Electronic Health Records
Annotated Bibliography

Prepared for The Robertson Group LLC
Prepared by Anne Turner, MLIS

Citations selected from a literature search of the following database sources: PubMed, Web of Science, and CINHAL. Search conducted in April 2009.
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Electronic Health Record General | Adoption and Use

Definition, structure, content, use and impacts of electronic health records: a review of the research literature.


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PURPOSE: This paper reviews the research literature on electronic health record (EHR) systems. The aim is to find out (1) how electronic health records are defined, (2) how the structure of these records is described, (3) in what contexts EHRs are used, (4) who has access to EHRs, (5) which data components of the EHRs are used and studied, (6) what is the purpose of research in this field, (7) what methods of data collection have been used in the studies reviewed and (8) what are the results of these studies.

METHODS: A systematic review was carried out of the research dealing with the content of EHRs. A literature search was conducted on four electronic databases: Pubmed/Medline, Cinalh, Eval and Cochrane.

RESULTS: The concept of EHR comprised a wide range of information systems, from files compiled in single departments to longitudinal collections of patient data. Only very few papers offered descriptions of the structure of EHRs or the terminologies used. EHRs were used in primary, secondary and tertiary care. Data were recorded in EHRs by different groups of health care professionals. Secretarial staff also recorded data from dictation or nurses' or physicians' manual notes. Some information was also recorded by patients themselves; this information is validated by physicians. It is important that the needs and requirements of different users are taken into account in the future development of information systems. Several data components were documented in EHRs: daily charting, medication administration, physical assessment, admission nursing note, nursing care plan, referral, present complaint (e.g. symptoms), past medical history, life style, physical examination, diagnoses, tests, procedures, treatment, medication, discharge, history, diaries, problems, findings and immunization. In the future it will be necessary to incorporate different kinds of standardized instruments, electronic interviews and nursing documentation systems in EHR systems. The aspects of information quality most often explored in the studies reviewed were the completeness and accuracy of different data components. It has been shown in several studies that the use of an information system was conducive to more complete and accurate documentation by health care professionals. The quality of information is particularly important in patient care, but EHRs also provide important information for secondary purposes, such as health policy planning.

CONCLUSION: Studies focusing on the content of EHRs are needed, especially studies of nursing documentation or patient self-documentation. One future research area is to compare the documentation of different health care professionals with the core information about EHRs which has been determined in national health projects. The challenge for ongoing national health record projects around the world is to take into account all the
different types of EHRs and the needs and requirements of different health care professionals and consumers in the development of EHRs. A further challenge is the use of international terminologies in order to achieve semantic interoperability.

Publication Types: Review

PMID: 17951106 [PubMed - indexed for MEDLINE]

Use of Electronic Health Records in U.S. Hospitals.


Jha AK, Desroches CM, Campbell EG, Donelan K, Rao SR, Ferris TG, Shields A, Rosenbaum S, Blumenthal D.

From the Department of Health Policy and Management, Harvard School of Public Health (A.K.J.); the Division of General Medicine, Brigham and Women's Hospital (A.K.J.); the Veterans Affairs Boston Healthcare System (A.K.J.); and the Institute for Health Policy (C.M.D., E.G.C., K.D., S.R.R., T.G.F., A.S., D.B.) and the Biostatistics Center (S.R.R.), Massachusetts General Hospital - all in Boston; and the Department of Health Policy, George Washington University, Washington, DC (S.R.). This article (10.1056/NEJMsa0900592) was published at NEJM.org on March 25, 2009. It will appear in the April 16 issue of the Journal.

BACKGROUND: Despite a consensus that the use of health information technology should lead to more efficient, safer, and higher-quality care, there are no reliable estimates of the prevalence of adoption of electronic health records in U.S. hospitals.

METHODS: We surveyed all acute care hospitals that are members of the American Hospital Association for the presence of specific electronic-record functionalities. Using a definition of electronic health records based on expert consensus, we determined the proportion of hospitals that had such systems in their clinical areas. We also examined the relationship of adoption of electronic health records to specific hospital characteristics and factors that were reported to be barriers to or facilitators of adoption.

RESULTS: On the basis of responses from 63.1% of hospitals surveyed, only 1.5% of U.S. hospitals have a comprehensive electronic-records system (i.e., present in all clinical units), and an additional 7.6% have a basic system (i.e., present in at least one clinical unit). Computerized provider-order entry for medications has been implemented in only 17% of hospitals. Larger hospitals, those located in urban areas, and teaching hospitals were more likely to have electronic-records systems. Respondents cited capital requirements and high maintenance costs as the primary barriers to implementation, although hospitals with electronic-records systems were less likely to cite these barriers than hospitals without such systems.

CONCLUSIONS: The very low levels of adoption of electronic health records in U.S. hospitals suggest that policymakers face substantial obstacles to the achievement of health care performance goals that depend on health information technology. A policy strategy focused on financial support, interoperability, and training of technical support staff may
be necessary to spur adoption of electronic-records systems in U.S. hospitals. Copyright 2009 Massachusetts Medical Society.

PMID: 19321858 [PubMed - as supplied by publisher]

**Using computerized provider order entry and clinical decision support to improve referring physicians' implementation of consultants' medical recommendations.**


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OBJECTIVES: Only half of consultants' medical recommendations are implemented. We created a tool that lets referring providers review and implement electronic recommendations made by consultants, with the hypothesis that facilitation with our tool could improve implementation.

MEASUREMENTS: The tool was piloted among geriatrics consultants and hospitalists. Pre-post evaluation was done with control (before pilot; N=20) and intervention (after pilot; N=20) patients. Consultants wrote notes containing recommendations for all study patients, and entered electronic recommendations only for intervention patients. We analyzed all recommendations and surveyed hospitalists.

RESULTS: A total of 249 recommendations were made for intervention patients versus 192 for controls (p<0.05). Of all recommendations about intervention patients, 78% were implemented, compared to 59% for controls (p=0.01). Of the intervention recommendations, 77% were entered electronically using our tool; of these, 86% were implemented. All 24 survey respondents indicated that the system improved quality, saved time, and should be expanded.

CONCLUSION: Consultant recommendations were implemented 30% more often when there was electronic facilitation of recommendations.

Publication Types: Evaluation Studies Research Support, N.I.H., Extramural

PMID: 18952934 [PubMed - indexed for MEDLINE]

**Change readiness assessment for conversion to electronic medical records.**


Mustain JM, Lowry LW, Wilhoit KW.
Nurse executives are challenged to translate the mission of their healthcare organizations into desired outcomes that accomplish what is best for patients. Moving from paper to an electronic clinical documentation system can be a key tool in meeting this challenge; thus, nurse executives must lead a workforce that understands and embraces technology. The authors describe the change management approach that began the organizational culture transformation from paper to an electronic clinical documentation system.

PMID: 18791421 [PubMed - indexed for MEDLINE]

Clinical decision support: the power behind the electronic health record.


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There are six strategic objectives for promoting adoption of clinical decision support: Use a standardized format for representing clinical data and CDS interventions. Ensure appropriate access to clinical data and CDS interventions. Provide support and incentives for providers to use CDS. Disseminate information about best practices for system design, CDS delivery, and CDS implementation. Continue national demonstrations and evaluation of CDS use. Leverage data interchange between EHRs.

PMID: 18683413 [PubMed - indexed for MEDLINE]

Personal health records: key adoption issues and implications for management.


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Electronic Personal Health Records (PHRs) has been perceived as the tool to empower consumers to become active decision-makers of their healthcare instead of leaving the decision to providers. However, there has been the lack of enthusiasm and adoption of PHRs. This paper examines the current healthcare climate and attempts to understand the major challenges associated with PHRs adoption. The paper-based and fragmented healthcare system is no longer appropriate for the digital economy of the 21st century. The integrated health information technology system is the solution to transform clinical practice to consumer centric and information driven. Tools such as PHRs are means to an end that provide better, safer and more affordable healthcare for consumers. However,
there has been little research conducted to demonstrate PHR's tangible value, despite the widespread perceived value of these technologies. Although survey data reveals that there is a lack of awareness among the public, consumers are receptive to this concept, especially when a physician recommends it. Key issues in adopting PHRs and strategies for successful implementation of PHRs are discussed.

PMID: 18583296 [PubMed - indexed for MEDLINE]

Health care information technology in rural America: electronic medical record adoption status in meeting the national agenda.


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Continuing is a national political drive for investments in health care information technology (HIT) that will allow the transformation of health care for quality improvement and cost reduction. Despite several initiatives by the federal government to spur this development, HIT implementation has been limited, particularly in the rural market. The status of technology use in the transformation effort is reviewed by examining electronic medical records (EMRs), analyzing the existing rural environment, identifying barriers and factors affecting their development and implementation, and recommending needed steps to make this transformation occur, particularly in rural communities. A review of the literature for HIT in rural settings indicates that very little progress has been made in the adoption and use of HIT in rural America. Financial barriers and a large number of HIT vendors offering different solutions present significant risks to rural health care providers wanting to invest in HIT. Although evidence in the literature has demonstrated benefits of adopting HIT such as EMRs, important technical, policy, organizational, and financial barriers still exist that prevent the implementation of these systems in rural settings. To expedite the spread of HIT in rural America, federal and state governments along with private payers, who are important beneficiaries of HIT, must make difficult decisions as to who pays for the investment in this technology, along with driving standards, simplifying approaches for reductions in risk, and creating a workable operational plan.

Publication Types: Research Support, Non-U.S. Gov't Research Support, U.S. Gov't, P.H.S.

PMID: 18397442 [PubMed - indexed for MEDLINE]

Benefiting from ambulatory EHR implementation: solidarity, six sigma, and willingness to strive.


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Ambulatory electronic health record systems have the potential to improve healthcare quality. Optimizing the value of EHR implementation requires that providers and staff become effective and efficient EHR users so paper charts are no longer required or desired. Transitioning from paper charts to EHR systems requires new learning, significant effort, and workflow changes associated with an initial adverse effect on provider efficiency. This case study describes how timely EHR implementation and regular use in a large academic internal medicine clinic was encouraged, achieved, and demonstrated. Critical success factors included readiness to change, solidarity in EHR use, a commitment to striving, and process improvement strategies that used the EHR system to repair suboptimal clinic workflows. Observed benefits include improvements in patient access, workflow efficiency, communication, decision support use, and financial performance. These success factors and implementation strategies may help others seeking to encourage greater adoption and use of EHRs.

PMID: 16429959 [PubMed - indexed for MEDLINE]

Health information technology--results from a roundtable discussion.


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BACKGROUND: Health information technology (HIT), notably e-prescribing and electronic health records (EHR), have the potential to improve the quality of care, reduce medication errors and adverse events, and decrease overall health care utilization and costs. However, the United States continues to lag behind other countries in the adoption and use of HIT.

OBJECTIVE: To review the various issues surrounding the implementation of HIT in the United States and potential drivers that will influence the use of e-prescribing and EHR.

SUMMARY: The United States has been slow to embrace HIT. However, various factors, including increasing government involvement, are speeding the implementation and use of HIT. E-prescribing and EHR are both electronic means to provide better coordination of care by enabling various health care professionals to access patient medical records. Widespread adoption of HIT can be especially helpful for the elderly, since this population tends to have more chronic conditions requiring polypharmacy. Adoption of e-prescribing can reduce medication errors due to poor handwriting, while EHR can promote better clinical outcomes, improve medication adherence and refill rates, improve member satisfaction, and lower overall health care expenditures. Unfortunately, barriers to the adoption of e-prescribing and EHR still exist, including resistance to learning new
technology, initial start-up costs, delay in seeing a return on investment, lack of a standardized platform, increased administrative burden, and misaligned incentives. In an effort to promote greater adoption of e-prescribing and EHR, the Centers for Medicare & Medicaid has designed several initiatives, and other private organizations are now becoming more involved to close the HIT gap.

CONCLUSION: Although the United States has been slow to implement HIT, there is reason to be hopeful. Increasing involvement by the government and other organizations will facilitate the greater adoption and use of e-prescribing and EHR in the near future. Ongoing data are needed, however, to demonstrate improvements in overall patient care and reductions in health care utilization and costs. These data are necessary to remove existing barriers that may prevent widespread implementation.

Publication Types: Research Support, Non-U.S. Gov't Review

PMID: 19125556 [PubMed - indexed for MEDLINE]

**Costs and benefits of health information technology.**


Shekelle PG, Morton SC, Keeler EB.

OBJECTIVES: An evidence report was prepared to assess the evidence base regarding benefits and costs of health information technology (HIT) systems, that is, the value of discrete HIT functions and systems in various healthcare settings, particularly those providing pediatric care.

DATA SOURCES: PubMed, the Cochrane Controlled Clinical Trials Register, and the Cochrane Database of Reviews of Effectiveness (DARE) were electronically searched for articles published since 1995. Several reports prepared by private industry were also reviewed.

REVIEW METHODS: Of 855 studies screened, 256 were included in the final analyses. These included systematic reviews, meta-analyses, studies that tested a hypothesis, and predictive analyses. Each article was reviewed independently by two reviewers; disagreement was resolved by consensus.

RESULTS: Of the 256 studies, 156 concerned decision support, 84 assessed the electronic medical record, and 30 were about computerized physician order entry (categories are not mutually exclusive). One hundred twenty four of the studies assessed the effect of the HIT system in the outpatient or ambulatory setting; 82 assessed its use in the hospital or inpatient setting. Ninety-seven studies used a randomized design. There were 11 other controlled clinical trials, 33 studies using a pre-post design, and 20 studies using a time series. Another 17 were case studies with a concurrent control. Of the 211 hypothesis-testing studies, 82 contained at least some cost data. We identified no study or collection of studies, outside of those from a handful of HIT leaders, that would allow a reader to make a determination about the generalizable knowledge of the study's reported benefit. Beside these studies from HIT leaders, no other research assessed HIT systems that had
comprehensive functionality and included data on costs, relevant information on organizational context and process change, and data on implementation. A small body of literature supports a role for HIT in improving the quality of pediatric care. Insufficient data were available on the costs or cost-effectiveness of implementing such systems. The ability of Electronic Health Records (EHRs) to improve the quality of care in ambulatory care settings was demonstrated in a small series of studies conducted at four sites (three U.S. medical centers and one in the Netherlands). The studies demonstrated improvements in provider performance when clinical information management and decision support tools were made available within an EHR system, particularly when the EHRs had the capacity to store data with high fidelity, to make those data readily accessible, and to help translate them into context-specific information that can empower providers in their work. Despite the heterogeneity in the analytic methods used, all cost-benefit analyses predicted substantial savings from EHR (and health care information exchange and interoperability) implementation: The quantifiable benefits are projected to outweigh the investment costs. However, the predicted time needed to break even varied from three to as many as 13 years.

CONCLUSIONS: HIT has the potential to enable a dramatic transformation in the delivery of health care, making it safer, more effective, and more efficient. Some organizations have already realized major gains through the implementation of multifunctional, interoperable HIT systems built around an EHR. However, widespread implementation of HIT has been limited by a lack of generalizable knowledge about what types of HIT and implementation methods will improve care and manage costs for specific health organizations. The reporting of HIT development and implementation requires fuller descriptions of both the intervention and the organizational/economic environment in which it is implemented.

Publication Types: Review

PMID: 17627328 [PubMed - indexed for MEDLINE]

Interventions for promoting information and communication technologies adoption in healthcare professionals.


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BACKGROUND: Information and communication technologies (ICT) are defined as digital and analogue technologies that facilitate the capturing, processing, storage and exchange of information via electronic communication. ICTs have the potential to improve information management, access to health services, quality of care, continuity of services, and cost containment. Knowledge is lacking on conditions for successful ICT integration into practice.
OBJECTIVES: To carry out a systematic review of the effectiveness of interventions to promote the adoption of ICT by healthcare professionals.

SEARCH STRATEGY: Specific strategies, defined with the help of an information specialist, were used to search the Cochrane Effective Practice and Organisation of Care Group (EPOC) register and additional relevant databases. We considered studies published from January 1990 until October 2007.

SELECTION CRITERIA: Randomised controlled trials (RCTs), controlled clinical trials (CCTs), controlled before/after studies (CBAs), and interrupted time series (ITS) that reported objectively measured outcomes concerning the effect of interventions to promote adoption of ICT in healthcare professionals' practices.

DATA COLLECTION AND ANALYSIS: Two reviewers independently assessed each potentially relevant study for inclusion. We resolved discrepancies by discussion or a third reviewer. Two teams of two reviewers independently extracted data and assessed the quality of included studies. A meta-analysis of study outcomes was not possible, given the small number of included studies and the heterogeneity of intervention and outcomes measures. We conducted qualitative analyses, and have presented the results in a narrative format.

MAIN RESULTS: Ten studies met the inclusion criteria. Nine of them were RCTs. All studies involved physicians as participants (including postgraduate trainees), and one study also included other participants. Only two studies measured patient outcomes. Searching skills and/or frequency of use of electronic databases, mainly MEDLINE, were targeted in eight studies. Use of Internet for audit and feedback, and email for provider-patient communication, were targeted in two studies. Four studies showed small to moderate positive effects of the intervention on ICT adoption. Four studies were unable to demonstrate significant positive effects, and the two others showed mixed effects. No studies looked at the long-term effect or sustainability of the intervention. AUTHORS' CONCLUSIONS: There is very limited evidence on effective interventions promoting the adoption of ICTs by healthcare professionals. Small effects have been reported for interventions targeting the use of electronic databases and digital libraries. The effectiveness of interventions to promote ICT adoption in healthcare settings remains uncertain, and more well designed trials are needed.

PMID: 19160265 [PubMed - indexed for MEDLINE]

Adopting electronic medical records in primary care: lessons learned from health information systems implementation experience in seven countries.


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The adoption of health information systems is seen worldwide as one method to mitigate the widening health care demand and supply gap. The purpose of this review was to identify the current state of knowledge about health information systems adoption in primary care. The goal was to understand factors and influencers affecting implementation outcomes from previous health information systems implementations experiences. A comprehensive systematic literature review of peer reviewed and grey literature was undertaken to identify the current state of knowledge regarding the implementation of health information systems. A total of 6 databases, 27 journal websites, 20 websites from grey sources, 9 websites from medical colleges and professional associations as well as 22 government/commission websites were searched. The searches returned almost 3700 article titles. Eighty-six articles met our inclusion and exclusion criteria. Articles show that systems' graphical user interface design quality, feature functionality, project management, procurement and users' previous experience affect implementation outcomes. Implementers had concerns about factors such as privacy, patient safety, provider/patient relations, staff anxiety, time factors, quality of care, finances, efficiency, and liability. The review showed that implementers can insulate the project from such concerns by establishing strong leadership, using project management techniques, establishing standards and training their staff to ensure such risks do not compromise implementation success. The review revealed the concept of socio-technical factors, or "fit" factors, that complicate health information systems deployment. The socio-technical perspective considers how the technical features of a health information system interact with the social features of a health care work environment. The review showed that quality of care, patient safety and provider/patient relations were not, positively or negatively, affected by systems implementation. The fact that no articles were found reviewing the benefits or drawbacks of health information systems accruing to patients should be concern to adopters, payers and jurisdictions. No studies were found that compared how provider-patient interactions in interviews are affected when providers used electronic health information systems as opposed to the paper equivalent. Very little information was available about privacy and liability.

PMID: 18644745 [PubMed - in process]

**Clinicians need to redesign their clinical practices to further stimulate the adoption of electronic health records.**


Yellowlees P.

Publication Types: Editorial

PMID: 18679540 [PubMed - in process]


Electronic health records: which practices have them, and how are clinicians using them?
Simon SR, McCarthy ML, Kaushal R, Jenter CA, Volk LA, Poon EG, Yee KC, Orav EJ, Williams DH, Bates DW.

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BACKGROUND: Limited data exist to estimate the use of electronic health records (EHRs) in ambulatory care practices in the United States.

METHODS: We surveyed a stratified random sample of 1829 office practices in Massachusetts in 2005. The one-page survey measured use of health information technology, plans for EHR adoption and perceived barriers to adoption.

RESULTS: A total of 847 surveys were returned, for a response rate of 46%. Overall, 18% of office practices reported having an EHR. Primary-care-only and mixed practices reported similar adoption rates (23% and 25%, respectively; P = 0.70). The adoption rate in specialty practices (14%) was lower compared with both primary-care-only (P < 0.01) and mixed (P < 0.05) practices. The number of clinicians in the practice strongly correlated with EHR adoption (P < 0.001), with fewer small practices adopting EHRs. Among practices that have EHRs with laboratory and radiology result retrieval capabilities, at least 87% of practices report that a majority of their clinicians actively use these functionalities, while 74% of practices with electronic decision support report that the majority of clinicians actively use it. Among the practices without an EHR, 13% plan to implement one within the next 12 months, 24% within the next 1-2 years, 11% within the next 3-5 years, and 52% reported having no plans to implement an EHR in the foreseeable future. The most frequently reported barrier to implementation was lack of adequate funding (42%).

CONCLUSIONS: Overall, fewer than 1 in 5 medical practices in Massachusetts have an EHR. Even among adopters, though, doctor usage of EHR functions varied considerably by functionality and across practices. Many clinicians are not actively using functionalities that are necessary to improve health care quality and patient safety. Furthermore, among practices that do not have EHRs, more than half have no plan for adoption. Inadequate funding remains an important barrier to EHR adoption in ambulatory care practices in the United States.

Publication Types: Research Support, U.S. Gov't, P.H.S.

PMID: 18211642 [PubMed - indexed for MEDLINE]

Correlates of electronic health record adoption in office practices: a statewide survey.


Simon SR, Kaushal R, Cleary PD, Jenter CA, Volk LA, Poon EG, Orav EJ, Lo HG, Williams DH, Bates DW.
OBJECTIVE: Despite emerging evidence that electronic health records (EHRs) can improve the efficiency and quality of medical care, most physicians in office practice in the United States do not currently use an EHR. We sought to measure the correlates of EHR adoption.

DESIGN: Mailed survey to a stratified random sample of all medical practices in Massachusetts in 2005, with one physician per practice randomly selected for survey.

MEASUREMENTS: EHR adoption rates.

RESULTS: The response rate was 71% (1345/1884). Overall, while 45% of physicians were using an EHR, EHRs were present in only 23% of practices. In multivariate analysis, practice size was strongly correlated with EHR adoption; 52% of practices with 7 or more physicians had an EHR, as compared with 14% of solo practices (adjusted odds ratio, 3.66; 95% confidence interval, 2.28-5.87). Hospital-based practices (adjusted odds ratio, 2.44; 95% confidence interval, 1.53-3.91) and practices that teach medical students or residents (adjusted odds ratio, 2.30; 95% confidence interval, 1.60-3.31) were more likely to have an EHR. The most frequently cited barriers to adoption were start-up financial costs (84%), ongoing financial costs (82%), and loss of productivity (81%).

CONCLUSIONS: While almost half of physicians in Massachusetts are using an EHR, fewer than one in four practices in Massachusetts have adopted EHRs. Adoption rates are lower in smaller practices, those not affiliated with hospitals, and those that do not teach medical students or residents. Interventions to expand EHR use must address both financial and non-financial barriers, especially among smaller practices.

Publication Types: Research Support, N.I.H., Extramural

PMID: 17068351 [PubMed-indexed for MEDLINE]

Community-wide implementation of health information technology: the Massachusetts eHealth Collaborative experience.


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The Massachusetts eHealth Collaborative (MAeHC) was formed to improve patient safety and quality of care by promoting the use of health information technology through community-based implementation of electronic health records (EHRs) and health information exchange. The Collaborative has recently implemented EHRs in a diverse set
of competitively selected communities, encompassing nearly 500 physicians serving over 500,000 patients. Targeting both EHR implementation and health information exchange at the community level has identified numerous challenges and strategies for overcoming them. This article describes the formation and implementation phases of the Collaborative, focusing on barriers identified, lessons learned, and policy issues.

PMID: 18952937 [PubMed - indexed for MEDLINE]
EHR Design and Implementation

Managing the complexity of a systemwide electronic medical record design and implementation: lessons for nurse leaders.


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Nurse executives are critical to the successful planning, implementation, and adoption of technology to support the workflow and documentation needs of nurses and other end users. Informed by key principles of complexity theory, the enormous task of broad-based implementation of a standardized electronic medical record can be accomplished through the thoughtful development of flexible structures and change management principles that promote intelligent decision making and adoption by key stakeholders.

PMID: 19305307 [PubMed - in process]

Implementing electronic health records: 10 factors for success.

Healthc Financ Manage. 2009 Jan;63(1):50-2, 54.

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Strategies for maximizing the value of an EHR implementation include: Establishing clear strategies, objectives, and plans for EHR implementation. Including managers and clinicians in discussions on ways to tie the EHR in with the organization's strategy and areas requiring improvement. Continually measuring performance of EHR-enabled processes. Investing in critical infrastructure. Maintaining efficient and effective IT governance.

PMID: 19161029 [PubMed - indexed for MEDLINE]

Barriers to implementation of a computerized decision support system for depression: an observational report on lessons learned in "real world" clinical settings.


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BACKGROUND: Despite wide promotion, clinical practice guidelines have had limited effect in changing physician behavior. Effective implementation strategies to date have included: multifaceted interventions involving audit and feedback, local consensus processes, marketing; reminder systems, either manual or computerized; and interactive educational meetings. In addition, there is now growing evidence that contextual factors affecting implementation must be addressed such as organizational support (leadership procedures and resources) for the change and strategies to implement and maintain new systems.

METHODS: To examine the feasibility and effectiveness of implementation of a computerized decision support system for depression (CDSS-D) in routine public mental health care in Texas, fifteen study clinicians (thirteen physicians and two advanced nurse practitioners) participated across five sites, accruing over 300 outpatient visits on 168 patients.

RESULTS: Issues regarding computer literacy and hardware/software requirements were identified as initial barriers. Clinicians also reported concerns about negative impact on workflow and the potential need for duplication during the transition from paper to electronic systems of medical record keeping.

CONCLUSION: The following narrative report based on observations obtained during the initial testing and use of a CDSS-D in clinical settings further emphasizes the importance of taking into account organizational factors when planning implementation of evidence-based guidelines or decision support within a system.

Publication Types: Research Support, N.I.H., Extramural Research Support, U.S. Gov't, P.H.S.

PMID: 19159458 [PubMed - in process]

Whose record is it anyway? Putting patients' interests at the heart of the implementation and use of electronic medical records.


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With the dawn of electronic medical records (EMRs) and patient portals, there is an unprecedented opportunity to provide truly collaborative patient-centred care. These tools can promote communication between healthcare providers and patients, improve chronic disease management and enable patients to become active members in the healthcare
delivery system, but only if the tools work for everyone involved—including patients. Without patient consultation and input, there will be limitations in the ways in which physicians and patients are able to capitalize on these tools. Decision-makers must begin to enact their commitment to collaborative patient-centred care by engaging patients in discussions related to EMR design, implementation and use.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 19068936 [PubMed - indexed for MEDLINE]

**Introduction of shared electronic records: multi-site case study using diffusion of innovation theory.**


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OBJECTIVE: To explore the introduction of a centrally stored, shared electronic patient record (the summary care record (SCR)) in England and draw wider lessons about the implementation of large scale information technology projects in health care.

DESIGN: Multi-site, mixed method case study applying utilisation focused evaluation.

SETTING: Four early adopter sites for the SCR in England-three in urban areas of relative socioeconomic deprivation and the fourth in a relatively affluent rural area. Data sources and analysis Data included 250 staff interviews, 1500 hours of ethnographic observation, interviews and focus groups with 170 patients and carers, 2500 pages of correspondence and documentary evidence, and incorporation of relevant surveys and statistics produced by others. These were analysed by using a thematic approach drawing on (and extending) a theoretical model of complex change developed in a previous systematic review. Main findings The mixed fortunes of the SCR programme in its first year were largely explained by eight interacting influences. The first was the SCR’s material properties (especially technical immaturity and lack of interoperability) and attributes (especially the extent to which potential adopters believed the benefits outweighed the risks). The second was adopters’ concerns (especially about workload and the ethicality of sharing "confidential" information on an implied consent model). The third influence was interpersonal influence (for example, opinion leaders, champions, facilitators), and the fourth was organisational antecedents for innovation (for example past experience with information technology projects, leadership and management capacity, effective data capture systems, slack resources). The fifth was organisational readiness for the SCR (for example, innovation-system fit, tension for change, power balances between supporters and opponents, baseline data quality). The sixth was the implementation process (including the nature of the change model and the extent to which new routines associated with the SCR aligned with existing organisational routines). The seventh influence was the nature and quality of links...
between different parts of the system, and the final one was the wider environment (especially the political context of the programme).

CONCLUSION: Shared electronic records are not plug-in technologies. They are complex innovations that must be accepted by individual patients and staff and also embedded in organisational and inter-organisational routines. This process is heavily influenced at the micro-level by the material properties of the technology, individuals' attitudes and concerns, and interpersonal influence; at the meso-level by organisational antecedents, readiness, and operational aspects of implementation; and at the macro-level by institutional and socio-political forces. A case study approach and multi-level theoretical analysis can illuminate how contextual factors shape, enable, and constrain new, technology supported models of patient care.

Publication Types: Evaluation Studies Multicenter Study Research Support, Non-U.S. Gov't

PMID: 18948344 [PubMed - indexed for MEDLINE]

**Defining the evolving role of the EMR Implementation Team.**


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With the electronic medical record (EMR) system implementation underway in a large multi-site physician practice, the EMR Implementation Team faces several challenges. Dealing with each challenge requires strategic thinking in order to meet short- and long-term goals. In doing so, the Implementation Team begins to evolve both in role and in function.

PMID: 18754252 [PubMed - indexed for MEDLINE]

**Implementing electronic health records: Key factors in primary care.**


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OBJECTIVE: To examine common themes about implementing and adopting electronic health record (EHR) systems that emerged from 3 separate studies of the experiences of primary health care providers and those who implement EHRs.
DESIGN: Synthesis of the findings of 3 qualitative studies.

SETTING: Primary health care practices in southwestern Ontario and the Centre for Studies in Family Medicine at The University of Western Ontario in London.

PARTICIPANTS: Family physicians, other primary health care providers, and the Deliver Primary Healthcare Information management and operations team.

METHOD: The findings of 3 separate qualitative studies exploring the implementation of EHRs were synthesized. In the 3 studies, investigators used semistructured interview guides to conduct one-on-one interviews and a focus group, which were audiotaped and transcribed verbatim, to collect information about participants' experiences implementing and adopting EHRs. Transcripts were coded and analyzed by 1 or 2 investigators, and the research team met regularly for synthesis and interpretation of themes.

MAIN FINDINGS: Four common themes arose from the 3 studies: expectations of EHRs, time and training required to implement and adopt the software, the emergence of an EHR champion or problem solver, and the readiness of health care providers to accept the system.

CONCLUSION: Those considering implementing and adopting EHRs into a family practice environment should reflect on the following issues: their expectations of the system and what is needed to use the software, the level of commitment to EHR implementation and adoption, the availability of someone willing to take a leadership or champion role, and how much knowledge of computers potential EHR users have.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 18474707 [PubMed - indexed for MEDLINE]

How to successfully select and implement electronic health records (EHR) in small ambulatory practice settings.


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BACKGROUND: Adoption of EHRs by U.S. ambulatory practices has been slow despite the perceived benefits of their use. Most evaluations of EHR implementations in the literature apply to large practice settings. While there are similarities relating to EHR implementation in large and small practice settings, the authors argue that scale is an important differentiator. Focusing on small ambulatory practices, this paper outlines the benefits and barriers to EHR use in this setting, and provides a "field guide" for these practices to facilitate successful EHR implementation.
DISCUSSION: The benefits of EHRs in ambulatory practices include improved patient care and office efficiency, and potential financial benefits. Barriers to EHRs include costs; lack of standardization of EHR products and the design of vendor systems for large practice environments; resistance to change; initial difficulty of system use leading to productivity reduction; and perceived accrual of benefits to society and payers rather than providers. The authors stress the need for developing a flexible change management strategy when introducing EHRs that is relevant to the small practice environment; the strategy should acknowledge the importance of relationship management and the role of individual staff members in helping the entire staff to manage change. Practice staff must create an actionable vision outlining realistic goals for the implementation, and all staff must buy into the project. The authors detail the process of implementing EHRs through several stages: decision, selection, pre-implementation, implementation, and post-implementation. They stress the importance of identifying a champion to serve as an advocate of the value of EHRs and provide direction and encouragement for the project. Key activities include assessing and redesigning workflow; understanding financial issues; conducting training that is well-timed and meets the needs of practice staff; and evaluating the implementation process.

SUMMARY: The EHR implementation experience depends on a variety of factors including the technology, training, leadership, the change management process, and the individual character of each ambulatory practice environment. Sound processes must support both technical and personnel-related organizational components. Additional research is needed to further refine recommendations for the small physician practice and the nuances of specific medical specialties.

Publication Types: Research Support, Non-U.S. Gov't  Research Support, U.S. Gov't, P.H.S.

PMID: 19236705 [PubMed - indexed for MEDLINE]

Challenges to EHR implementation in electronic- versus paper-based office practices.


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BACKGROUND: Challenges in implementing electronic health records (EHRs) have received some attention, but less is known about the process of transitioning from legacy EHRs to newer systems.

OBJECTIVE: To determine how ambulatory leaders differentiate implementation approaches between practices that are currently paper-based and those with a legacy EHR system (EHR-based).

DESIGN: Qualitative study.
PARTICIPANTS: Eleven practice managers and 12 medical directors all part of an academic ambulatory care network of a large teaching hospital in New York City in January to May of 2006.

APPROACH: Qualitative approach comparing and contrasting perceived benefits and challenges in implementing an ambulatory EHR between practice leaders from paper- and EHR-based practices. Content analysis was performed using grounded theory and ATLAS.ti 5.0.

RESULTS: We found that paper-based leaders prioritized the following: sufficient workstations and printers, a physician information technology (IT) champion at the practice, workflow education to ensure a successful transition to a paperless medical practice, and a high existing comfort level of practitioners and support staff with IT. In contrast, EHR-based leaders prioritized: improved technical training and ongoing technical support, sufficient protection of patient privacy, and open recognition of physician resistance, especially for those who were loyal to a legacy EHR. Unlike paper-based practices, EHR-based leadership believed that comfort level with IT and adjustments to workflow changes would not be difficult challenges to overcome.

CONCLUSIONS: Leadership at paper- and EHR-based practices in 1 academic network has different priorities for implementing a new EHR. Ambulatory practices upgrading their legacy EHR have unique challenges.

Publication Types:    Research Support, Non-U.S. Gov't

PMID: 18369679 [PubMed - indexed for MEDLINE]
EHR Outcomes

Implementing an integrated electronic outcomes and electronic health record process to create a foundation for clinical practice improvement.


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BACKGROUND AND PURPOSE: Improving clinical outcomes requires continuous measurement and interpretation in conjunction with treatment process and patient characteristics. The purposes of this study were: (1) to describe implementation and integration of electronic functional status outcomes into an electronic health record (EHR) for the promotion of clinical practice improvement processes and (2) to examine the effect of ongoing outcomes data collection in a large physical therapy service in relation to patient and clinic burden.

SUBJECTS: Data were examined from 21,523 adult patients (mean age=50.6 years, SD=16.3, range=18-99; 58.9% women, 41.1% men) referred for physical therapist management of neuromusculoskeletal disorders.

METHODS: Process and patient characteristic data were entered into the EHR.

OUTCOMES: data collected using computerized adaptive testing technology in 11 outpatient clinics were integrated into the EHR. The effect of data collection was assessed by measuring the participation rate, completion rate, and data entry time. Qualitative assessment of the implementation process was conducted.

RESULTS: After 1 year, the average participation rate per clinic was 79.8% (range=52.7%-100%), the average completion rate per clinic was 45.1% (range=19.3%-64.7%), and the average data entry time per patient (minutes:seconds) was 03:37 (SD=02:19). Maximum estimate of average administrative time per patient was 9.6% of overall episode time. Barriers to and facilitators of the implementation process were identified.

DISCUSSION AND CONCLUSION: The results indicate that routine collection of outcome data is realistic in a large public physical therapy service and can be successfully integrated with EHR data to produce a valuable clinical practice improvement platform for service evaluation and outcomes research. Participation and completion rate goals of 90% and 65%, respectively, appear to be feasible.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 18042656 [PubMed - indexed for MEDLINE]


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User satisfaction with an electronic medical record (EMR) plays a decisive role in its implementation and subsequent use. We developed a survey tool to identify features of an EMR that contribute to user satisfaction and administered it in an adult primary care clinic. Most physician respondents were highly satisfied with the EMR and used all of its components. The EMR decreased the time to develop a synopsis of the patient and improved communication efficiency. Most respondents valued remote access to the EMR. Electronic messaging was an important component of improved care delivery according to 80% of the respondents. Access to online references within the EMR was not valued over web-based access for most respondents. Our results demonstrate acceptance of an EMR in adult primary care. Features such as remote access and electronic messaging were surprisingly useful and successful for primary care practice.

PMID: 17238370 [PubMed - indexed for MEDLINE]

Impact of clinical alerts within an electronic health record on routine childhood immunization in an urban pediatric population.


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OBJECTIVES: The objective of this study was to test the hypothesis that clinical alerts for routine pediatric vaccinations within an electronic health record would reduce missed opportunities for vaccination and improve immunization rates for young children in an inner-city population.

METHODS: A 1-year intervention study (September 1, 2004, to August 31, 2005) with historical controls was conducted in 4 urban primary care centers affiliated with an academic medical center. All children who were younger than 24 months were enrolled. Electronic health record-based clinical reminders for routine childhood vaccinations were programmed to appear prominently at every patient encounter with vaccines due. The main outcome measures were rates of captured immunization opportunities and overall immunization rates at 24 months of age.

RESULTS: Immunization alerts appeared at 15,928 visits during the intervention. Alert implementation was associated with increases in captured immunization opportunities from
78.2% to 90.3% at well visits and from 11.3% to 32.0% at sick visits. Adjusted up-to-date immunization rates at 24 months of age increased from 81.7% to 90.1% from the control to intervention period. Children in the intervention group also became up-to-date earlier than control patients. Patient characteristics were stable throughout the study.

CONCLUSIONS: An electronic health record-based clinical alert intervention was associated with increases in captured opportunities for vaccination at both sick and well visits and significant improvements in immunization rates at 2 years of age. As electronic health records become more common in medical practice, such systems may transform immunization delivery to children.

Publication Types: Multicenter Study Research Support, Non-U.S. Gov't

PMID: 17908756 [PubMed - indexed for MEDLINE]

**Variation in implementation and use of computerized clinical reminders in an integrated healthcare system.**


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OBJECTIVES: To identify patterns of use of computerized clinical reminders (CCRs) across an integrated healthcare system and describe institutional factors associated with their implementation.

STUDY DESIGN: Cross-sectional study.

METHODS: At a national electronic health record (EHR) meeting, we surveyed 261 participants from 104 Veterans Health Administration (VHA) healthcare facilities regarding the number and types of CCRs available at each facility. Potential explanatory measures included perceived utility and ease of use of CCRs, training and personnel support for computer use, EHR functionalities, and performance data feedback to providers at each facility.

RESULTS: The number of conditions with CCRs in use at a facility ranged from 1 to 15; most reported implementation of reminders for 10 of the 15 conditions surveyed. The most commonly implemented CCRs, used in more than 85% of facilities, were for conditions with VHA national performance measures (eg, tobacco cessation, immunizations, diabetes mellitus). The least commonly implemented CCRs were for post-deployment health evaluation and management, medically unexplained symptoms, and erectile dysfunction. Facilities that had implemented greater numbers of clinical reminders had providers who reported greater ease of use and utility of the reminders (P=.01).

CONCLUSIONS: VHA facilities vary markedly in their implementation of CCRs. This effect may be partly explained by greater incorporation of clinical reminders for conditions
Prompting clinicians about preventive care measures: a systematic review of randomized controlled trials.


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Preventive care measures remain underutilized despite recommendations to increase their use. The objective of this review was to examine the characteristics, types, and effects of paper- and computer-based interventions for preventive care measures. The study provides an update to a previous systematic review. We included randomized controlled trials that implemented a physician reminder and measured the effects on the frequency of providing preventive care. Of the 1,535 articles identified, 28 met inclusion criteria and were combined with the 33 studies from the previous review. The studies involved 264 preventive care interventions, 4,638 clinicians and 144,605 patients. Implementation strategies included combined paper-based with computer generated reminders in 34 studies (56%), paper-based reminders in 19 studies (31%), and fully computerized reminders in 8 studies (13%). The average increase for the three strategies in delivering preventive care measures ranged between 12% and 14%. Cardiac care and smoking cessation reminders were most effective. Computer-generated prompts were the most commonly implemented reminders. Clinician reminders are a successful approach for increasing the rates of delivering preventive care; however, their effectiveness remains modest. Despite increased implementation of electronic health records, randomized controlled trials evaluating computerized reminder systems are infrequent.

Publication Types: Research Support, N.I.H., Extramural Review

PMID: 18308989 [PubMed - indexed for MEDLINE]
We examined the impact of implementing a comprehensive electronic health record (EHR) system on ambulatory care use in an integrated health care delivery system with more than 225,000 members. Between 2004 and 2007, the annual age/sex-adjusted total office visit rate decreased 26.2 percent, the adjusted primary care office visit rate decreased 25.3 percent, and the adjusted specialty care office visit rate decreased 21.5 percent. Scheduled telephone visits increased more than eightfold, and secure e-mail messaging, which began in late 2005, increased nearly sixfold by 2007. Introducing an EHR creates operational efficiencies by offering nontraditional, patient-centered ways of providing care.

PMID: 19275987 [PubMed - in process]

**Electronic health records in specialty care: a time-motion study.**


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BACKGROUND: Electronic health records (EHRs) have great potential to improve safety, quality, and efficiency in medicine. However, adoption has been slow, and a key concern has been that clinicians will require more time to complete their work using EHRs. Most previous studies addressing this issue have been done in primary care.

OBJECTIVE: To assess the impact of using an EHR on specialists' time.

DESIGN Prospective, before-after trial of the impact of an EHR on attending physician time in four specialty clinics at an integrated delivery system: cardiology, dermatology, endocrine, and pain.

MEASUREMENTS: We used a time-motion method to measure physician time spent in one of 85 designated activities.

RESULTS: Attending physicians were monitored before and after the switch from paper records to a web-based ambulatory EHR. Across all specialties, 15 physicians were observed treating 157 patients while still using paper-based records, and 15 physicians were observed treating 146 patients after adoption. Following EHR implementation, the average adjusted total time spent per patient across all specialties increased slightly but not significantly (Δ = 0.94 min., p = 0.83) from 28.8 (SE = 3.6) to 29.8 (SE = 3.6) min.

CONCLUSION: These data suggest that implementation of an EHR had little effect on overall visit time in specialty clinics.

Publication Types: Comparative Study

PMID: 17600102 [PubMed - indexed for MEDLINE]
Electronic health records in four community physician practices: impact on quality and cost of care.


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OBJECTIVE: To assess the impact of the electronic health record (EHR) on cost (i.e., payments to providers) and process measures of quality of care.

STUDY DESIGN: Retrospective before-after-study-control. From the database of a large managed care organization (MCO), we obtained the claims of patients from four community physician practices that implemented the EHR and from about 50 comparison practices without the EHR in the same counties. The diverse patient and practice populations were chosen to be a sample more representative of typical private practices than has previously been studied.

MEASUREMENTS: For four chronic conditions, we used commercially-available software to analyze cost per episode over a year and the rate of adherence to clinical guidelines as a measure of quality.

RESULTS: The implementation of the EHR had a modest positive impact on the quality measure of guideline adherence for hypertension and hyperlipidemia, but no significant impact for diabetes and coronary artery disease. No measurable impact on the short-term cost per episode was found. Discussions with the study practices revealed that the timing and comprehensiveness of EHR implementation varied across practices, creating an intervention variable that was heterogeneous.

CONCLUSIONS: Guideline adherence increased across practices without EHRs and slightly faster in practices with EHRs. Measuring the impact of EHRs on cost per episode was challenging, because of the difficulty of completely capturing the long-term episodic costs of a chronic condition. Few practices associated with the study MCO had implemented EHRs in any form, much less utilizing standardized protocols.

Publication Types: Evaluation Studies Research Support, Non-U.S. Gov't Research Support, U.S. Gov't, P.H.S.

PMID: 17329734 [PubMed - indexed for MEDLINE]

Systematic review: impact of health information technology on quality, efficiency, and costs of medical care.

BACKGROUND: Experts consider health information technology key to improving efficiency and quality of health care.

PURPOSE: To systematically review evidence on the effect of health information technology on quality, efficiency, and costs of health care.

DATA SOURCES: The authors systematically searched the English-language literature indexed in MEDLINE (1995 to January 2004), the Cochrane Central Register of Controlled Trials, the Cochrane Database of Abstracts of Reviews of Effects, and the Periodical Abstracts Database. We also added studies identified by experts up to April 2005.

STUDY SELECTION: Descriptive and comparative studies and systematic reviews of health information technology.

DATA EXTRACTION: Two reviewers independently extracted information on system capabilities, design, effects on quality, system acquisition, implementation context, and costs.

DATA SYNTHESIS: 257 studies met the inclusion criteria. Most studies addressed decision support systems or electronic health records. Approximately 25% of the studies were from 4 academic institutions that implemented internally developed systems; only 9 studies evaluated multifunctional, commercially developed systems. Three major benefits on quality were demonstrated: increased adherence to guideline-based care, enhanced surveillance and monitoring, and decreased medication errors. The primary domain of improvement was preventive health. The major efficiency benefit shown was decreased utilization of care. Data on another efficiency measure, time utilization, were mixed. Empirical cost data were limited.

LIMITATIONS: Available quantitative research was limited and was done by a small number of institutions. Systems were heterogeneous and sometimes incompletely described. Available financial and contextual data were limited.

CONCLUSIONS: Four benchmark institutions have demonstrated the efficacy of health information technologies in improving quality and efficiency. Whether and how other institutions can achieve similar benefits, and at what costs, are unclear.

Publication Types: Research Support, U.S. Gov't, P.H.S. Review

PMID: 16702590 [PubMed - indexed for MEDLINE]
Provider attitudes, experiences, and perceptions of EHR

Managing the quality of health information using electronic medical records: an exploratory study among clinical physicians.


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As technology is advancing in the healthcare field, ways of reducing costs and improving quality are key initiatives in the tedious processes of operations planning. There are several ways of reducing costs and improving quality management. One such way is the implementation of Electronic Health Records (HERs). A personally interviewed sample from a relatively large healthcare facility located in Pittsburgh, Pennsylvania, which is associated with the University of Pittsburgh Medical Center, netted a total of 44 physicians. There were no statistically significant relationships found based on 'clinicians' willingness to accept Electronic Medical Record (EMR)-embedded systems with gender', 'benefits outweigh risks for EMR-embedded implementation', 'EMR-embedded systems should be mandated', 'EMR-embedded systems should be administered by the federal government', 'EMR-embedded systems should be administered by regional systems', 'EMR applications are an invasion of privacy' and 'IT-related technologies pose an added threat to the healthcare environment'. It was only for the independent variable 'improves quality of care by EMR-embedded implementation' that most physicians felt that such a technology does positively impact patient care.

PMID: 19174363 [PubMed - indexed for MEDLINE]


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BACKGROUND: Clinician perceptions of a newly implemented electronic health record play an important role in its success or failure.

OBJECTIVE: To measure changes in primary care clinician attitudes toward an electronic health record during the first year following implementation.

DESIGN: Longitudinal survey.
PARTICIPANTS: 86 primary care clinicians surveyed between December 2006 and January 2008.

MEASUREMENTS: Perceived impact on overall quality of care, patient safety, communication, and efficiency at 1, 3, 6, and 12 months following implementation.

RESULTS: Response rates for months 1, 3, 6, and 12 were 92%, 95%, 90%, and 82%, respectively. The proportion of clinicians agreeing that the EHR improved the overall quality of care (63% to 86%; p < 0.001), reduced medication-related errors (72% to 81%; p = 0.03), improved follow-up of test results (62% to 87%; p < 0.001), and improved communication among clinicians (72% to 93%; p < 0.001) increased from month 1 to month 12. During the same time period, a decreasing proportion of clinicians agreed that the EHR reduced the quality of patient interactions (49% to 33%; p = 0.001), resulted in longer patient visits (68% to 51%; p = 0.001), and increased time spent on medical documentation (78% to 68%; p = 0.006). Significant improvements in perceptions related to test result follow-up were first detected at 6 months, while those related to overall quality, efficiency, and communication were first identified at 12 months.

CONCLUSIONS: Primary care clinicians report increasingly positive perceptions of a new electronic health record within 1 year of implementation across a spectrum of domains of care.

Publication Types: Research Support, N.I.H., Extramural Research Support, U.S. Gov't, P.H.S.

PMID: 19156468 [PubMed - in process]

Providers Expectations of Ambulatory Electronic Health Records (EHRs).


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Little is known about how providers expect the implementation of a new electronic health record (EHR) will affect their clinical workflow. We found that providers currently completing clinical tasks electronically are more satisfied with task completion than those completing similar tasks on paper. Yet, these already electronic providers expect less future satisfaction with the new EHR compared with paper-based providers. Further understanding of provider expectations can assist in optimally tailoring implementation plans.

PMID: 18998972 [PubMed - in process]
Replacing an inpatient electronic medical record. Lessons learned from user satisfaction with the former system.


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OBJECTIVE: Since it is important to develop strategies for the successful implementation of electronic clinical information systems, the aim of this study is to explore where, and to what extent, users’ attitudes toward the former system that is being replaced may vary.

METHODS: A cross-sectional survey of 346 nurses and physicians practicing in two Canadian teaching hospitals resulted in a total response rate of 63%. User attitudes were measured in three dimensions: a) user satisfaction with the system's quality attributes, b) perceived system usefulness, and c) perceived impact on quality of care and patient safety. The current system (the one being replaced) was analyzed as a dual system composed of both paper-based and electronic records.

RESULTS: The results on user satisfaction demonstrate a wide variation in opinions, with satisfaction ranging from 4.2 to 7.7 on a 10-point disagree-agree, Likert scale. The quality attributes varied by record type, with differences that were systematically in favor of the electronic record component, which received higher scores. The results also highlighted large differences by user group. Physicians and nurses systematically rated the two record formats differently. The nurses were more satisfied with the attributes of the paper-based record. Multivariate regression analyses results also revealed strong interdependencies among the three dimensions of user attitudes, to the extent that perceived system usefulness was strongly correlated with system quality attributes and the system outcomes were also correlated, although less strongly, with the two former system dimensions.

CONCLUSION: Understanding users' attitudes toward a clinical information system in use, both in its paper and electronic aspects, is crucial for developing more successful implementation strategies for electronic record systems.

Publication Types: Research Support, Non-U.S. Gov't

PMID: 19151889 [PubMed - indexed for MEDLINE]

Electronic health records in ambulatory care--a national survey of physicians.


BACKGROUND: Electronic health records have the potential to improve the delivery of health care services. However, in the United States, physicians have been slow to adopt such systems. This study assessed physicians' adoption of outpatient electronic health records, their satisfaction with such systems, the perceived effect of the systems on the quality of care, and the perceived barriers to adoption.

METHODS: In late 2007 and early 2008, we conducted a national survey of 2758 physicians, which represented a response rate of 62%. Using a definition for electronic health records that was based on expert consensus, we determined the proportion of physicians who were using such records in an office setting and the relationship between adoption and the characteristics of individual physicians and their practices.

RESULTS: Four percent of physicians reported having an extensive, fully functional electronic-records system, and 13% reported having a basic system. In multivariate analyses, primary care physicians and those practicing in large groups, in hospitals or medical centers, and in the western region of the United States were more likely to use electronic health records. Physicians reported positive effects of these systems on several dimensions of quality of care and high levels of satisfaction. Financial barriers were viewed as having the greatest effect on decisions about the adoption of electronic health records.

CONCLUSIONS: Physicians who use electronic health records believe such systems improve the quality of care and are generally satisfied with the systems. However, as of early 2008, electronic systems had been adopted by only a small minority of U.S. physicians, who may differ from later adopters of these systems.

Publication Types: Research Support, Non-U.S. Gov't Research Support, U.S. Gov't, Non-P.H.S.

PMID: 18565855 [PubMed - indexed for MEDLINE]

**Physicians and electronic health records: a statewide survey.**


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BACKGROUND: Electronic health records (EHRs) allow for a variety of functions, ranging from visit documentation to laboratory test ordering, but little is known about physicians' actual use of these functions.

METHODS: We surveyed a random sample of 1884 physicians in Massachusetts by mail and assessed availability and use of EHR functions, predictors of use, and the relationships between EHR use and physicians' perceptions of medical practice.

RESULTS: A total of 1345 physicians responded to the survey (71.4% response rate), and 387 (28.8%) reported that their practice had adopted EHRs. More than 80% of physicians with EHRs reported having the ability to view laboratory reports (84.8%) and document visits electronically (84.0%), but considerably fewer reported being able to order laboratory tests electronically (46.8%) or transmit prescriptions to a pharmacy electronically (44.7%). Fewer than half of the physicians who had systems with clinical decision support, transmittal of electronic prescriptions, and radiology order entry actually used these functions most or all of the time. Compared with physicians who had not adopted EHRs, EHR users reported more positive views of the effects of computers on health care; there were no significant differences in these attitudes between high and low users of EHRs. Overall, about 1 in 4 physicians reported dissatisfaction with medical practice; there was no difference in this measure by EHR adoption or use.

CONCLUSIONS: There is considerable variability in the functions available in EHRs and in the extent to which physicians use them. Future work should emphasize factors that affect the use of available functions.

Publication Types: Research Support, U.S. Gov't, P.H.S.

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Electronic health records in outpatient clinics: perspectives of third year medical students.


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BACKGROUND: United States academic medical centers are increasingly incorporating electronic health records (EHR) into teaching settings. We report third year medical students' attitudes towards clinical learning using the electronic health record in ambulatory primary care clinics.

METHODS: In academic year 2005-06, 60 third year students were invited to complete a questionnaire after finishing the required Ambulatory Medicine/Family Medicine clerkship. The authors elicited themes for the questionnaire by asking a focus group of third year students how using the EHR had impacted their learning. Five themes emerged: organization of information, access to online resources, prompts from the EHR, personal
performance (charting and presenting), and communication with patients and preceptors. The authors added a sixth theme: impact on student and patient follow-up. The authors created a 21-item questionnaire, based on these themes that used a 5-point Likert scale from "Strongly Agree" to "Strongly Disagree". The authors emailed an electronic survey link to each consenting student immediately following their clerkship experience in Ambulatory Medicine/Family Medicine.

RESULTS: 33 of 53 consenting students (62%) returned completed questionnaires. Most students liked the EHR's ability to organize information, with 70% of students responding that essential information was easier to find electronically. Only 36% and 33% of students reported accessing online patient information or clinical guidelines more often when using the EHR than when using paper charts. Most students (72%) reported asking more history questions due to EHR prompts, and 39% ordered more clinical preventive services. Most students (69%) reported that the EHR improved their documentation. 39% of students responded that they received more feedback on their EHR notes compared to paper chart notes. Only 64% of students were satisfied with the doctor-patient communication with the EHR, and 48% stated they spent less time looking at the patient.

CONCLUSION: Third year medical students reported generally positive attitudes towards using the EHR in the ambulatory setting. They reported receiving more feedback on their electronic charts than on paper charts. However, students reported significant concerns about the potential impact of the EHR on their ability to conduct the doctor-patient encounter.

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Implementation and use of an electronic health record within the Indian Health Service.


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OBJECTIVES: There are limited data regarding implementing electronic health records (EHR) in underserved settings. We evaluated the implementation of an EHR within the Indian Health Service (IHS), a federally funded health system for Native Americans.

DESIGN: We surveyed 223 primary care clinicians practicing at 26 IHS health centers that implemented an EHR between 2003 and 2005.

METHODS: The survey instrument assessed clinician attitudes regarding EHR implementation, current utilization of individual EHR functions, and attitudes regarding the use of information technology to improve quality of care in underserved settings. We fit a multivariable logistic regression model to identify correlates of increased utilization of the EHR.
RESULTS: The overall response rate was 56%. Of responding clinicians, 66% felt that the EHR implementation process was positive. One-third (35%) believed that the EHR improved overall quality of care, with many (39%) feeling that it decreased the quality of the patient-doctor interaction. One-third of clinicians (34%) reported consistent use of electronic reminders, and self-report that EHRs improve quality was strongly associated with increased utilization of the EHR (odds ratio 3.03, 95% confidence interval 1.05-8.8). The majority (87%) of clinicians felt that information technology could potentially improve quality of care in rural and underserved settings through the use of tools such as online information sources, telemedicine programs, and electronic health records.

CONCLUSIONS: Clinicians support the use of information technology to improve quality in underserved settings, but many felt that it was not currently fulfilling its potential in the IHS, potentially due to limited use of key functions within the EHR.

Publication Types: Evaluation Studies Research Support, U.S. Gov't, P.H.S.

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Impact of EHR on provider-patient communication and patient satisfaction

Physicians, patients, and the electronic health record: an ethnographic analysis.


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PURPOSE: Little is known about the effects of the electronic health record (EHR) on physician-patient encounters. The objectives of this study were to identify the factors that influence the manner by which physicians use the EHR with patients.

METHODS: This ethnographic study included 4 qualitative components: 80 hours of participant observation in 4 primary care offices in the Pacific Northwest; individual interviews with 52 patients, 12 office staff members, 23 physicians, and 1 nurse-practitioner; videotaped reviews of 29 clinical encounters; and 5 focus-group interviews with physicians and computer advocates. The main outcome measures were factors that influence how physicians use the EHR. Researchers qualitatively derived these factors through serial reviews of data.

RESULTS: This study identified 14 factors that influence how EHRs are used and perceived in medical practice today. These factors were categorized into 4 thematic domains: (1) spatial--effect of the physical presence and location of EHRs on interactions between physicians and patients; (2) relational--perceptions of physicians and patients about the EHR and how those perceptions affected its use; (3) educational--issues of developing physicians' proficiency with and improving patients' understandings about EHR use; and (4) structural--institutional and technological forces that influence how physicians perceived their use of EHR.

CONCLUSIONS: This study found that the introduction of EHRs into practice influences multiple cognitive and social dimensions of the clinical encounter. It brings into focus important questions that through further inquiry can determine how to make best use of the EHR to enhance therapeutic relationships.

Publication Types: Research Support, Non-U.S. Gov't

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Communicating about medications during primary care outpatient visits: the role of electronic medical records.

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OBJECTIVES: To assess the role of electronic medical records (EMR) in facilitating the content and process of patient-provider exchanges about medications during outpatient primary care visits.

METHODS: Fifty encounters with six physicians using the EMR were videotaped, transcribed and content-analysed by applying conversation analysis and ethnomethodology techniques. The analysis focused on three aspects of medication communication: (1) process of care: practices by patients and physicians to implement medication decisions; (2) themes: medication topics that consistently emerge; and (3) names: ways patients and physicians refer to medications. In-depth analysis of 20 encounters examined the extent to which either or both parties initiated, expanded and concluded medication discussions.

RESULTS: On average 21.2 (range: 8-35; SD=7.4) distinct exchanges per encounter were observed. Of those, 33% were related to medication. Of the 350 medication-related exchanges throughout the encounters, 56% were categorised as routine medication discussion such as ordering and/or refilling medications. Mailing issues were the next most common medication-related exchanges (10.6%), followed by partial adherence (8.9%), self-regulation (7.4%), alternative therapy/over-the-counter medication (6.6%), side effects (6%) and formulary issues (4.6%). Patients and providers used three ways to name medications: generic/scientific name (42%); physical description (39.7%) and brand name (18.3%). Forty-one percent of exchanges included initiation by one or both parties but no further discussion of the issue; 42% included initiation and expansion by both parties but not conclusion; only 17% of exchanges contained complete medication exchanges (initiation, expansion and conclusion) by both parties.

CONCLUSIONS: EMR facilitated content and process of communication regarding medications during outpatient encounters, especially among patients taking multiple medications and patients who used physical descriptions to identify their medications. EMR use stimulated medication exchanges, leading to further expansion about the topic. However, fewer than one-fifth of exchanges ended with clear conclusions by both parties regarding prescribed medication regimens.

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Clinician style and examination room computers: a video ethnography.

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BACKGROUND AND OBJECTIVES: The use of computers in medical examination rooms is growing. Advocates of this technology suggest that all family physicians should have and use examination room computers (ERCs) within the near future. This study explored how family physicians incorporate the use of ERCS in their interactions with patients.

METHODS: This qualitative study involved five family physicians, one family nurse practitioner, and a convenience sample of 29 patients. Data included videotaped visits, clinician interviews, and videotape reviews. The setting was an urban family practice with a 7-year history of viewing electronic medical records. The main outcome measures were themes emergent from videotaped data.

RESULTS: We identified three distinct practice styles that shaped the use of the ERC: informational, interpersonal, and managerial styles. Clinicians with an informational style are guided by their attention to gathering data as prompted by the computer screen. Clinicians with an interpersonal style focus their attention and body language on patients. Clinicians with a managerial style bridge informational and interpersonal styles by alternating their attention in defined intervals between patients and the computer.

CONCLUSIONS: Family physicians have varying practice styles that affect the way they use examination room computers during visits with patients.

Publication Types: Research Support, Non-U.S. Gov't

Impact of an automated test results management system on patients' satisfaction about test result communication.


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BACKGROUND: Few reliable and efficient systems support the communication of test results to outpatients, and this may lead to patient dissatisfaction with test result communication. The objective of this study was to assess the impact of physicians' use of a test results management tool embedded in an electronic health record on patient satisfaction with test result communication.

METHODS: A prospective, cluster-randomized, controlled trial of 570 patient encounters in 26 outpatient primary care practices was performed from December 1, 2002, to April 31, 2005. Physicians in the intervention practices were trained and given access to a physician
test results management tool with imbedded patient notification functions to evaluate whether patient satisfaction with communication of test results ordered by the primary care provider was improved. Patient satisfaction surveys were conducted by telephone after the patient underwent the test and were administered before and after the intervention in both arms.

RESULTS: The survey response rate after successful patient contact was 74.2% (570/768). After adjusting for patient age, sex, race, socioeconomic status, and insurance type, the intervention significantly increased patient satisfaction with test results communication (odds ratio, 2.35; 95% confidence interval, 1.05-5.25; P = .03). In addition, patients in the post intervention group were more satisfied with information given them for medical treatments and conditions regarding their results (odds ratio, 3.45; 95% confidence interval, 1.30-9.17; P = .02).

CONCLUSION: An automated test results management system can improve patient satisfaction with communication of test results ordered by their primary care provider and can improve patient satisfaction with the communication of information regarding their condition and treatment plans.

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A multicenter, randomized, open study to evaluate the impact of an electronic data capture system on the care of patients with rheumatoid arthritis.


OBJECTIVE: To examine the impact of an electronic data capture system on patient satisfaction and patient-physician interactions in a rheumatology clinical setting.

Study design: In this multicenter study, 1079 patients with rheumatoid arthritis completed questionnaires quarterly about their health and satisfaction with care using a computer. At 6 months, 901 eligible patients were randomized 2:1 to receive or not to receive graphical summarized health information or Health Tracker (HT) reports. Data collected at each visit included patient satisfaction with care; patient-physician interaction assessments; a 56-joint self-assessment for patients; a 28-joint assessment for physicians; patient pain, fatigue, and global assessments (visual analogue scale, physician global assessment, Health Assessment Questionnaire, and Short Form-12) all of which were cumulatively recorded in the HT report.

RESULTS: Patient demographics at baseline were similar between groups. Changes from baseline to 1 year showed that patients in the HT-viewers group were significantly more satisfied with their care (p < 0.001) than those in the HT-nonviewers group (p = 0.131). Physicians reported improved interactions with patients at 1 year in both the HT-viewers (p
< 0.001) and HT-nonviewers groups (p = 0.002); however, the improvement was significantly larger for the HT-viewers group than for the HT-nonviewers group (p < 0.001). Adverse events were comparable between groups.

CONCLUSIONS: Patient access to systematically collected patient data reports promoted self-involvement and improved patient satisfaction and patient-physician interactions more in the HT-viewers than in HT-nonviewers groups at 1 year (p < 0.001). This was an open, observational study; no formal hypothesis testing was conducted. The HT system was not validated and some bias may have existed with respect to patient comfort level with a computer, user error, and timing of data entry of the physicians' assessments.

PMID: 17626700 [PubMed - indexed for MEDLINE]

**Patient accessible electronic health records: exploring recommendations for successful implementation strategies.**


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BACKGROUND: Providing patients with access to their electronic health records offers great promise to improve patient health and satisfaction with their care, as well to improve professional and organizational approaches to health care. Although many benefits have been identified, there are many questions about best practices for the implementation of patient accessible Electronic Health Records (EHRs).

OBJECTIVES: To develop recommendations to assist health care organizations in providing patients with access to EHRs in a meaningful, responsible, and responsive manner.

METHODS: A Patient Accessible Electronic Health Record (PAEHR) Workshop was held with nationally and internationally renowned experts to explore issues related to providing patient access to the EHR and managing institutional change.

RESULTS: The PAEHR Workshop was attended by 45 participants who discussed recommendations for the implementation of patient accessible EHRs. Recommendations were discussed under four subject domains: (1) providing patient access to the EHR, (2)
maintaining privacy and confidentiality related to the PAEHR, (3) patient education and navigation of the PAEHR, and (4) strategies for managing institutional change. The discussion focused on the need for national infrastructure, clear definitions for privacy, security and confidentiality, flexible, interoperable solutions, and patient and professional education. In addition, there was a strong call for research into all domains of patient accessible EHRs to ensure the adoption of evidence-based practices.

CONCLUSIONS: Patient access to personal health information is a fundamental issue for patient engagement and empowerment. Health care professionals and organizations should consider the potential benefits and risks of patient access when developing EHR strategies. Flexible, standardized, and interoperable solutions must be integrated with outcomes-based research to activate effectively patients as partners in their health care.

Publication Types: Research Support, Non-U.S. Gov't

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**Patient first: a patient sensitivity tool for an electronic health record implementation.**


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Throughout the country, use of electronic health records continues to increase. For successful implementation of an electronic health record system in an acute care setting, it is vital to educate and address the patient's perceptions about the use of technology when caring for the patient. This article describes the development of an educational sensitivity tool designed to enhance clinicians' simultaneous interactions with patients and computers in a midsize community hospital. The Patient First tool brings attention to the thoughts and perceptions a patient may have in various situations, promoting alternative solutions for staff to properly address the patient's concerns. A committee was developed to address concerns regarding the impact a computer at the bedside would have on patient and clinician interactions. One primary educational tool developed was the Patient First sensitivity presentation that cautioned and guided clinicians to be aware of patient perceptions.

PMID: 17356333 [PubMed - indexed for MEDLINE]

**Computers in the exam room: differences in physician-patient interaction may be due to physician experience.**


Rouf E, Whittle J, Lu N, Schwartz MD.
BACKGROUND: The use of electronic medical records can improve the technical quality of care, but requires a computer in the exam room. This could adversely affect interpersonal aspects of care, particularly when physicians are inexperienced users of exam room computers.

OBJECTIVE: To determine whether physician experience modifies the impact of exam room computers on the physician-patient interaction.

DESIGN: Cross-sectional surveys of patients and physicians.

SETTING AND PARTICIPANTS: One hundred fifty five adults seen for scheduled visits by 11 faculty internists and 12 internal medicine residents in a VA primary care clinic.

MEASUREMENTS: Physician and patient assessment of the effect of the computer on the clinical encounter.

MAIN RESULTS: Patients seeing residents, compared to those seeing faculty, were more likely to agree that the computer adversely affected the amount of time the physician spent talking to (34% vs 15%, P = 0.01), looking at (45% vs 24%, P = 0.02), and examining them (32% vs 13%, P = 0.009). Moreover, they were more likely to agree that the computer made the visit feel less personal (20% vs 5%, P = 0.017). Few patients thought the computer interfered with their relationship with their physicians (8% vs 8%). Residents were more likely than faculty to report these same adverse effects, but these differences were smaller and not statistically significant.

CONCLUSION: Patients seen by residents more often agreed that exam room computers decreased the amount of interpersonal contact. More research is needed to elucidate key tasks and behaviors that facilitate doctor-patient communication in such a setting.

Publication Types: Research Support, U.S. Gov't, P.H.S.

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Training

The right mix to support electronic medical record training: classroom computer-based training and blended learning.


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Staff development plays a crucial role in supporting clinicians to adapt to the ever changing technological advances in the healthcare setting. The quest to support staff in the implementation and ongoing optimization of an electronic medical record (EMR) led these staff development educators to computer based training and a blended learning approach building upon the traditional anchor of classroom learning and the advantages of computer-based training.

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Throughout the country, use of electronic health records continues to increase. For successful implementation of an electronic health record system in an acute care setting, it is vital to educate and address the patient's perceptions about the use of technology when caring for the patient. This article describes the development of an educational sensitivity tool designed to enhance clinicians' simultaneous interactions with patients and computers in a midsize community hospital. The Patient First tool brings attention to the thoughts and perceptions a patient may have in various situations, promoting alternative solutions for staff to properly address the patient's concerns. A committee was developed to address concerns regarding the impact a computer at the bedside would have on patient and clinician interactions. One primary educational tool developed was the Patient First sensitivity presentation that cautioned and guided clinicians to be aware of patient perceptions.

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