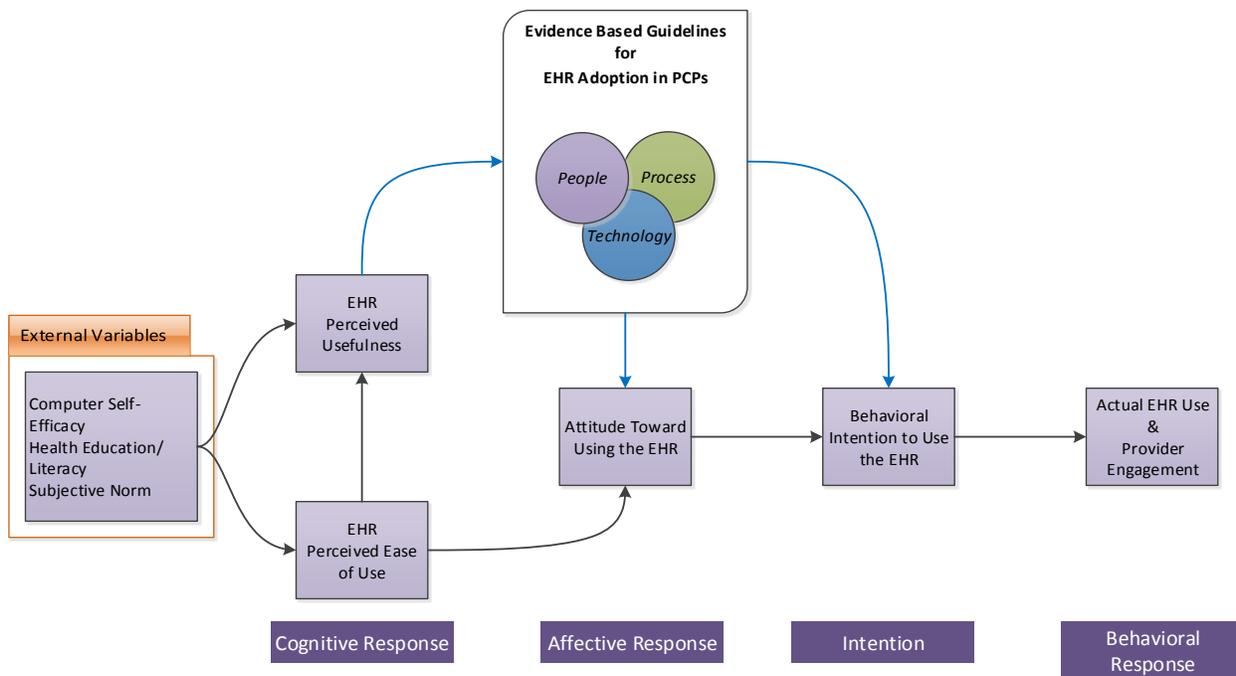


Figure 2. Modified Technology Acceptance Model. Adapted from “Theory Development in Nursing and Healthcare Informatics: A Model Explaining and Predicting Information and Communication Technology Acceptance by Healthcare Consumers,” by J. Y. An, L. L. Hayman, T. Panniers & B. Carty, 2007, *Advances in Nursing Science*, 30(3), e37-e49. In this model EHR perceived usefulness leverages the constructive approach of Evidence Based Guidelines for EHR Adoption in PCPs and links to both attitude towards and behavioral intentions to use the HER.

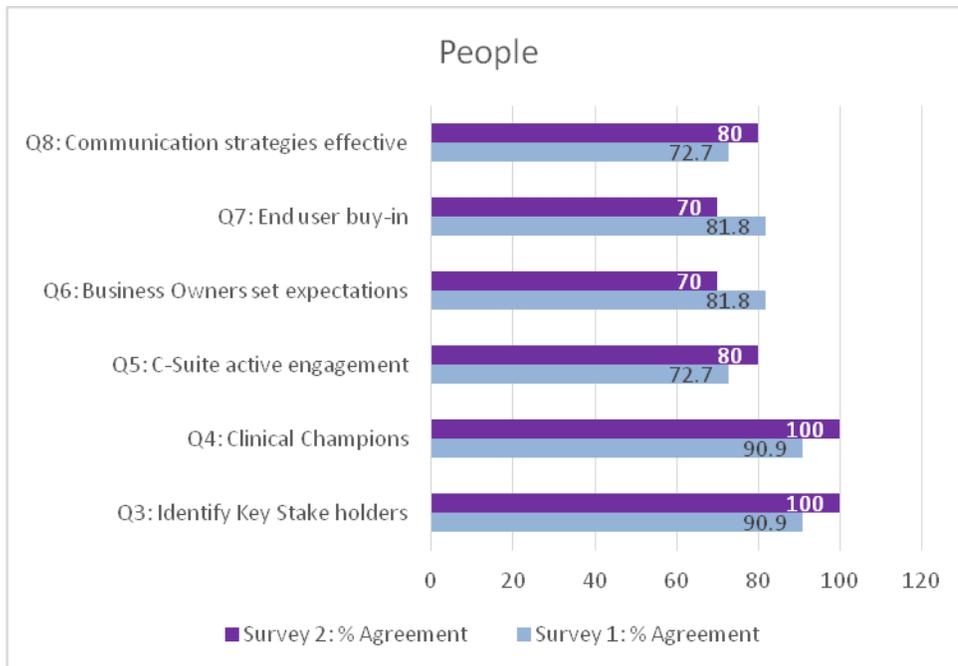


Figure 3. Graph depicts comparison result of survey 1 and survey 2 for questions related to people. Question 6 related to business owners setting expectations for the end users, provide oversight, transparency and understand and champion the mission and vision of the EHR and question 7 related to end user buy-in, while there is agreement, there was not improvement from survey 1 to survey 2. The variation for question 6 correlates with the decrease in mean noted in table 4.

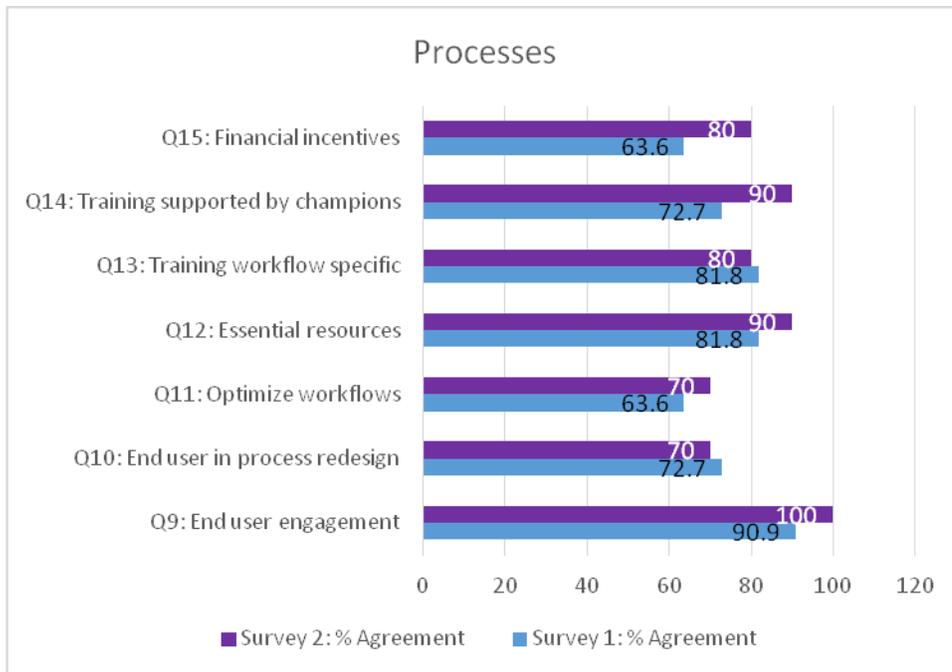


Figure 4. Graph depicts comparison result of survey 1 and survey 2 for questions related to processes. Question 10 related to end users need involvement in process redesign of optimized workflows and question 13 related to provider specific training while there is agreement, there was not improvement from survey 1 to survey 2. The variation for questions 9, 10 and 13 correlates with the decrease in mean noted in table 5.

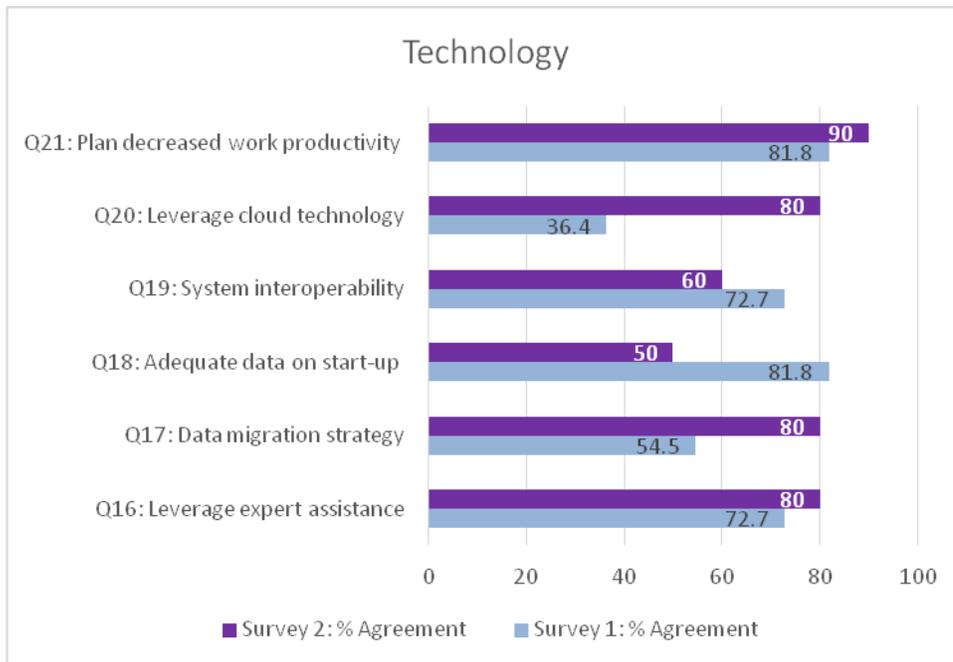


Figure 5. Graph depicts comparison result of survey 1 and survey 2 for questions related to technology. Question 18 related to adequate data on startup and question 19 related to system interoperability while there is agreement, there is not improvement from survey 1 to survey 2. The variation for questions 18 and 19 correlates with the decrease in mean noted in table 6.

Appendix A: Delphi Panel Experts

Name	Title	Organization	Contact
Julia Adler-Milstein, PhD	Assistant Professor, School of Information and Public Health	University of Michigan, Ann Arbor	juliaam@umich.edu
Melinda Buntin, PhD	Department of Health Policy	Vanderbilt University	Melinda.buntin@vanderbilt. edu
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Jayna Holroyd- Leduc, MD	Associate Professor, Departments of Medicine and Community Health Sciences	Department of Medicine, University of Calgary, Calgary, Alberta, Canada	jayna.holroyd- leduc@albertahealthservices .ca
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Max J. Romano	Program on Prevention Outcomes and Practices	Stanford Prevention Research Center, Stanford University School of Medicine, USA.	mromano4@jhmi.edu

Patty Sengstack, DNP	CNIO Assistant Professor, Division of Health Services Management and Policy	BonSecours Health System	Patricia_Sengstack@bshsi.org
Paula H. Song, PhD		The Ohio State University, Columbus	psong@cph.osu.edu
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Appendix B: Invitation to Participate in Survey Round One

Subject: Request to participate as Expert in Delphi Survey on Electronic Health Record Adoption Best Practices: SURVEY 1

Dear Name of Survey Participant,

You have been identified as an expert in Electronic Health Record (EHR) Adoption for Primary Care Providers (PCP). I would like to please invite you to participate in a study that involves the analysis of evidence based guidelines for EHR adoption best practices for small size PCPs. I am a Doctoral Candidate at the University of Maryland School of Nursing in Baltimore, Maryland. The project focus is on best practices for small sized (less than 5 providers) PCP adoption of EHRs. This is my scholarly project for my Doctor in Nursing Practice and I believe will make a meaningful impact to practice.

The study design will utilize the Delphi technique through the response of two rounds of surveys. This is the first of two surveys that would respectfully request you complete in the next five business days https://www.surveymonkey.com/s/EHR_Guideline

Upon receipt of all surveys, questions will be compiled based on the feedback and a second survey will be sent.

The survey estimated completion time is approximately 30 minutes. Your information will remain anonymous and confidential. If you have any questions or concerns, please feel free to contact me at the information below. I greatly appreciate your time and attention to this matter.

Thank you in advance for your participation.

Best Regards,

Kathleen McGrow

Kathleen McGrow, MS, RN, PMP

kmcgrow@umaryland.edu | 443-602-1945

IRB # HP- 00060288



facilitate adoption and should include end users							
Comment:							
11. Post-implementation optimization of workflows should minimize disruption to productivity, will facilitate EHR adoption and should include end users	○	○	○	○	○	○	○
Comment:							
12. Identification and engagement of essential resources needs to be done early and requires adequate communication	○	○	○	○	○	○	○
Comment:							
13. Training needs to be adequate and occur just in time prior to system roll out	○	○	○	○	○	○	○
Comment:							
14. Training needs to be supported by champions as important to success and be optimized for the specific workflows	○	○	○	○	○	○	○
Comment:							
15. Financial incentives (including Meaningful Use) need to be leveraged as an upside to EHR adoption	○	○	○	○	○	○	○
Comment:							
16. Primary Care Providers should leverage available assistance during the vendor selection process	○	○	○	○	○	○	○
Comment:							
17. Identification of an effective data migration strategy is imperative to successful EHR adoption	○	○	○	○	○	○	○
Comment:							
18. It is imperative to have adequate data in the EHR (Labs, problems, allergies) to ensure successful adoption	○	○	○	○	○	○	○
Comment:							
19. System interoperability including EHR, Scheduling and Billing is imperative to successful EHR adoption	○	○	○	○	○	○	○
Comment:							
20. Ability to leverage cloud technology will promote EHR adoption	○	○	○	○	○	○	○
Comment:							
21. Consider end user decreased work productivity during rollout period	○	○	○	○	○	○	○
Comment:							

user experience and promote EHR adoption.							
Comment:							
10. End users need to be involved in process redesign of workflows that are optimized, prior to implementation, in order to facilitate EHR adoption.	○	○	○	○	○	○	○
Comment:							
11. Optimization of workflows done by experts post implementation for fine tuning, should minimize disruption to productivity; include end users as experts; and facilitate EHR adoption.	○	○	○	○	○	○	○
Comment:							
12. Identification and engagement of essential resources needs to be done early and should be ongoing, requires adequate communication and must be considered as part of the total cost of ownership.	○	○	○	○	○	○	○
Comment:							
13. Training must be provider specific, workflow and scenario based, adequate in feature and functionality, content and length of time; and occur just in time prior to system roll out.	○	○	○	○	○	○	○
Comment:							
14. Training needs to be: supported by champions, considered as essential to success, and an investment in and for staff.	○	○	○	○	○	○	○
Comment:							
15. Financial incentives (including Meaningful Use) and provider return on investment, need to be leveraged as a positive aspects to EHR adoption.	○	○	○	○	○	○	○
Comment:							
16. Primary Care Providers should leverage available assistance, including experts, consultative and financial, during the vendor selection process and implementation.	○	○	○	○	○	○	○
Comment:							
17. Identification of an effective data migration strategy is imperative to successful EHR adoption and should be seamless to the end users.	○	○	○	○	○	○	○
Comment:							
18. It is imperative to have adequate data upon initial startup in the EHR (labs, problems, allergies) to promote value and utility, and ensure successful EHR adoption.	○	○	○	○	○	○	○

Comment:							
19. System interoperability for internal and external systems, including EHR, Scheduling and Billing which promote ease of use and reporting are imperative to successful EHR adoption.	○	○	○	○	○	○	○
Comment:							
20. Ability to leverage cloud technology will enable remote and secure accessibility, which will promote EHR adoption for small provider practices.	○	○	○	○	○	○	○
Comment:							
21. Plan for provider end user(s) decreased work productivity during rollout period.	○	○	○	○	○	○	○
Comment:							

Appendix E: Invitation to Participate in Survey Round Two

Subject: Request to participate as Expert in Delphi Survey on Electronic Health Record Adoption Best Practices: SURVEY 2

Dear Name of Survey Participant,

Thank you very much for completing round one survey as a panel expert in Electronic Health Record (EHR) Adoption for Primary Care Providers (PCP). The expert panel feedback and input was extremely valuable for improvement of the guidelines and greatly appreciated. I would like to please invite you to participate in **round two** of the study that involves the analysis of evidence based guidelines for EHR adoption best practices for small size sized (less than 5 providers) PCPs.

I am a Doctoral Candidate at the University of Maryland School of Nursing in Baltimore, Maryland. This is my scholarly project for my Doctor in Nursing Practice and I believe will make a meaningful impact to practice. The study design utilizes the Delphi technique through the response of two rounds of surveys.

This is the second of two surveys, and respectfully request you complete in the next **five (5) business days** https://www.surveymonkey.com/s/EHR_Guidelines2

The survey estimated completion time is approximately 15-20 minutes. Your information will remain anonymous and confidential. If you have any questions or concerns, please feel free to contact me at the information below. I greatly appreciate your time and attention to this matter.

Thank you in advance for your participation.

Kathleen McGrow

Kathleen McGrow, MS, RN, PMP

kmcgrow@umaryland.edu | 443-602-1945

IRB # HP- 00060288



Appendix F: Evidence Based Guidelines for EHR Adoption in PCPs

Component	#	Guideline Statement
People	1	Identification of key stakeholders (high level decision makers) who are strong leaders is imperative to successful EHR adoption.
People	2	Identification of clinical champion(s) from medical and nursing staff/services is imperative to successful EHR adoption.
People	3	Identification of a C-Suite senior leader as champion and their active engagement is essential to successful EHR adoption.
People	4	Business owners that represent their areas as stakeholders, must set correct expectations for the end users, provide oversight, transparency and understand and champion the mission and vision of the EHR.
People	5	It is imperative to ensure end user buy-in (active support) is facilitated by setting correct expectations and listening to their input for successful EHR adoption.
People	6	It is imperative to develop effective communication strategies that are transparent, and keep end users informed as strategies for successful EHR adoption.
Processes	7	End users should participate in processes to assess current state and future state workflows as this will optimize the end user experience and promote EHR adoption.
Processes	8	End users need to be involved in process redesign of workflows that are optimized, prior to implementation, in order to facilitate EHR adoption.
Processes	9	Optimization of workflows done by experts post implementation for fine tuning, should minimize disruption to productivity; include end users as experts; and facilitate EHR adoption.
Processes	10	Identification and engagement of essential resources needs to be done early and should be ongoing, requires adequate communication and must be considered as part of the total cost of ownership.
Processes	11	Training must be provider specific, workflow and scenario based, adequate in feature and functionality, content and length of time; and occur just in time prior to system roll out.
Processes	12	Training needs to be: supported by champions, considered as essential to success, and an investment in and for staff.
Processes	13	Financial incentives (including Meaningful Use) and provider return on investment, need to be leveraged as a positive aspects to EHR adoption.
Technology	14	Primary Care Providers should leverage available assistance, including experts, consultative and financial, during the vendor selection process and implementation.
Technology	15	Identification of an effective data migration strategy is imperative to successful EHR adoption and should be seamless to the end users.
Technology	16	It is important for end users to have adequate data upon initial startup in the EHR (labs, problems, allergies) to promote value and utility, and ensure successful EHR adoption.
Technology	17	System interoperability for internal and external systems, including EHR, Scheduling and Billing which promote ease of use and reporting are imperative to successful EHR adoption.
Technology	18	Ability to leverage cloud technology will enable remote and secure accessibility, which will promote EHR adoption for small provider practices.
Technology	19	Plan for provider end user(s) decreased work productivity during rollout period.

Note: Compiled and validated guidelines based on expert panel feedback.

