

**Determining Factors of Organizational Readiness for Technology
Adoption in Long-Term Care Facilities**

**Phase 1 Report:
Literature Review Synthesis and
Annotated Bibliography**

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Table of Contents

ABBREVIATIONS LIST	iii
SYNTHESIS REPORT.....	1
ANNOTATED BIBLIOGRAPHY	
Professional Organization Reports.....	8
Scientific Reports	11
Expert Reports	31
Industry Reports	45
Case Reports.....	54
REFERENCE LIST	64

Abbreviations List

AAHSA	American Association of Homes and Services for the Aged
ACMI	American College of Medical Informatics
AGS	American Geriatrics Society
CME	Continuing Medical Education
CPOE	Computerized Physician Order Entry
CPR	Computerized Patient Record
DON	Director of Nursing
EHR	Electronic Health Record
EMR	Electronic Medical Record
EPRS	Electronic patient record system
ER	Emergency Room
FOSS	Free and Open Source Software
HC	Health Care
HCIS	Healthcare Information Systems
HCT	Health Care Technology
HEDIS	Health plan Employer Data and Information Set
HIM	Health Information Management
HIMSS	Healthcare Information and Management Systems Society
HIT	Healthcare Information Technology
ICD-9	International Classification of Diseases—9th Revision
IOM	Institute of Medicine
IT	Information Technology
LTC	Long-Term Care
MDS	Minimum Data Set
MEPS	Medical Expenditure Panel Survey
NCVHS	National Committee for Vital and Health Statistics
NHIN	National Health Information Network
ONCHIT	Office of the National Coordinator of HIT
PACS	Picture Archiving Communication System
PDA	Personal Device Assistant
RN	Registered Nurse
ROI	Return on Investment
VHA	Veterans Health Administration
VISTA	Veterans Health Information System and Technology Architecture

Literature Synthesis Report

This synthesis of the literature reviewed is based on questions and issues that are relevant to the primary research goal of identifying factors that hinder or facilitate implementation of electronic health records (EHR) in long-term care (LTC) facilities. Overall, there is extensive published literature about healthcare information technology (HIT) in general and EHRs specifically. This literature reviewed was comprised of scientific reports, case reports, expert reports, industry reports, and reports from professional organizations.

The vast majority of this literature focused on the hospital, clinic and physician practice settings. Few articles and reports focused on or mentioned IT and/or EHRs in LTC settings (AGS, 2005; Dougherty, 2005; Derr, 2004; IOM, 2003; Dyck, 2002). However, most of the information gleaned from the literature review is applicable to most healthcare settings and should prove valuable in achieving the research goal.

Benefits and Core Functionalities of HIT and EHR Systems

Overwhelmingly, the literature supports the idea that HIT and EHRs hold tremendous value for the healthcare system especially in the areas of improved patient safety, operational efficiencies and reduced costs. The most often cited keys to gaining the full benefit of technology in healthcare are: (a) interoperability; (b) integration among clinical systems; (c) standardized language; (d) decision support; and (e) physician usage. The following are some key points from the literature review related to the functionality, benefits and development of HIT and EMRs:

- Successful EHR systems will improve patient safety, support delivery of effective patient care, facilitate management of chronic conditions, improve efficiency, and facilitate easy implementation (IOM, 2003).
- The basic inpatient EMR system should at a minimum integrate computerized patient records, clinical decision support, and clinical data repository (Fonkych, 2005).
- Software standards need to be developed for both interoperability and interconnectivity between sectors of health care (Derr, 2004).
- Interoperability with preexisting systems and among HC organizations is essential to realize the full potential of EHRs (Brookstone, 2004; Dougherty, 2005; IOM, 2003).
- Benefits include improved quality and patient safety, reduced lengths of stay, increased efficiency and timeliness of care, avoidance of adverse events such as med errors, improved treatment protocols, improved continuity of care, instant availability of charts, rapid and informed response to patients' telephone questions, refill requests, communication and education modules for enhanced patient understanding and satisfaction, accuracy and completeness of notes, effective disease management by gathering extensive data quickly and efficiently on patient populations (HIMSS, 2003).
- These key elements must exist in order to see gains with EHR systems: widespread provider adoption of standard-based EMR systems, improved connectivity among providers and with patients, and a strong focus on improving quality and efficiency performance (Taylor, 2005).
- HIT can improve workplace efficiency, particularly with less documentation time in three ways: reduce the number of employed nurses, increase time spent with individual patients, or increase the number of patients being attended to (Giroso, 2005).
- EMR systems must allow for authentication of information contained in the electronic entry; system back-up, availability and protection from disaster; contingency plans to allow access to patient information in the event of a system crash; and integrity of clinical record (Zuber, 2002).

- The successful VistA (Veterans Health Information System and Technology Architecture) program integrates applications like pharmacy, radiology, laboratory, dietetics, progress notes, billing, and patient administration into a single system and has virtually eliminated all paper record keeping in VHA health facilities (Graham, 2003).
- The need for a standardized data set for computerized nurse charting was realized when early efforts to change paper forms to computerized forms did not work well (Turpin, 2005).
- Broad categories of HIT functions include: information systems that incorporate finance, accounting, patient registration, clinical information system and EHR/CPRs, and human resource system; pharmacy, radiology, lab and nursing systems; biomedical monitoring devices; connectivity & communications; patient safety devices; business and clinical decision support; and education and reference resources (Smith, 2004).
- Several EMR features that have been successfully implemented include documentation of demographic data, laboratory results, allergies, medical history and radiological tests (Medical Records Institute, 2005).
- The path to quality improvement and financial gain with EHRs lies in getting the greatest number of physicians to use the system (Miller, 2004).
- Four recommendations to help the LTC sector begin to implement EHR systems are to recognize the interoperability potential, advance industry participation in use and support, develop a single application to increase awareness and demand, and emphasize the need for future research (Dougherty, 2005).
- Improved document completeness has been demonstrated with the use of EHRs (Smith, 2005).
- Studies have demonstrated that IT contributes to medical error prevention in the following categories: (a) improved communication; (b) more readily accessible knowledge; (c) requirement for key pieces of information (such as the dose of a drug); (d) assistance with calculations; (e) checks performed in real time; (f) assistance with monitoring; (g) decision support; and (h) rapid response to and tracking of adverse events (Bates et al, 2003).
- Excellent commentary of “where we should be” with HIT and EMRs: *“We should strive to have a national system of EHRs that can share information on any patient in any health care setting. From the point of view of the patient, he or she should be able to enter any health care setting and see a clinician who has comprehensive access to information about that patient. From the health care provider’s perspective, this access should be fast, the information should be easy to find, and the process should help rather than hinder the workflow. Health care will be safer for the patient and more satisfying for the clinician, who would now be able to provide far better care and feel more secure in his or her decision making”* (Ash & Bates, 2005, p. 9).

Barriers to EHR Implementation

The primary barriers to EHR implementation identified in the literature are: (a) costs; (b) physician acceptance; (c) disruption of current clinical routine; and (d) lack of documentation standards. To summarize more specific points from the literature, EHR implementation barriers include:

- Funding and costs for implementation (Boudreau, 2005; Ford, 2005; Hillestad, 2005; Anderson, 2004; Miller, 2004; Valdes, 2004; Ash, 2003; Bates, 2003)
- Lack of standards adoption (Dougherty, 2005; Hillestad, 2005; Middleton, 2005; Brookstone, 2004; Abbott, 2003; Bates, 2003).

- Insufficient methods for data coding, collection, storage, and retrieval (Abbott, 2003).
- Increased time for documentation (Poissant, 2005; Miller, 2004).
- Perceptions that EMRs interfere with clinical workflow (Ash, 2005; Chambliss, 2001).
- Requirement for practitioners to change from handwriting to computer entry and from free text to structured or interactive recording (Waegemann, 2002).
- Physicians who view EHR decision support as "cookbook medicine" (Sprague, 2004).
- Confidentiality, privacy, safety of records, and HIPAA violations (Hillestad, 2005; HIMSS, 2004; Valdes, 2004; Bates, 2003; Soper, 2002; Waegemann, 2002).
- Lack of interoperability and the excessive number of commercially available EMR systems (i.e., Valdes identified 264 systems in use) (Valdes, 2004).
- Software issues such as lack of an efficient way to view the overall picture of patient progress and care, lack of automatic prompts, and poor system navigability (Smith, 2005).
- Vendor issues including vendor volatility and immaturity of software (Ford, 2005; Brookstone, 2004; Podichetty, 2004).
- Hardware and connectivity issues including slow system response and computer speed (Smith, 2005; Chambliss, 2001; Poissant, 2005).
- Difficult implementation processes (Ash, 2003).
- Training concerns (Brookstone, 2004).
- Lack of EHR experts specializing in LTC [specifically a barrier for EHRs in LTC] (Dougherty, 2005).

Facilitators to EHR Implementation and Strategies for Mitigating Problems

Important facilitators to EHR implementation based on scientific studies and lessons learned are (a) strong support from administrative and clinical leaders; (b) understanding users' attitude and knowledge base prior to initiating an EHR implementation; (c) clear goals to be achieved by the EHR implementation with realistic expectations about what can be achieved; (d) thorough analysis of current work processes and how they will change with EHR implementation; (e) user involvement in system design and implementation plan development; and (f) individualized initial and ongoing training and support for users. To summarize more specific points from the literature, EHR implementation facilitators and strategies for mitigating problems include:

- Strong physician leadership with a "physician champion" and/or support from clinical leaders (Poissant, 2005; Podichetty, 2004; Smith, 2003; Ash, 2003)
- Clarification of how workflows will be redefined early in the planning processes (Poissant, 2005; Deese, 2004; Ash, 2003).
- Involvement of users early in the process through such strategies as establishing a clinical advisory team with representatives from all departments affected by the EHR [i.e., radiology, pharmacy, physicians, medical records, IT dept, patient care services, etc] (Graham, 2005; McLane, 2005; Smith, 2003; Schmitt, 2002; Souther, 2001).
- Clear definition of goals prior to implementation (Ash, 2003; Smith, 2003).
- Consideration of key strategic questions prior to implementation [What is the degree of clinician support for the product? Are the right professions and professionals involved in planning the implementation? Is there adequate MD involvement? Will the product provide a safety net against clinical error, simply the work flow and save time in documentation and routine care tasks? How does this product support the organization's strategic plan?] (Smith, 2004).

- Consideration of key strategic functions prior to implementation [work-flow analysis, facility modification, hardware installation, software configuration, back-up systems, entering old data, dealing with paper, and training] (Smith, 2003).
- Thorough product evaluation prior to purchase [i.e., "play" with the system before purchasing; don't base the decision on a "slick salesman" presentation, talk to and visit others who use the system, have staff use the system and talk to others] (Soper, 2002).
- Realistic expectations with an understanding that the initial conversion to EMRs may be painful and frustrating but long-term results are worth the short term pain (Soper, 2002).
- Recognition that numbers do not tell the whole story; other benefits include increased efficiencies that might not translate into staffing reductions but ultimately increase productivity and quality (Schmitt, 2002).
- Individualized approaches to training for physicians and all users (Dillon, 2005).
- Designation of "super users" to serve as a resource with the goal that everyone will become "proficient and use the system to its full potential" (Laing, 2002).

Criteria and Quantitative Measures of Success for EHR Implementation

Various criteria and quantitative measures were identified in the literature to document the success of the EHR implementation. Criteria indicative of success were: (a) acceptance by clinicians; (b) instant availability of charts; (c) improved communication; and (d) interoperability among systems. Important quantitative measures of success included (a) documentation time and quality; (b) adverse events related to medication administration; and (c) transcription and record storage space costs. To summarize more specific points from the literature, criteria and quantitative measures of success in EHR implementation include:

- Interoperability among systems with the ability to extract multi-site relevant data/share information among organizations (Graham, 2005; Walker, 2005; Brookstone, 2004; Waegemann, 2002).
- Physician acceptance as evidenced by physicians actually implementing EHRs in their daily routine (Brookstone, 2004; Chambliss, 2004).
- Positive attitudes by nurses towards use of computers (McLane, 2005; Smith, 2005).
- Enhanced time efficiency of documentation (Poissant, 2005; Pizziferri, 2005).
- Improved completeness and quality of documentation (Smith, 2005; HIMSS, 2003; Smith, 2003).
- Accurate medication lists (Smith, 2003).
- Decreased chart pulls and lower transcription costs (Miller, 2004; Smith, 2003; Wang, 2003; Schmitt, 2002; Soper, 2002)
- Reduced lengths of stay in the hospital (HIMSS, 2003).
- Avoidance of adverse events such as med errors (HIMSS, 2003; Wang, 2003; Davenport, 2002; Schmitt, 2002).
- Instant availability of charts (HIMSS, 2003; Smith, 2003; Laing, 2002; Keshavjee, 2001).
- Procedures to address compliance with licensure, Medicare certification, and accreditation requirements and meet surveyor needs during the survey process (Zuber, 2002).
- Improved communication among clinicians (Turpin, 2005).
- Elimination of physical storage space (Laing, 2002; Soper, 2002).
- Staffing efficiency gains (HIMSS, 2003).
- Improved adherence to medication protocols (HIMSS, 2003).
- Easier regulatory reporting (HIMSS, 2003).
- Simplified physician referrals (HIMSS, 2003).

- Increased capture of allowed billable expenses (HIMSS, 2003; Wang, 2003; Schmitt, 2002; Soper, 2002).
- Savings from staff to process lab and radiology orders entry (Schmitt, 2002).
- Reduction in pharmacy staff for processing pharmacy orders (Schmitt, 2002).

Costs and Savings Associated with EHR Use

The literature was fairly rich with financial models and documentation of costs and savings associated with EHR use. Financial models addressed EMR related costs and savings from a nation-wide perspective and their impact on the U.S. healthcare system as a whole. There were also various studies and financial analyses conducted in individual organizations. Overwhelmingly, the literature supports the notion that significant costs savings can result from the use of EHRs. However, savings may not be realized for 1-3 years. The following is a summary of some important points related to costs and savings from EHR use:

- A completely standardized HIEI system could yield a net value of \$77.8 billion annually after a 10 year period, comprising approximately 5% of projected nation-wide healthcare expenditures in 2003 (Walker et al, 2005).
- The article states over fifteen years, the net efficiency and safety savings from physicians using EHR systems could be \$142 billion; once fully implemented, the authors believe EHR systems could save more than \$81 billion annually (Hillestad, 2005).
- Financial benefits are increased as more features are used and the time horizon increases (Wang, 2003).
- Savings will be realized at year 3 and will continue to grow through year 7 (Schmitt, 2002).
- Savings can be realized at one year after implementation (Giroi, 2005; Soper, 2002).
- Positive ROI can be experienced in the second year but ROI is greater over time (Wang, 2003).
- Physician productivity falls 20% during the first three months after a new EHR system is installed (Sprague, 2004).
- One EHR evaluation cited 65,700 conflicting test results found, avoidance of \$2,673,989 of annual direct expenses, savings of \$322,445 in medical record costs, and a reduction of \$149,000 annual management administrative costs (Deese, 2004).
- HIT can reduce drug utilization by 15% (Wang, 2003).
- Nationally, HIT could potentially reduce medical records costs by 50%, creating a savings of 1.3 billion annually (Giroi, 2005).
- Expenditures on inpatient EHR systems are expected to rise to \$10 billion annually by 2018; ambulatory costs are not expected to be nearly as much as with inpatient care with only \$1.5 billion spent by 2018 with an adoption rate little over 80% (Giroi, 2005).
- HIT could save 8% in annual productivity (Hillestad, 2005).
- The benefits of implementation are substantially larger than the costs (Giroi, 2005).
- Cost elements to consider include software, hardware, installation, training, licensing fees, lost productivity in the first few months (Wang, 2003; Soper, 2002).
- Savings elements to consider are chart pull savings, transcription, prevention of adverse drug events, drug savings, laboratory savings radiology savings, charge capture improvement, billing error decrease; malpractice premium costs, storage and supply costs, generic drug substitutions, increased provider productivity, decreased staffing requirements (medical records staff), increased reimbursement from more accurate evaluation and management coding, and decreased claims denials from inadequate

Conceptual Models and Indications of Organizational Readiness for Change

Very few articles focused on conceptual models in relation to organizational readiness for change and EMR systems. Three models identified were the technology acceptance model (Ammenworth, 2003); diffusion of innovation model (Ford, 2005); and complexity theory (Kouroubali, 2005). Additionally, some general comments about organizational readiness were gleaned from the articles. Following are the some key points related to organizational readiness:

- The technology acceptance model determines usefulness in four ways: characteristics of the information system, characteristics of the users, characteristics of task processes, and other environmental characteristics (Ammenworth, 2003).
- The technology diffusion theory describes adoption patterns for innovators, early adopters, early majority, late majority and laggards. Innovation factors are driven by information from a source outside the potential adopter's social system (Ford, 2005).
- Complexity theory can be used to explain the complexity of adaptive processes, particularly in implementing a technology system; the theory accounts for the "collection of agents that interact in a non-linear way;" the key to change in this model is through the method of self-organization, the "self-guided process of transformation that does not need to be externally driven or hierarchically controlled" (Kouroubali, 2005).
- Rapid advancement of technology is a key indication that medical organizations are ready to begin employing EHRs in clinical settings (Anderson, 2004).
- Rapid adoption and use of technology such as personal computers and PDAs by individuals including physicians and administrative leaders is an indicator of readiness to adopt technology at all levels of the organization (Ash, 2005).
- Questions to assess organizational readiness include: How technologically savvy are the physicians and administrators? What is the organization's culture regarding decision making? Will a consensus need to be achieved before the EMR is accepted, or will the decision reside with a few individuals? Does the organization value group-oriented behavior, or is it more individualistic? Will it enforce the use of the EMR, or will it adopt a more laissez-faire approach? (Schmitt, 2002).
- "Metcalf's Law" states that the value of a network grows as the square of its number of users - in other words, to get the maximum value of a network, one must connect with everyone else, be like everyone else and share information (Valdes, 2004).

Policy Initiatives to Facilitate Diffusion of EHRs

The literature strongly supported the notion that government intervention in the form of financial incentives and/or legislative mandates would be necessary to stimulate the diffusion of technology throughout healthcare organizations. Following are some key points related to governmental policy initiatives and EHRs:

- Government assistance in Europe has proven to aid in the wide acceptance of EHR systems; pay-for-performance programs are a means of encouraging physicians to utilize EHRs in their practices (Ford, 2005).
- Government incentives and policy will be needed to promote EHR adoption (Hillestad, 2005).
- EHR adoption can be stimulated through financial incentives, informatics standards, enabling policy, and educational and marketing support described as follows (Middleton, 2005):

- Reimbursement reform to directly or indirectly reward users of HIT; increase capital availability to organizations that lack sufficient capital reserves or credit; establish an EHR certification processes to attest to the appropriate functionality; and consider open-source software to lower the price.
- Specification of a minimal set of essential standards that have the property of supporting interoperability and that are critical to rapid adoption of HIT.
- National policy initiatives that could have a significant effect on HIT adoption include modification of Stark antitrust regulations, policies to guide clinical data ownership and stewardship, mechanisms to support creation of regional health care information authorities, and establishing means for national professional licensure in the health care professions.
- Educational and marketing campaign to promote the value of EHRs to the general public [similar to public announcements and efforts for smoking cessation, drug abuse, obesity, etc.].
- Reduce the costs for effective EHR system adoption – research indicates that financial or non-financial incentives that reduce the cost of EHR implementation by 50% over five years could increase the adoption rate by 14.7% annually over 15 years Taylor et al, 2005).
- Direct subsidies for EHR system acquisition – although the cost of subsidies will vary from institution to institution depending on the healthcare setting, a potential benefit-to-cost ratio over 15 years would approximately be 5:1 if started in 2006 (Taylor et al, 2005).
- Direct subsidies for network development – the more interoperable an EHR system is, the lower the costs should be; therefore, healthcare settings should be recommended to implement systems which boast common networking standards and infrastructures enabling information sharing and provider linking (Taylor et al, 2005).
- Performance incentives and mandates could increase adoption rates among small physician groups; cite California's 2003 incentive program which measures health plans based on a "pay-for-performance" strategy, requiring improvements in patient satisfaction, IT use, and overall quality (Miller, 2004).

**Determining Factors of Organizational Readiness for Technology Adoption in
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Annotated Bibliography
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Bibliography Summary:

- 49 Total Articles
 - 3 Professional Organization Reports
 - 17 Scientific Reports
 - 14 Expert Reports
 - 6 Industry Reports
 - 8 Case Reports
-

Professional Organization Reports

1. Article: *Caring for Older Americans: The Future of Geriatric Medicine*

American Geriatric Society (2005). Caring for older Americans: The future of geriatric medicine. *Journal of the American Geriatrics Society*, 53(s6), S245-S256.

Primary Author's Credentials/Affiliations

MD; Fellow, American Geriatrics Society

Purpose/Objectives

To report on the state of geriatric medicine and detail five goals aimed at optimizing the health of older adults, which were established by the AGS Task Force on the Future of Geriatric Medicine.

Study Design

N/A

Results/Main Finding

N/A

Recommendations/Summary

The 5 goals to optimizing the health of older persons are to: (a) ensure that every older person receives high-quality, patient-centered health care; (b) expand the geriatrics knowledge base; (c) increase the number of healthcare professionals who employ the principles of geriatric medicine; (d) recruit physicians and other healthcare professionals into careers in geriatric medicine; and (e) unite professional and lay groups in the effort to influence public policy to continually improve the health and health care of seniors. The authors specifically suggest EHR systems that are tailored to long-term care will aid professionals in making choices regarding the treatment and diagnosis of seniors.

Discussion

Although the article does not directly address EMR implementation, it does address the need for innovation and technology, specifically EMRs, to improve the quality and

efficiency of long-term care for older adults. The article represents one more level of support for EMRs from a prestigious organization – the AGS.

2. Article: *Key Capabilities of an Electronic Health Record System: Letter Report*

Institute of Medicine (IOM). (2003). *Key Capabilities of an Electronic Health Record System: Letter Report*. Washington, D.C.: Institute of Medicine of the National Academies.

Primary Author's Credentials/Affiliations

Committee on Data Standards for Patient Safety, Institute of Medicine

Purpose/Objectives

To provide guidance to the Department of Health and Human Services on a set of basic functionalities that an EHR system should possess to promote patient safety. The committee was asked to provide guidance pertaining to four care settings: hospitals, ambulatory care settings (including small practice settings, community health centers, and group practices), nursing homes, and care in the community.

Study Design

Report developed by the IOM Committee on Data Standards for Patient Safety. The committee focused on care delivery functions rather than infrastructure functions like terminology and network protocols.

Results/Main Finding

An EHR system includes (a) longitudinal collection of health information maintained electronically, where health information is defined as information pertaining to the health of an individual or health care provided to an individual; (b) immediate electronic access to person- and population-level information by authorized users; (c) provision of knowledge and decision-support that enhance the quality safety, and efficiency of patient care; and (d) support of efficient processes for health care delivery. Essential components include results management, order entry and order management, electronic communication and connectivity, patient education and support, chronic disease management, administrative process management (i.e., billing, claims management and insurance eligibility), and ease in implementation.

The IOM committee has offered the following guidelines for the immediate future, the near term and the long term:

- Immediate future (2004-2005): providers in ambulatory care settings, hospitals, and nursing homes will focus on the capture of essential patient data already found frequently in electronic form, such as laboratory and radiology results; acquisition of limited decision support capabilities for which software is readily available (e.g., order entry, electronic prescribing); and generation of reports required by external organizations for quality and safety oversight and public health reporting.
- Near term (2006-2007): EHR systems should allow for the capture of defined sets of health information; incorporate a core set of decision support functions (e.g., clinical guideline support, care plan implementation); and support the exchange of basic patient care data and communication (e.g., laboratory results,

- Longer term (2008-2010): Fully functional, comprehensive EHR systems will be available and implemented by some health systems and regions; it may take considerably longer for all providers to be using a comprehensive EHR system as described herein with extensive support for applications that fall outside immediate patient care (e.g., homeland security, public health, clinical research).

Recommendations/Summary

The authors believe it will take 7 or more years to transition from paper medical records to completely electronic records; the report focus is not on the potential for a paperless medical record system, but rather a means of making patient data readily available and accessible. The report stresses interoperability as especially important when implementing an EHR system. Electronic communication and connectivity are key components for exchanging data and keeping physicians up-to-date about patient prognosis. The report states that for an EHR to be useful, "a functional model of an EHR system must also reflect a balance between what is desirable and what can feasibly be implemented immediately or within a short time frame."

Discussion

This is a landmark report on the functionalities of a true EMR and should provide guidance to all HC organizations as they seek to evaluate and implement EMR systems.

3. Article: *Sixth Annual Survey of Electronic Health Record Trends and Usage of 2004*

Medical Record Institute, M. R. (2005). *Sixth Annual Survey of Electronic Health Record Trends and Usage of 2004*. Boston: Medical Records Institute.

Primary Author's Credentials/Affiliations

Professional Organization

Purpose/Objectives

To determine perceptions and opinions of various healthcare professionals including physicians, nurses, and administrators about EHRs.

Study Design

Cross Sectional Survey

Sample: $n=436$, majority of respondents were IT managers, physicians and nurses

Setting: majority of respondents were employed in hospitals or ambulatory clinics

Results/Main Finding

The most cited need for EHRs is to improve clinical processes and workflow efficiency; current tops uses of the EHR include capturing demographic information, lab results, allergies, and medications currently taken; barrier to EHRs most frequent cited by the respondents is the lack of adequate funding or resources to implement EHR systems.

Recommendations/Summary

Only the survey results by question were reported in the article; no recommendations were made by the authors.

Discussion

The data was collected from individuals who chose to respond to email invitation to complete the survey on the Medical Record Institute website so it may not be fully representative of the medical community. The results support other studies that identified funding as a primary barrier and workflow efficiency as a primary need.

Scientific Reports

4. **Article:** *The Impact of Electronic Health Records on Time Efficiency of Physicians and Nurses: A Systematic Review*

Poissant, L., J. Pereira, R. Tamblyn, and Y. Kawasumi. (2005). The impact of electronic health records on time efficiency of physicians and nurses: A systematic review. *Journal of the American Medical Informatics Association*, 12(5), 505-516.

Primary Author's Credentials/Affiliations

PhD; Clinical and health informatics; McGill University, Montreal
Academic

Purpose/Objectives

To conduct a systematic review of the literature to examine the impact of electronic health records on documentation time of physicians and nurses, as well as to identify factors that may explain efficiency differences across studies.

Study Design

The researchers reviewed published quantitative studies which included abstracts and full papers in a ten year time period. For the purpose of this study, documentation comprises all notes, orders, and referrals that are part of the care plan of a patient, as well as any documents in a patient's medical chart.

Results/Main Finding

The authors discuss successful EHR implementation in terms of the system's fit between routine clinical practice and time efficiency. Time efficiency includes reduced documentation time and increased time spent in direct patient care as a secondary outcome. This change of time should lead to increased quality of care delivered, greater user satisfaction, more accurate information, more complete data entry, and positive overall impact on work flow. Continuous observation of work processes as captured by time and motion or video recording methods, are seen as the most accurate data collection techniques to monitor clinical activities.

The study found that while documentation time decreases are unlikely, especially for physicians, time savings can be generated in other activities such as patient chart assessment.

Only 23 papers met the final criteria set forth by the researchers and were included in the review. Overall 628 abstracts were read and 63 papers were retrieved and assessed against the selected criteria. In general, nurses were found more likely than

physicians to gain time efficiencies using a computer system to document patient information using bedside terminals and central station desktops. These tools saved nurses respectively 24.5% and 23.5% in overall documentation time. For physicians, bedside or point-of-care systems increased documentation time by 17.5%. However, using central desktops for CPOE was found to be highly inefficient, increasing the work time from between 98.1% and 328.6% above baseline.

Recommendations/Summary

The article addresses technological organizational readiness to some extent by claiming a shift is needed from user efficiency to organizational-wide system efficiency. Factors like number of data entry fields, speed of the system, easy retrieval and viewing of information, number of bedside or central station desktops may influence the documentation time for physicians and nurses.

The study suggests that value-added functionalities of EHR systems like order entry and automated reports should be integrated into clinical workflow. But to achieve this, workflow needs to be taken into account during the early phases of planning. Since increased documentation time is one of the most commonly stated barriers to successful EHR implementation, paid training lessons and support from clinical leaders can combat clinician resistance. Physicians tend to work in multiple locations, both inside and outside hospitals, while nurses tend to work in one location. Therefore, workflow analysis is an integral part to the EHR development process to create the most efficient system for both groups of clinic professionals. The authors recommend a shift in the research focus from individual efficiency to organizational efficiency.

Discussion

The emphasis of organizational productivity and efficiency contradicts most of the informatics literature claiming individual attention is paramount for successful EHR implementation. Although the literature review spanned publications from the early 1990's to 2000, the limitation of the study does not focus on a single case study or research effort. The focus on workflow does provide some insight into the variety of ways both physicians and nurses interact with HIT in the clinical setting, this report does not offer ways to alter the implementation process to avoid the higher documentation times cited from the literature.

5. Article: HIMSS Leadership Survey - Healthcare CIO Results: Final Report

Health Information Management Systems Society (HIMSS). (2004). *HIMSS Leadership Survey - Healthcare CIO Results: Final Report*. Chicago: HIMSS.

Primary Author's Credentials/Affiliations

Professional Organization

Purpose/Objectives

To collect information about IT priorities, technology adoption, application usage and other crucial factors in the use of IT to enhance healthcare.

Study Design

Cross Sectional Survey

Sample and setting: $n=307$; one senior IT executive per healthcare organization were invited to participate in the survey for a population of nearly 2,000 information officers

(CIOs)/directors of information systems at healthcare facilities across the U.S. invited to participate via e-mail; total of 307 respondents completed the self-administered, web-based questionnaire representing 700 hospitals in the U.S.

Results/Main Finding

Patient safety and HIPAA compliance remain concerns of IT officers; respondents believe that speech recognition systems will be a top priority for HIT in the next two years; lack of financial support continues to be the primary barrier to HIT implementation; respondents identified bar coding, clinical information systems, EHRs, and CPOE systems to be the focus of HIT applications. PDAs, barcoding systems, and speech recognition will be introduced to clinical practices in the near future; use of networks is expected to increase staff communication over the next two years. 75% of respondents indicated that their institution outsources one or more IT functions with no indication of decreasing the frequency of this outsourcing. Respondents indicated that implementing technology to reduce medical errors/promote patient safety topped the list of future priorities and was second only to upgrading security on IT systems to meet HIPAA requirements among current priorities.

Recommendations/Summary

No specific recommendations related to study results were suggested.

Discussion

The report provides good information about the status and IT priorities for hospitals. No other HC settings were represented in the survey such as LTC facilities or physician practices.

6. Article: *Evaluating the Impact of Computerized Clinical Documentation*

Smith, K., V. Smith, M. Krugman, and K. Oman. (2005). Evaluating the impact of computerized clinical documentation. *CIN:Computers, Informatics, Nursing* , 23(3), 132-138.

Primary Author's Credentials/Affiliations

MS, RN; University of Colorado Hospital
Academic, Practice

Purpose/Objectives

To evaluate staff attitudes towards computerization, time needed for documentation, and the comprehensiveness of charting entries pre and post implementation of a computerized system for nursing documentation and care planning.

Study Design

Post-nursing survey of 46 RNs in a teaching hospital was conducted in the pre/post implementation of an EHR system. The implementation timeframe served as an intervention variable to compare nursing perceptions of the technology before and after it was installed. The survey implemented tools outlined in Strong & Brodt's *Nurses' Attitude Toward Computerization* published in 1985.

The authors also conducted a review of the literature but reported that no consistent demographic variable identifies a nurse who is more or less likely to have a positive attitude towards computerization. Studies have reported an improvement in charting compliance with longer time periods between EHR implementation and follow-ups.

Recent research efforts have indicated EHR systems have decreased the time spent in direct care and financial savings in overtime and differentials paid.

Results/Main Finding

The survey found staff attitudes were generally less positive towards computers, although time required for charting remained unchanged. However, the EHR system did improve general document completeness.

Recommendations/Summary

The authors identify establishing a standardized nursing charting language and building tools to connect care planning with documentation as ways of successfully implementing HIT in nursing clinical environments. Successful implementation of technology should improve the completeness and quality of patient documentation, while promoting improved chart compliance, more efficient use of nurses' time, and increase positive nurse attitudes towards computer usage. Indications of system failure are measured by decreased efficiency, decreased quality and completeness of documentation, as well as negative attitudes of system users.

To combat implementation problems, a care plan needs to be developed before documentation screens are available to transition nursing staff to the electronic system. Nursing staff voiced problems relating to slow system response, lack of efficient means to view overall patient progress and care, lack of automatic prompts, and poor system navigability. A care plan can address these issues before EHR implementation.

Discussion

The article discusses nursing attitudes towards computers in clinical environments and ways to address implementation problems. The key strategy to avoid major disruptions to clinical practices is to develop a plan which accounts for user needs and factors them into the electronic documentation system.

7. Article: *The Value of Health Care Information Exchange and Interoperability*

Walker, J., E. Pan, D. Johnson, J. Adler-Milstein, D. W. Bates, and B. Middleton. (2005). The value of health care information exchange and interoperability. *Health Affairs Online*. Retrieved October 12, 2005.

Primary Author's Credentials/Affiliations

Center of Information Technology Leadership, Partners Healthcare System, Harvard University
Academia

Purpose/Objectives

To evaluate the impact of electronic health care information exchange and interoperability (HIEI) on medical centers, public institutions, and financial stakeholders. The authors discuss HIEI value in terms of nation-wide healthcare and practice.

Study Design

The study surveyed an expert panel of nationally known HIEI experts while invoking a cost-benefit model to determine the costs and savings of HIEI over a ten year span. This quantitative study employed the HIEI system as an intervention variable in the cost-benefit model.

Results/Main Finding

The authors define four different levels of HIEI implementation:

- Level 1: Non-electronic data with no use of information technology to share information.
- Level 2: Machine-transportable data such as fax machine or personal computers.
- Level 3: Machine-organizable data involving the transmission of structured messages containing nonstandardized data requiring an interface which can translate incoming data usually resulting in imperfect levels of detail.
- Level 4: Machine-interpretable including the transmission of structured messages containing standardized, coded data in an idealized state where all systems exchange this information using the same format.

Since implementation success depends on the ability to share appropriate information electronically among all organizations in healthcare, Level 4 integration is considered most ideal.

At the cost level, national implementation of HIEI over a ten year period would yield annual savings relating to connectivity between providers and other healthcare organizations after the eleventh year.

The study establishes a compelling business case for national implementation for a fully standardized HIEI. A completely standardized HIEI system could yield a net value of \$77.8 billion annually after a 10 year period, comprising approximately 5% of projected nation-wide healthcare expenditures in 2003. However, this study did not address issues of improved patient safety, quality of care, lost revenues due to redundant tests, or other costs relating to major workflow interruptions during implementation. The cost-benefit model also did not account for the expense for a HIEI capable system for labs, radiological facilities, pharmacies, and other public health departments.

Recommendations/Summary

The article cites several possible innovations through the use of HIEI systems:

- **Provider-Lab connectivity:** HIEI systems could improve this form of communication by providing reduced delays and other costs relating to traditional paper-based ordering and lab reporting between physicians and testing facilities. This innovation has led to more efficient access to patient longitudinal test results, elimination of lab reporting errors, optimized ordering patterns with test costs readily available, and finally the reduction of redundant testing.
- **Provider-Radiology connectivity:** In this area of communication, HIEI systems can reduce redundant testing, cut costs associated with paper, provide radiologists with access to relevant clinical information, improved patient safety test contradictions, and enable automated reminders for follow up studies.
- **Provider-Pharmacy connectivity:** HIEI systems can improve provider-pharmacy connectivity by reducing the number of medical-related phone calls for both clinicians and pharmacists, and facilitating clinical care by formulating complete med lists. HIEI systems have also reduced duplicate therapy, drug interactions, adverse drug events, and medication abuse.
- **Provider-Provider connectivity:** Inter-provider communication could experience time savings associated with paper chart handling requests and referrals,

- Provider-Public Health System connectivity: HIEI systems can make reporting of vital statistics and certain diseases more efficient and provide earlier signs for recognizing emerging disease outbreaks

The authors project that the clinical payoff in improved patient safety and quality of care would dwarf the financial benefits described in the model. Giving providers access to data about their patients from other providers outside their organization would likely result in fewer medical errors and better continuity of care

In terms of policy, the authors believe incentives to support local integration efforts and national standards can be established to knit local initiatives into a seamless national Level 4 healthcare information system. However, the larger question remains as to the responsible financial stakeholder to pay for development and implementation. Achieving Level 4 will require strong policy incentives, federal leadership, and legislative mandates to establish seamless interoperability among vital sectors. The establishment of an information delivery system must proceed in parallel with the move from paper to EMRs

Discussion

This article, while discussing HIEI in a national scale, presents the case of a financially beneficial model for implementation of such technology in healthcare facilities. The national policies outlined by the authors can be considered a starting point in determining the local and state initiatives that can be used to encourage HIT implementation in long-term care facilities.

8. Article: Factors Affecting and Affected by User Acceptance of Computer-Based Nursing Documentation: Results of a Two-Year Study

Ammenwerth, E., Mansmann, U., Iller, C., & Eichstadter, R. (2003). Factors affecting and affected by user acceptance of computer-based nursing documentation: Results of a two-year study. *Journal of the American Medical Informatics Association*, 10(1), 69-84.

Primary Author's Credentials/Affiliations

PhD; University for Health Informatics and Technology, Tyrol, Innsbruck, Austria
Academia

Purpose/Objectives

To answer the following questions: a) what changes in user acceptance of the nursing process occur before, during, and after computer-based documentation systems? b) What changes in user acceptance of computers in nursing occur before, during, and after computer-based documentation systems? c) What changes in user acceptance of computers in general occur before, during, and after computer-based documentation systems? d) What is the level of user acceptance of the system itself?

Study Design

Pre-post intervention study with validated questionnaires pre and 3, 6 and 9 months post intervention for quantitative data and focus group interviews post intervention for qualitative data.

Sample: Nurses ($n = 70$); 80% completed at least one questionnaire

Setting: Hospital

Intervention: Computerized nursing documentation system

Results/Main Findings

Positive correlation with between experience with computers in general prior to intervention, acceptance of computers in nursing prior to intervention, acceptance of the nursing process prior to intervention and user acceptance of the computerized nursing documentation system at 9 months after introduction; the further time out from introduction of the system, the higher the acceptance scores.

Recommendations/Summary

Key factors to consider in implementation of a nursing documentation system: (a) computer experience and acceptance of the nursing process prior to introduction of a computerized documentation system and (b) fit between nursing workflow and the functionality of a nursing documentation system.

Discussion

The study was conducted on 4 units in a large hospital in Germany; qualitative data (focus group interviews) supported and validated questionnaire results; only those nurses who worked on the units during the entire study period were included in the study results; functionalities of the nursing documentation system implemented was structured according to the basic nursing process, which is the same process as taught in U.S. nursing schools.

9. Article: *Nursing Homes as Complex Adaptive Systems: Relationship Between Management Practice and Resident Outcomes*

Anderson, R. A., Issel, L. M., & McDaniel, R. R., Jr. (2003). Nursing homes as complex adaptive systems: Relationship between management practice and resident outcomes. *Nursing Research*, 52(1), 12-21.

Primary Author's Credentials/Affiliations

RN, PhD; Duke University School of Nursing
Academia

Purpose/Objectives

To test the relationship between management practices (communication openness, decision making, relationship-oriented leadership, and formalization) and resident outcomes (aggressive behavior, restraint use, immobility of complications, and fractures) while controlling for case mix, size, ownership, and director's tenure and experience; used complexity science as a framework for the study.

Study Design

Cross-sectional correlation study design; primary data from surveys of nurses; secondary data from the 1995 Medicaid cost reports and MDS

Sample: Proportional, stratified, random sampling to represent distribution of profits, nonprofits, geographic, and racial diversity of the major metropolitan areas in Texas; 380 nursing homes invited to participate, 195 (51%) participated and 164 (43%) provided sufficient data for analysis; DONs ($n = 164$) and staff RNs ($n = 201$) provided data

Setting: Nursing homes in Texas

Intervention: N/A

Results/Main Finding

More experience and longer tenure of the DON are important factors in achieving better resident outcomes; larger size also explained better resident outcomes.

Recommendations/Summary

Management practices that increase communication and interaction among people are needed for better resident outcomes as is avoiding a top-down management approach.

Discussion

The authors used complexity science to explain results and viewed nursing homes as complex adaptive systems; the limitations of the study include the cross sectional design which precludes causation and that no other staff in the nursing home were surveyed; study results are important when considering implementation of EMRs in long-term care as the facility management style will impact the ability to be successful in a major change project.

10. Article: A Consensus Statement on Considerations for a Successful CPOE Implementation

Ash, J. S., Stavri, P. Z., & Kuperman, G. J. (2003). A consensus statement on considerations for a successful CPOE implementation. *J Am Med Inform Assoc*, 10(3), 229-234.

Primary Author's Credentials/Affiliations

PhD; Division of Medical Informatics and Outcomes Research, School of Medicine, Oregon Health & Science University

Purpose/Objectives

To develop a consensus set of recommendations for CPOE implementation.

Study Design

Qualitative study using grounded theory; study conducted over a 2-day conference with 13 experts in CPOE from around the world; participants were led through a series of activities designed by the research team and included a thinking task before participant arrival, brainstorming after arrival, narrative generation, prioritization of issues, and small team assignments.

Results/Main Findings

Developed the following set of recommendations in 9 areas:

- **Consideration 1: Motivation for Implementation:**
Motivation influences where funding will come from, who will provide political support, and who will provide clinical leadership. Questions to consider include: Will local or national authorities require CPOE at some future point? Are administrators and/or clinicians pressing for CPOE adoption? What are the stated objectives for CPOE implementation? Are external conditions forcing CPOE adoption (e.g., competitors)?
- **Consideration 2: CPOE Vision, Leadership, and Personnel:**
Successful implementation requires effective leadership over extended time periods and from multiple levels in the organization including leadership needed at the executive level for vision and funding; at the clinical level for champions and buy-in; and at the project management level to make practical and effective decisions. Top-level leadership must commit unwaveringly and visibly to CPOE.

- **Consideration 3: Costs:**
What is the total cost of ownership rather than simply the cost of technology: Can the organization afford the temporary productivity losses that occur with CPOE implementation? Have funds been dedicated solely for CPOE and does the organization have the ability to commit additional funds quickly for good (unanticipated) cause?
- **Consideration 4: Integration:**
Workflow, Health Care Processes: The impact of CPOE on the work processes of physicians, nurses, pharmacists, ward clerks, laboratory personnel, registration personnel, and other hospital staff must be carefully considered and closely followed during and after implementation. Questions to consider are: Does an organization-wide change management strategy exist? Will CPOE be used for all orders or only categories of orders? How users will view orders during construction, after entry, and after completion? How will new, potentially life-saving orders be communicated reliably to nurses or others who need the information immediately? How does CPOE integrate with other hospital applications? What will be the impact of CPOE on human communication among key employees?
- **Consideration 5: Value to Users/Decision Support Systems:**
The "value proposition" is important, in other words, users must do things differently but there will be some benefit in return. Key points include: plan for the ongoing management of clinical CPOE system content and decision support; users must participate in development of decision support and other benefits and receive adequate training; understand where the CPOE system can and cannot provide help; system must be consistent in decision support; and emphasize what cannot be done via manual and paper systems.
- **Consideration 6: Project Management and Staging of Implementation:**
Project management dictates that implementation be completed in carefully planned stages. Key points include: "people issues" must always have highest priority; early milestones should be selected to produce "wins" that help maintain momentum; plans should be detailed enough but not overly so; mechanisms for collecting feedback from users and staff must be in place; a critical mass of users must be ready for the implementation; plan for involving clinicians must be developed; metrics for success should be determined beforehand and evaluated over time; accountability must be established and maintained; and develop plans for the pre-implementation phase, implementation phase, and after-implementation phase.

- **Consideration 7: Technology:**
Technical details to consider include strategic considerations, user considerations, task completion flexibility, and the quality of the application, from customizability to user friendliness. Issues to consider include authorizing users who need access to the system; customizable system to meet organizational needs and decision support where needed; balance between customization and standardization; considerations for replacing older systems; interface with existing and planned future systems; risk assessment; remote access; response; escape routes; and aspects of the user interface that are most likely to be difficult for users.
- **Consideration 8: Training and Support 24 x 7:**
Of critical importance is the availability of live help "at the elbow" at the time of implementation. Key points include: intensive support at "go-live" time allows the implementation team to have direct experience with what is and what is not working well; most successful implementations have had more post-go-live support than pre-go-live training; training plan for support staff; provisions for online help as well as direct assistance; and users who will train and mentor other users.
- **Consideration 9: Learning/Evaluation/Improvement:**
CPOE is an ongoing effort that benefits from continuous improvement; mechanisms for feedback and modification must be in place. Questions to consider include: How can the organization learn from its mistakes? Is there a process for responding to problems in a timely manner? How can the system be "test piloted" without putting patients at risk? What the plan is for formal feedback and evaluation? How the system will be continuously improved?

Recommendations/Summary:

As above in results/key findings; the authors cite leadership as THE most important factor for successful implementation.

Discussion

This study, funded by the National Library of Medicine with participation by nationally and internationally recognized experts in HC IT, is an excellent resource for implementing CPOE as well as for implementation of any EMR system in healthcare. The authors point out that some issues will be more easily addressed than others; some issues will be more relevant to one particular organization than others; and some questions and issues will have clear and obvious answers while other will not. Most importantly, the difficult-to-answer questions must be addressed rather than avoided.

11. Article: *Electronic Medical Records: A Multidimensional Analysis*

Boudreau, T., Davis, M., Delery, L., Korbich, J., Lambert, S., Vogel, E., et al. (2005). *Electronic medical records: A multidimensional analysis*. Paper presented at IEEE Systems and Information Engineering Design Symposium. Charlottesville, VI: IEEE. Retrieved November 22, 2005 from <http://www.sys.virginia.edu/sieds05/proceedings/C103.pdf>.

Primary Author's Credentials/Affiliations

PhD; University of Virginia
Academia

Purpose/Objectives:

To develop an evaluative model to measure aspects of EMRs and system health by taking a multidimensional approach from an unbiased standpoint.

Study Design

Evaluative model development

Results/Main Finding

Produced a hierarchical holographic model (HHM) which addresses all of the stakeholders (patients, providers, organizations, government, and insurers) to evaluate a preexisting EHR system.

Recommendations/Summary

Authors suggest that evaluation of EHRs must come from the perspective of each of the major stakeholders: patient, provider, organization, government, and insurer and each of these groups and their particular needs must be considered in an EHR implementation and evaluation. Also suggest the 3 functionalities of EMRs: demographic, administrative, and clinical.

Discussion

The most valuable information in the article was the authors outline the “mission statement” for each of the stakeholder groups as follows:

- Patient: Obtain effective and efficient healthcare by tracking medical history, decreasing costs, decreasing wait times, reducing redundancy of clinical testing
- Provider: provide effective and efficient care by having on-demand patient information
- Organizations: provide EMRs to support accurate, efficient and cost-effective care
- Government: Synergize information and make it public, ensure the growth and effective implementation of EMRs, legislate standards that will improve quality of healthcare, facilitate data collection for research and evaluation
- Health insurer: cooperate with entities developing, facilitating, and utilizing EMRs to promote time efficient and cost-effective health insurance delivery.
- The evaluation model itself was not easy to understand and would be difficult to replicate in another setting.

12. Article: *Complexity Science and Leadership in Healthcare*

Burns, J. P. (2001). Complexity science and leadership in healthcare. *Journal of Nursing Administration*, 31(10), 474-482.

Primary Author's Credentials/Affiliations

RD, MBA; Scripps Mercy Hospital
Practice

Purpose/Objectives

To determine if complexity principles intuitively made sense to front-line healthcare leaders.

Study Design

Cross-sectional survey

Sample: $n=103$ healthcare leaders including supervisors, managers, directors, and administrators at three hospitals of a healthcare system in San Diego.

Results/Main Finding

A majority of the participants viewed their system as complex with diversity of thought and information that allow this system to grow independently from other "chunks." Most participants believed healthcare is chaotic and complex, but there was no consensus about what standards and principles could be applied to address this complexity.

Recommendations/Summary

Burns outlines 9 principles for healthcare management:

- 1) The Lens of Complexity
- 2) Minimum Specifications and a Good Enough Vision
- 3) Clockware and Swarmware
- 4) Tune to the Edge
- 5) Paradox and Tension
- 6) Multiple Actions that Let Direction Arise
- 7) The Shadow System
- 8) Chunking
- 9) Balance Cooperation and Competition

These principles are explained in detail in the article.

Discussion

Burns provides a detailed definition of complexity science and how it relates to healthcare management; the article is relevant to HIT implementation because HIT will fundamentally change the way organizations work; thus, an understanding of their complex nature as described through the lens of complexity is important.

13. Article: *Nursing Attitudes and Images of Electronic Patient Record Systems.*

Dillon, T. W., Blankenship, R., & Crews, T., Jr. (2005). Nursing attitudes and images of electronic patient record systems. *CIN: Computers, Informatics, Nursing*, 23(3), 139-145.

Primary Author's Credentials/Affiliations

PhD; James Madison University, Harrisonburg, VA
Academia

Purpose/Objectives

To identify the factors that affects the attitude of the nursing staff towards technology. Research questions were: (a) what demographic characteristics and self-reported computer use variables affect a nurse's attitude toward an EPRS? (b) Does the image profile of an EPRS affect a nurse's attitude toward the system? (c) Would the image profile of an EPRS serve as a predictor of system adoption and use?

Study Design

Cross sectional survey

The survey was composed of demographic information, volunteered information about technology experiences and self-reported computer use, and image profile related to the proposed EPRS. Content validity for this study was supported by the use of instruments drawn from previous studies of similar design.

Setting: 450 bed regional hospital before an EHR system was implemented

Sample: n=140; 612 nursing staff members were mailed surveys with 22.9% responding
Intervention: N/A

Results/Main Finding

More positive attitude towards EPRS was influenced by more technology experience and age; the age group 30-39 had the most positive attitude towards technology with the age 20-29 group being similar to the age 40-49 and 50-59; Overall, the results show a very positive attitude towards the adoption of EPRS with the authors reporting the results reflected a "growing acceptance of technology throughout the general population" (p. 144).

Recommendations/Summary

Education, past experiences, and computer skills may either serve as barriers or facilitators to technology use and should be addressed through supportive individualized or group interventions; training, group or individual, has been shown to improve nurses' attitudes in support of information systems.

Since gaining experience with technology is equated with positive attitudes, the availability of "practice" technology should be considered including incentives from the hospital to assist employees to purchase home computers to encourage computer experience.

Authors suggest that overall, nursing staff will be supportive of technology, provided their overall system effectiveness and patient care concerns are addressed.

Discussion

The article supports other studies that suggest prior experience with technology has a positive influence on EMR acceptance. The study did not follow-up with a post-implementation analysis; thus it would be difficult to determine how effective the model was in predicting success with EPRS implementation.

14. Article: *Predicting the Adoption of Electronic Health Records by Physicians: When will Health Care be Paperless?*

Ford, E. W., Menachemi, N., & Phillips, M. T. (2005). Predicting the adoption of electronic health records by physicians: When will health care be paperless? *Journal of the American Medical Informatics Association*, M1913.

Primary Author's Credentials/Affiliations

PhD, MPH; Tulane University
Academia

Purpose/Objectives

To gather and synthesize the historic literature regarding EHR adoption rates among physicians in small practices; construct models to project estimated future EHR adoption trends and timelines; discuss the likelihood of achieving universal EHR adoption in the near future; and articulate how barriers can be overcome in the small and solo practice medical environment.

Study Design

Secondary data analysis utilizing EHR adoption data from six previous surveys of small practices to estimate historic market penetration rates; applying technology diffusion theory, three future adoption scenarios – optimistic, best estimate, and conservative – were empirically derived. Technology diffusion theory was used as the framework for the study.

Results/Main Finding

All three scenarios display the characteristic diffusion S-curve that is indicative that the technology is likely to achieve significant market penetration, given enough time; under current conditions, EHR adoption will reach its maximum market share in 2024 in the small practice setting.

Recommendations/Summary

Authors suggest that the full diffusion in a critical market segment is unlikely to occur in the timeframe targeted by policy makers. Barriers to adoption include decision-support technology that represents a "disruptive change in the health care workplace;" EHR systems do not immediately yield financial gains; vendor volatility; and physician fear of loss of autonomy. An interactive-educational strategy is cited as the best means of influencing physician opinion within social organizations (medical education, CME, academic detailing).

Government assistance in Europe has proven to aid in the wide acceptance of EHR systems; pay-for-performance programs are suggested as a means of encouraging physicians to utilize EHRs in their practices.

Discussion

The study supports slow diffusion as suggested by many of the expert opinions voiced in the literature; strategies are suggested to aid in diffusion including education for physicians and a focus on quality and pay-for-performance as government incentives for EHR adoption.

15. Article: *Can Electronic Medical Record Systems Transform Health Care? Potential Health Benefits, Savings, And Costs*

Hillestad, R., Bigelow, J., Bower, A., Girosi, F., Meili, R., Scoville, R., et al. (2005). Can electronic medical record systems transform health care? Potential health benefits, savings, and costs. *Health Affairs*, 24(5), 1103-1117.

Primary Author's Credentials/Affiliations

Credentials not provided; Senior Management Scientist at Rand in Santa Monica, California

Purpose/Objectives

To compare to better understand the role and importance of EMRs in improving health care and inform government actions that could maximize the benefits of EMRs and increase their use.

Study Design

Secondary data analysis of the HIMSS–Dorenfest 2004 survey to capture adoption rates; broad literature survey to capture potential efficiency savings; financial model development based on literature review and information supplied by hospitals and

commercial outpatient systems to capture adoption costs; analyzed medication error and adverse drug event rates from the literature and limited evidence of CPOE's reduction rates to capture safety benefits; and developed a representative national sample from MEPS data to capture other potential benefits related to disease prevention and chronic disease management.

Results/Main Finding

Over fifteen years, the net efficiency and safety savings from physicians using EHR systems could be \$371 billion for hospital systems and \$142 billion for physician practices; once fully implemented, EHR systems could save more than \$81 billion annually for the U.S. HC system; estimate HIT could save 8% in annual productivity; potential net financial benefit could double if the health savings produced by chronic disease prevention and management were included. The most important areas of savings are: reduced hospital lengths-of-stay, nurses' administrative time, drug usage in hospitals, and drug and radiology usage in the outpatient setting. Study suggests that CPOE could eliminate 200,000 adverse drug events per year if installed in all hospitals. Report that 15-20% of physician offices and 20-25% of hospitals have adopted EHR system.

Recommendations/Summary

Barriers to wide spread adoption include acquisition and implementation costs, slow and uncertain financial payoffs, and disruptive effects on practices; if EMR systems were widely adopted, the market might fail to develop interoperability and robust information exchange networks. The authors recommend strong government policy to facilitate widespread diffusion of interoperable HIT with actions in the early stages of adoption providing the most leverage.

Discussion

Excellent review of costs and savings for the healthcare industry overall; authors make a strong case for the value of the short-term costs of EMRs to achieve significant savings over the long-term.

16. Article: *The Costs of a National Health Information Network*

Kaushal, R., D. Blumenthal, E. G. Poon, A.K. Jha, C. Franz, B. Middleton, J. Glaser, G. Kuperman, M. Christino, R. Fernandopulle, J.P. Newhouse, and D.W. Bates. (2005). The costs of a national health information network. *Annals of Internal Medicine*, 143(3), 165-173.

Primary Author's Credentials/Affiliations

MD, MPH; Division of General Internal Medicine, Brigham and Women's Hospital, Boston Practice

Purpose/Objectives

To explore the potential structure and cost estimates of a national health information network.

Study Design

An expert panel was used to estimate information technology and its functionalities in a five year time frame by defining key providers, functions, and interoperability capabilities.

However, because of a lack of primary data relating to costs, the study relied on expert estimates rather than exact figures.

The authors define the NHIN in two components: the ability to perform key functions (EHR, CPOE) and interoperability (data exchange). An achievable NHIN model can be implemented in 5 years, although it would not utilize an ideal infrastructure designed to fully implement functionality and interoperability to its full potential. This model was constructed by a panel of IT experts from academia, industry, and government. Several domains for the NHIN identified: inpatient and ambulatory result viewing, inpatient and ambulatory EHR, inpatient and ambulatory CPOE, electronic claims submission, electronic eligibility verification, secure electronic patient communication, and electronic prescription acceptance by pharmacies. The model would have six primary stakeholders: physician office practices, hospitals, skilled nursing facilities, home health agencies, laboratories, and pharmacies.

An interoperability model was defined according SBCDE guidelines as a brokered peer-to-peer network. Brokered means the network employs a central host, while peer-to-peer allows for direct exchange of information among providers. The authors indicate supplying data is much more expensive than receiving it. Each supplier would be required to purchase and maintain a dedicated server to ensure secure, reliable data exchange.

The article evaluates the functionality and interoperability costs independently. The authors established two different sets of national costs of the NHIN: 1) advancing from current IT functionality to the proposed model NHIN and 2) expected expenditures over the next 5 years if current levels of spending on IT continue unchanged.

Results/Main Finding

The panel found to achieve a completely functional NHIN, it would cost nearly \$156 billion in capital investment over a five year period and an additional \$48 billion in operating costs annually. Although additional costs would be divided between functionality and interoperability, policymakers need assistance in constructing policies to determine the level of investment needed to create a NHIN.

Recommendations/Summary

Public policy initiatives like HIPAA have actually improved HIT adoption rates though the standardization among EHR systems, encouraging uniformity. The article cited the Veterans Affairs clinical use of the VISTA open-source system which is often referred to as an example of a major success of HIT supported by federal initiatives. Similar policies can be developed for private practices and large-scale hospitals to begin to adopt HIT to experience the savings developed in this study's interoperable model for NHIN.

Discussion

The article cites the financial benefits of creating a nationwide health information network. However, problems have been experienced in individual institutional implementations of HIT. Therefore, the scope of NHIN may be extremely broad and overly ambitious given the amount of capital necessary to create a healthcare information network which would require participation from all sectors of healthcare and the creation of data standards which have proven to be extremely difficult to develop.

17. Article: *Measuring the Success of Electronic Medical Record Implementation Using Electronic and Survey Data*

Keshavjee, K., Troyan, S., Holbrook, A. M., & VanderMolen, D. (2001). Measuring the success of electronic medical record implementation using electronic and survey data. *Proceedings of the American Medical Informatics Association Annual Symposium*, 309-313.

Primary Author's Credentials/Affiliations

MD; McMaster University, Hamilton, Ontario, Canada

Purpose/Objectives

To describe an evaluation of work flow and processes pre and post-computerization; the COMPETE (Computerization of Medical Practices for the Enhancement of Therapeutic Effectiveness) study was a three year project designed to evaluate the impact of EMR systems on practice efficiency, quality of care, and privacy in physician practices. .

Study Design

Pre-post evaluation study design; used investigator-developed qualitative and quantitative measures of medical office work processes and front office efficiencies; direct observation, data collection tools and questionnaires were completed pre-EMR implementation and again at 6 months and 18 months post implementation. The following variables were included: administrative variables of pulling charts, preparing daily schedules, writing in charts and billing tasks; physician variables of writing in chart, percent paper use, script writing and renewals, consult reports review, lab report review, number of patients seen/day, length of work day and quality of charting.

Sample and setting: 32 family physicians and their staff in 18 family practice sites

Results/Main Finding

Most practices experienced significant gains in billing data entry and reconciliation processes; time saving was also cited in retrieving patient charts with a reduction of over 50%; physician time to chart increased initially by 50%, but went down to original levels by 18 months. At the end of the study, the researchers found physicians did not think the volume of work increased when the EHR system was implemented and the majority thought sufficient time was being saved to justify the continued use of EHRs. Overall, the investigators found most physicians felt although their charting time increased, they were able to see more patients or leave earlier at the end of the day.

Recommendations/Summary

While many physicians reported that their charting time had increased, they also reported that they were able to see more patients and/or leave earlier at the end of the day. This difference may be related to time savings found elsewhere in work processes or it may be that time spent with the patient is sacrificed for increased time spent charting. Investigators suggest further research in work flow analysis related to EMRs is needed.

Discussion

The study relied heavily on self-reports by physicians and office staff, which may have been influenced by their personal feelings toward EMRs. The study does provide some excellent variables to consider when evaluating EMRs and physician usage.

18. Article: *Implementation of Health Care Information Systems: Key Factors and the Dynamics of Change*

Kouroubali, A. (2003). *Implementation of Health Care Information Systems: Key Factors and the Dynamics of Change*. Cambridge, UK: Kings College.

Primary Author's Credentials/Affiliations

PhD candidate; Kings College, Cambridge

Purpose/Objectives

To describe the experience of HCIS implementation in Crete, and the implications for policy and practice for similar implementation initiatives.

Study Design

Qualitative study using a longitudinal interpretive methodology of multiple interviews, participant observation, and document analysis.

Sample and setting: 8 case studies were conducted in primary care clinics in rural areas in Crete and included 84 interviews with 54 participants.

Results/Main Finding

The study focused on five key factors which contribute to variations in implementation: technology, education, leadership, organizational structures, and environment; complexity theory concepts of *far-from-equilibrium* and *information flow* explain how particular factors influenced the implementation of the technology; investigator uses complexity theory to address the nature of the complex adaptive system particularly in implementing a technology system and states that the model accounts for the various agents that interact in a non-linear way through a method of self-organization, which is the self-guided process of transformation that does not need to be externally driven or hierarchically controlled.

Implementation of HCIS either supplemented ongoing organizational change already occurring or forced change within the organization; technology facilitated collaboration among employees in terms of research, education, and daily activities; most physicians were open and willing to adopt technology under appropriate conditions, which included education, staffing, and how the technology equated to freedom and responsibility.

Recommendations/Summary

Complexity theory can explain the unpredictability of technology implementation and the difficulties for individuals in clinical settings trying to integrate technology into their practices; suggests that identifying techniques to easily implement information technology should be a focus of medical informatics research.

Discussion

Literature from the fields of implementation research, organizational change, and complexity theory are relevant to understand the process of implementation and the organizational change that occurs within these settings. The use of complexity theory as a framework for understanding the unpredictability of IT implementation initiatives was well done by the author.

19. Article: *Designing an EMR Planning Process Based on Staff Attitudes Toward and Opinions about Computers in Healthcare*

McLane, S. (2005). Designing an EMR planning process based on staff attitudes toward and opinions about computers in healthcare. *CIN: Computers, Informatics, Nursing*, 23(2), 85-92.

Primary Author's Credentials/Affiliations

RN, MBA; University of Texas M.D. Anderson Cancer Center, Houston
Practice

Purpose/Objectives

To understand the personal experiences of staff in the use of a computer, their attitudes about the use of computers in a clinical practice setting, and their perceptions of the value of computer support to clinical documentation.

Study Design

Cross sectional survey

Survey tool used was adapted from a tool employed by Gardner and Lundsgaarde

Sample: $n=44$; 132 surveys sent out for a 33% response rate

Setting: 52-bed bone marrow transplant unit in a hospital

Intervention: N/A

Results/Main Finding

More than half of respondents claimed they had no experience with an EHR system; 25% stated they thought using a computer was a "boring and repetitive task;" surprisingly, 70% of respondents reported that EHRs increased the potential for monitoring by administrators and government agencies; over half expressed concern about an increased risk to patient confidentiality; 23% indicated that workload would be increased through computer use; 42% indicated that doubts about whether computerized decision support could enhance nursing professionalism; overall, responses indicated that staff believe that computers are somewhat or very important adjuncts to care delivery.

Recommendations/Summary

Staff acceptance and willingness must be present in order to successfully implement an EHR system; understanding staff attitudes and perceptions is of vital importance to staff acceptance and willingness. Suggestions to gain buy-in are as follows: staff education about the benefits and expectations of an EHR system is essential before such a system is implemented and will help prevent unrealistic expectations; clinicians need education about patient confidentiality and how it relates to EHR systems; clarification that redundant documentation will be virtually eliminated and data will be presented in new and meaningful ways that support nursing practice is important prior to implementation; and input from the nursing staff through design meetings about decision support and clinical alerts will strengthen the acceptance process.

Discussion

The article illustrates the importance of understanding staff attitudes about EMRs prior to planning an implementation process and emphasizes the importance of education

focused to address staff needs and attitudes about EMRs as well of staff involvement in system design and implementation processes.

20. Article: *Resistance to Electronic Medical Records (EMRs): A Barrier to Improved Quality of Care*

Meinert, D. B. (2005). *Resistance to Electronic Medical Records (EMRs): A Barrier to Improved Quality of Care*. Paper presented at the Issues in Informing Science and Information Technology, Flagstaff, AZ.

Primary Author's Credentials/Affiliations

PhD; Southwest Missouri State University

Purpose/Objectives

To determine physician perceptions related to ambulatory EMR systems, experience with EMRs, expectations of EMR data, and importance of functionality.

Study Design

Cross Sectional Survey

Sample: $n=261$; 358 physicians were mailed surveys and 261 were determined to be usable.

Setting: Physicians affiliated with large, multi-specialty clinic in the Midwest

Intervention: N/A

Results/Main Finding

Physicians thought the most important EMR functions were the display of lab results, radiology reports, and clinical notes; more than 56% expressed doubt that physicians were familiar with EMR functions and benefits; 80% felt that EMR systems would improve the quality of patient care; 71.5% felt that EMR use would have to be mandated in order for the majority of physicians to use such a system; 31.7% were doubtful that physicians would dedicate time for adequate EMR instruction; 79.6% percent felt that EMRs should be implemented in clinical settings. Overall, the author believes that the general physician attitude points to overall support for EMRs.

Recommendations/Summary

Suggests five major reasons for physician resistance to EMRs: well-publicized EHR failures, limited computer literacy, concerns over productivity, patient satisfaction, and unreliable technology; author states that it has been difficult to determine physician perceptions because the definition of EMRs varies widely and suggesting that the hype of EMRs created "unrealistic expectations among physicians," leading to disappointment with current EMR systems.

Suggest major functionalities for EMRs: enhanced physician-patient communication, reduced redundancy, graphical display of results, formulary decision making, medication/allergy/problem documentation, and patient education.

Additional research about physicians' perceptions of EMRs is needed; understanding physician perceptions will aid in the development and marketing of functional, "user-friendly" EMR applications and allow for targeted education to demonstrate the advantages of EMRs and further improve physician acceptance; also suggest need for further research on patient satisfaction related to EMR use.

Discussion

The study was conducted in one multi-specialty clinic and results may not be applicable to other settings; however, the author did present several important considerations and a useful tool for understanding physician perceptions related to EMRs. The information could feasibly be applied to almost any HC setting that is considering an EMR implementation.

Expert Reports

21. Article: *Electronic Clinical Records: What do Regulators Want?*

Zuber, R. (2002). Electronic clinical records: What do regulators want. *Home Healthcare Nurse*, 20(1), 14-17.

Primary Author's Credentials/Affiliations

MA, BSW; Editorial Board Member – Home Healthcare Nurse Industry

Purpose/Objectives

To discuss data integrity and system security issues of electronic health record implementation in home healthcare environments.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

Zuber states factors of information authentication in electronic entry, system back-up, availability of disaster protection, contingency plans to allow patient information access, and the integrity of the clinical record must be considered when implementing EHR systems. Clinical record integrity has many important components in regards to data entry accuracy, access authorization, and entry corrections which must be addressed. User interface components are also paramount to successful implementation, requiring user-friendly formats which allow for the adjustment to multiple systems and platforms. Therefore, EHR systems need to possess variability and versatility to provide an effective means of record keeping.

Primary suggestions made by the author primarily deal with the authentication and integrity of patient data entered into the EHR system. Managers and system surveyors must take steps to ensure staff compliance which includes developing sanctions for clinicians disregarding policies designed to protect patient data. Managers must also provide primary support to surveyors designated as system support staff as well as providing an orientation system for surveyors to work independently from the rest of the

clinical staff. To use the EHR system securely, staff members must be capable of explaining the security and integrity safeguards. Managers must also develop strategies to allow a surveyor to easily navigate the electronic documenting system to find necessary information for various tasks such as printing paper copies. These strategies should also address the variability of technological competency and comfort of system surveyors.

Discussion

EHR system implementation requires policies designed to educate and ensure proper usage to keep patient data secure and accurate. Zuber identifies five different issues which surveyors and providers must consider when developing these policies: the acceptability of different approaches to authentication, the integrity of the clinical record, system back-up and availability, concerns of confidentiality, and survey issues. The policies and procedures developed to address these issues must balance system security as well as user needs in order for an EHR system to be used securely and effectively.

22. Article: *The Ultimate Health Care IT Consumers: How Nurses Transform Patient Data into a Powerful Narrative of Improved Care.*

Deese, D., & Stein, M. (2004). The ultimate health care IT consumers: How nurses transform patient data into a powerful narrative of improved care.[erratum appears in Nurs Econ. 2005 Jan-Feb;23(1):45]. *Nursing Economics*, 22(6), 336-341.

Primary Author's Credentials/Affiliations

RN, MBA; IDX Systems, Seattle, WA.
Industry

Purpose/Objectives

To explore how nurses at leading institutions are using the HIT tools to support preventive care, manage the demands of the inpatient and ambulatory experience, and streamline reporting and billing responsibilities.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary/Summary

Authors emphasize that nurses are key to the success of EMRs and technology initiatives to promote patient safety and improve outcomes. Ground-level issues for nurses and HIT are: (a) quality and efficient care delivery – how can HIT enhance rather than inhibit nurses' complex and demanding workflow; (b) continuity of care – how can IT streamline the flow of information across the continuum of care; and (c) outcomes – how can IT be used to help patients maintain a better quality of life after they leave the hospital and also benefit the HC organization itself?

To Implement HIT, authors suggest that reaping the full benefits of a HIT CIS requires a multifaceted approach of which the technology itself is only one aspect; change management is critical with the ability to the process of evaluating and redefining

workflows to develop new procedures that will be more efficient and effective with HIT; simply automating paper-based practices will not produce the patient safety, cost savings, and productivity outcomes. Suggest improvements in the following functional areas: admissions, discharges, access to identical current data by all care providers, medication administration, bed management, clinic/outpatient follow-up reporting and auditing, and population health management. Several examples in each of these areas are provided including: An electronic white board allowed nurses in ER settings to monitor their patients and have instantaneous access to vital signs; patient badge feature whereby all patients in the ER can be tracked using sensors in the walls of each room; and online documentation reduced the amount of time nurses spent on charting by 50%. However, in one implementation, a network of community hospitals' implemented a barcode system to manage patient data which actually added steps to the process.

Discussion

The article is an excellent review of innovative uses of HIT and how success has been measured. A special focus on change management provides good suggestions for EMR implementation strategies.

23. Article: *The Vision of Electronic Health Records*

Waegemann, C.P. (2002). The vision of electronic health records. *Journal of Medical Practice Management, 18*(2), 63-65.

Primary Author's Credentials/Affiliations

Not given.

Purpose/Objectives

To identify the barriers preventing wide-scale implementation of electronic patient records as well as indicate possible future trends of HIT implementation and the influence the Internet will have on EHR systems.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

In order for electronic health records to be successfully implemented, universally adopted standards must exist to efficiently capture data, generate reports, and provide a technically-sound interoperable system on a national scale. Electronic health records must utilize a longitudinal, paperless system which can be employed in a multi-provider, multi-discipline setting with uniform documentation by all health professionals. Successful implementation will balance health information infrastructure and electronic health record requirements in terms of technical interoperability, information representation, security, information usage, and decision support rules.

For those institutions that have already implemented EHR systems, the most difficult issue was transitioning doctors from paper, hand-written documentation to computer entry using methods like structured documentation fields and interactive recording.

Because organizations implement EHR systems to improve the sharing of patient information among healthcare providers as well as to facilitate clinical decision support, physicians must be provided with adequate training to ensure secure, reliable data entry.

Discussion

Waegemann emphasizes the future potential Internet technology will have on electronic health record functionality. While communication will be improved through the use of websites and mobile technology, the primary roadblock to this functionality is transitioning physicians from traditional methods of documentation to electronic data entry.

24. Article: *Nursing Informatics: A Foundation for Nursing Professionalism*

Abbott, P. A. (2003). *Nursing Informatics: A foundation for nursing professionalism* [Electronic Version]. *AACN Clinical Issues*, Retrieved October 14, 2005 from <http://www.aacn.org/AACN/jrn/nci.nsf/GetArticle/ArticleTwo143?OpenDocument>.

Primary Author's Credentials/Affiliations

PhD, RN, BC, FAAN; Johns Hopkins University School of Nursing
Academia

Purpose/Objectives

To raise awareness of the power and importance of nursing data and nursing involvement in the development, acquisition, and utilization of automated systems in healthcare; discusses the relationship between nursing informatics and computers; supports the use of technology to improve patient care.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

Encourages nurses to "step up to the plate" in technology innovation to support patient care and documentation of nurses' contribution to patient care.

Discussion

Discusses insufficient methods for data collection, storage, and retrieval as barriers to EHR implementation with consensus of coding data and how to retrieve it being extremely controversial; the biggest problem stated by the author is representing nursing practices in a format that can be stored, manipulated, and managed by computers; "the greatest struggle in nursing informatics is in the representation of nursing in language that a computer can use."

25. Article: *Factors and Forces Affecting EHR System Adoption: Report of a 2004 ACMI Discussion*

Ash, J. S., & Bates, D. W. (2005). Factors and forces affecting EHR system adoption: Report of a 2004 ACMI discussion. *J Am Med Inform Assoc*, 12(1), 8-12.

Primary Author's Credentials/Affiliations

PhD; Department of Medical Informatics and Clinical Epidemiology, School of Medicine, Oregon Health & Science University
Academia

Purpose/Objectives

To explore the gap between where the U.S. is concerning adoption of the EHR, where ACMI members believe the nation should be, why the gap exists, and suggest strategies for decreasing the inhibiting factors and strengthening the facilitating forces for EHR adoption.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

(a) Determine motivating factors to get people to make the transition from paper to electronic records; (b) Help users understand that it may take longer to enter an individual order but there will be impressive payoffs downstream; (c) impart an understanding that the system is not just replacing a paper system but that there will be a fundamental change in workflow that will help users do their work better; (d) honestly admit that there may be difficulties for a while but that organizations that have implemented EMRs claim they would never go back to paper; (e) medical and nursing education must focus on the use of IT in their training programs and avoid allowing students to "get attached" to the paper record; (f) If the greatest financial rewards will be reaped by payers, liability carriers, healthcare systems, and patients, then these entities need to provide an incentive for the clinicians financially; (g) address Stark laws that may interfere with incentives between networks and providers to implement (i.e., Safe Harbor); and (h) provide a reward structure that includes such things as CME for system training, encouragement of social interaction about system concerns, and awards for innovative uses of IT.

Discussion

Where should we be: *"We should strive to have a national system of EHRs that can share information on any patient in any health care setting. From the point of view of the patient, he or she should be able to enter any health care setting and see a clinician who has comprehensive access to information about that patient. From the health care provider's perspective, this access should be fast, the information should be easy to find, and the process should help rather than hinder the workflow. Health care will be safer for the patient and more satisfying for the clinician, who would now be able to provide far better care and feel more secure in his or her decision making"* (p. 9).

Suggest that the most important barrier to EHR adoption is the misalignment of incentives in relation to cost benefits; for example, outpatient facilities must pay for EHR implementation but 90% of the financial gain is accrued to payers and purchasers.

Competition in the HC sector also creates awareness among patients of the potential of IT; suggest that patients may begin demanding hospitals start investing in technology for easier access to medical information.

Indicators of readiness are the willingness to adopt new technology at all levels of the organization including physicians who are rapidly adopting PDAs for clinical purposes.

Physicians are resistant to methods that may interfere with their work flow; the EHR system employing CPOE must work in conjunction with pre-existing systems and methods of clinical, laboratory, pharmacy, and radiological practice; authors compare the operation of an EHR as a "hub" which must work congruently with all clinical activity, providing a non-interfering way to access information; the potential of the technology will allow institutions to share information in the future.

Discussed on one survey in which respondents cited cost, time of educating, and security as reasons for not implementing computer technology in their own practices but were less concerned with security issues in hospital settings.

26. Article: *Improving Safety with Information Technology*

Bates, D. W., & A. A. Gawande. (2003). Improving safety with information technology. *New England Journal of Medicine*, 348(25), 2526-2534.

Primary Author's Credentials/Affiliations

M.D.; Partners HealthCare System, Harvard Medical School
Academia

Purpose/Objectives

To analyze what is known about the role and effect of information technology with respect to safety and consider the implications for medical care, research, and policy.

Study Design

N/A; review of various studies that demonstrate the benefits of IT in HC

Results/Main Finding

Studies have demonstrated that IT contributes to medical error prevention in the following categories: (a) improved communication; (b) more readily accessible knowledge; (c) requirement for key pieces of information (such as the dose of a drug); (d) assistance with calculations; (e) checks performed in real time; (f) assistance with monitoring; (g) decision support; and (h) rapid response to and tracking of adverse events. Despite the many advantages of IT to improve safety of HC, diffusion has been slow. The following barriers are identified by the authors: financial (IT applications are commercially funded and reimbursement mechanisms reward good billing practices rather than outstanding clinical care); lack of standards (no single standard for representation of clinical data exists in the U.S.); and cultural (tendency for clinicians and policy makers to view IT as relatively unimportant for research or medical practice).

Recommendations/Summary

To overcome financial barriers: public assistance with capital investments; legislation has been introduced in the U.S. Senate to provide nearly \$1 billion over a period of 10 years to hospitals and Medicare-supported nursing homes that implement technology to improve medication safety (Medication Errors Reduction Act of 2001, S. 824, 107th Cong., 1st Session).

To overcome standards barriers: several initiatives are moving forward but the most important aspect is the recognition of this area as a priority and to continue the current focus on standards development.

To overcome cultural barriers: HC clinicians, leaders and policy makers must recognize that most preventable adverse events result from failures of systems, not individuals and that adoption of new forms of HIT is the key to improving all aspects of the HC system.

Discussion

The author, who is a nationally recognized leader in HC IT stresses that “investment in and adoption of new forms of IT must be understood as being as vital to good patient care as the adoption of new technological tools for diagnosis and treatment” (p. 2533). One great example given in the article related to the cultural barrier is: “academic centers are more apt to seek and reward faculty members who pursue research on a drug or a device that might lead to a reduction of 0.5 percent in the rate of death from myocardial infarction than those who develop a decision-support system that could result in a far greater reduction” (p. 2533).

27. Article: *Will the Wave Finally Break? A Brief View of the Adoption of Electronic Medical Records in the United States*

Berner, E. S., Detmer, D. E., & Simborg, D. (2005). Will the wave finally break? A brief view of the adoption of electronic medical records in the United States. *Journal of the American Medical Informatics Association*, 12(1), 3-7.

Primary Author’s Credentials/Affiliations

EdD; University of Alabama at Birmingham
Academia

Purpose/Objectives

To discuss factors which indicate that there may be reason for optimism related to the diffusion of technology in today’s healthcare climate.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

Authors suggest that federal funding of EHR technology is limited because of federal deficit spending, which may hamper policy initiatives in support of HIT advancement. Article presented a positive spin on EMRs and the potential for a “wave” of adoption in the near future. Physicians are wary of the “cookbook” approach to medicine that many fear will come to pass if EMR technology is widely adopted.

Discussion

Barriers to HIT in the 1980s and early 1990s: technology immaturity, health administrator focus on financial systems, application “unfriendliness,” and physician resistance. Following factors may be indicators of a “wave” in HIT adoption: (a) steady improvement in technology; (b) continued development of standards such as HL7; (c) increased

interest of the federal government in policies and activities that further the development of EMRs; (d) technology has improved; (e) growing investment in HIT; and (f) experience of the new crop of health professionals. Physician resistance continues to be a primary barrier as is related to their feeling that decision support may contribute to a “cookbook” approach to medicine. Interoperability is also a huge issue to address for implementing EMRs successfully.

28. Article: *Accelerating U.S. EHR Adoption: How to Get There From Here. Recommendations Based on the 2004 ACMI Retreat*

Middleton, B., Hammond, W. E., Brennan, P. F., & Cooper, G. F. (2005). Accelerating U.S. EHR adoption: How to get there from here. Recommendations Based on the 2004 ACMI Retreat. *Journal of the American Medical Informatics Association*, 12(1), 13-19.

Primary Author’s Credentials/Affiliations

MD, MPH; Partners HealthCare System and Harvard Medical School

Purpose/Objectives

To identify a set of recommendations to stimulate adoption of EHRs including financial incentives, promotion of EHR standards, enabling policy, and educational and marketing support for providers and healthcare consumers.

Study Design

N/A (Expert Report: recommendations developed by attendees at the 2004 ACMI retreat)

Results/Main Finding

N/A

Recommendations/Summary

Financial Incentives: Reimbursement reform to directly or indirectly reward users of HIT; increase capital availability to organizations that lack sufficient capital reserves or credit; establish EHR certification processes to attest to the appropriate functionality; and consider open-source software to lower the price.

Promotion of standards: Specification of a minimal set of essential standards that have the property of supporting interoperability is critical to rapid adoption of HIT.

Enabling Policy: National policy initiatives that could have a significant effect on HIT adoption: modification of Stark antitrust regulations, policies to guide clinical data ownership and stewardship, mechanisms to support creation of regional health care information authorities, and establishing means for national professional licensure in the health care professions.

Educational and Marketing: Campaign similar to public announcements and efforts for smoking cessation, drug abuse, obesity, etc.

Discussion

The article provides value information for policy makers who are interested in promoting EHR adoption; the authors are eminently qualified and knowledgeable to make such recommendations.

29. Article: *Electronic Medical Records: Creating the Environment for Change.*

Brookstone, A. (2004). Electronic medical records: Creating the environment for change. *BC Medical Journal*, 46(5), 233-235.

Primary Author's Credentials/Affiliations

MD; Practicing physician in Richmond, BC, Practice Solutions Advisory Team, Physicians Computing Chronicle, and the Richmond Physician's IT User Group Practice

Purpose/Objectives

To detail barriers to successful EMR implementation and to suggest strategies to bridge the "value-gap" that currently exists between where physicians are and where they should be for implementing EMRs.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

Suggests the following barriers to EMRs: software immaturity, training issues, privacy concerns, and limited availability to access HC information from external sources. To be successful, EMRs must provide a selection of information, tools, and data-entry mechanisms that allow the physician to access and input data in a manner that he/she prefers (i.e., text entry, pen/tablet, speech recognition, templates, clinical guides). Emphasizes that the requirement to work with both paper and electronic systems reduces efficiencies that can be gained with the EMR. Physicians oppose interfaces that impede the entry and access of patient data. Suggests that documentation about management workflow has not been adequate enough to determine successful handling of clinical data by physicians. Another consideration is the physician interaction between patients and computers.

The "value-gap" is defined as the difference between the efficiencies gained using the current level of technology and the total cost of making the jump to the next level of technology; total cost must be measured in the time, expense, training needs, systems change, loss of productivity, and pain in implementing a new technology. Suggested strategies to overcome the value gap are: (a) government financial incentives to accelerate the uptake of technology by physicians; and (b) trusted independent resource to provide guidance to physicians on software selection and best practices in the implementation of EMR systems and other technologies (i.e., Physician IT user groups).

Discussion

The author focuses primarily on the acceptance of IT in physician practices and presents a good summary of barriers to successful implementation with some practical suggestions for physicians (i.e., physician IT user group) to overcome some of these barriers.

30. Article: EHR Development Steps in Long-term Care

Dougherty, M. (2005). EHR development steps in long-term care. *Journal of AHIMA* 59(1), 54-55.

Primary Author's Credentials/Affiliations

RHIA; affiliations not provided
LTC

Purpose/Objectives

To outline initiatives and opportunities open to the LTC industry related to EHR development.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary/Summary

Recommendations to help the LTC sector begin to implement EHR systems: (a) recognizing the interoperability potential to improve care and efficiency; (b) industry participation in standards development; (c) development of a single application to increase awareness and demand; and (d) emphasizing the need for future research. The report cites AAHSA and the AHCA as the two main groups offering strategies to implement information technology in long-term care.

Suggest the primary advantages of the system are exchange of health information at the point of care transition, ability to manage medication through the EHR with functions such as CPOE and automated med sheets with bar code med administration, and clinician and physician documentation. Limitations to overcome include connectivity with other HC organizations, software applications that lack the use of standards in messaging, vocabulary, clinical content, and document architecture, and integration of required data sets (i.e., MDS).

Discussion

Overall, the author gave good a good overview of some of the issues related to EHRs in LTC and presented several steps to get started, the most important being to become involved in learning about technology and how it can be incorporated to improve quality and efficiencies in LTC.

31. Article: Nursing Informatics: Applications for Long-Term Care

Dyck, M. J. (2002). Nursing informatics: Applications for long-term care. *Journal of Gerontological Nursing*, 28(10), 30-39.

Primary Author's Credentials/Affiliations

RN, MSN; University of Iowa

Purpose/Objectives

To identify applications for nursing informatics in long-term care settings.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

Suggest the following 5 functions for nursing informatics in LTC: (a) providing the legal record of care; (b) supporting clinical decision making; (c) capturing financial data; (d) accumulating a data base for administrative queries, quality assurance and research; and (e) supporting data exchange between systems.

The author provides a good review of nursing informatics based on the framework of data – knowledge- information; emphasizes the need for standardized languages in LTC documentation systems. An information system could assist the LTC Director of Nursing to make quality decision; studies related to common nursing home conditions such as infections, pressure sores, and incontinence could be more easily and effectively accomplished with an information system; one solution to professional isolation cited as a concern among nurses in LTC is connection to on-line journals and other resources related to geriatrics and LTC. LTC has made great advancements in computerization with the automated MDS system – but further advancement needs to be made to support the five functions identified.

Discussion

The article presents a good discussion of IT applications in LTC and goes on to illustrate the value of the MDS database to clinical care and research; the article did not discuss barriers to IT diffusion in or strategies for LTC facilities to move forward in informatics; the best practical recommendation was for LTC nurses to use internet resources related to geriatrics to support decision making.

32. Article: *The Benefits and Challenges of the Computerized Electronic Medical Record*

Laing, K. (2002). The benefits and challenges of the computerized electronic medical record. *Gastroenterology Nursing*, 25(2), 41-45.

Primary Author's Credentials/Affiliations

RN; Endoscopy and Minor Surgical Procedures Center, Fairview Southdale, Edina, Minnesota
Practice

Purpose/Objectives

To describe benefits and challenges of the computerized electronic medical record, with particular emphasis on the concept of the computerized endoscopic medical record (CEMR)

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

Reported benefits of EHRs are improving efficiency and workflow, patient data access, and the elimination of physical storage; suggests designating "super users" to serve as a resource for assisting other professionals to use the technology; suggests that the goal of the organization should be for everyone to become "proficient and use the system to its full potential."

Discussion

While the article discusses the use of the EHRs in endoscopy centers, the author provides some valuable suggestions for EHR implementation in any setting. The goal of ensuring that everyone in the organization is using such a system proficiently and to its full potential is especially timely to overcome issues of not gaining full benefits because of inefficient/incomplete use.

33. Article: *The Implementation of the Electronic Medical Record: The Team Approach*

Souther, E. (2001). The implementation of the electronic medical record: The team approach. *Computers in Nursing, 19*(2), 47-55.

Primary Author's Credentials/Affiliations

PhD; University of Texas School of Allied Health
Academia

Purpose/Objectives

To report on a team-based approach for implementing an electronic health system utilizing a tiered structure to divide responsibilities among three different specialized teams.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

The author, a nursing informatics specialist, defines the team approach to EHR implementation as a hierarchical structure comprised of an Executive Steering Team, a Project Steering Team, and a Project Work Team. The Executive Steering Team is responsible for defining the scope and process of the system, providing technical assistance, creating goals and measurable outcomes, and implementing marketing guidelines for the EHR system. The Project Steering Team is tasked with performing requirements analysis, considering analysis of alternatives, conducting a cost-benefit analysis, reporting possible return on investments, and requesting proposals for comparing commercially developed EHR packages. The Project Work Team develops the project implementation plan, conducts a work-flow analysis, handles user training, and evaluates measurement and feedback once the system is implemented.

Discussion

Souther stresses the importance of cooperation between key individuals responsible for clinical management and IT experts to efficiently and effectively implement electronic

health records in healthcare facilities. The construction of the team-based approach she presents places the Executive Steering Team as the primary stakeholder responsible for the larger issues of HIT implementation. However, the construction of these teams will vary from institution to institution, but this multiple team approach helps mitigate the risk of potential failure. Specialized teams can help encourage physician participation and support by providing support systems in regards to credentialing and peer reviews.

34. Article: *New Technology Continues to Invade Healthcare: What are the Strategic Implications/Outcomes?*

Smith, C. (2004). New technology continues to invade healthcare: What are the strategic implications/outcomes? *Nursing Administration Quarterly*, 28(2), 92-98.

Primary Author's Credentials/Affiliations

MSN, ND, RN, CNA, CHE; Patient Care Services, Benedictine Hospital, Kingston, New York
Practice

Purpose/Objectives

To provide a matrix of the various types of HCT and establish strategies for selecting, evaluating, and making decisions about HCT systems.

Study Design

N/A (Expert Report)

Results/Main Finding

This article discusses technology applications in general healthcare environments, particularly in acute care settings. While there are no specific guidelines provided for HIT implementation, this article provides good discussion of the various types of IT available and considerations for implementation.

Recommendations/Summary

The author outlines several questions which must be considered when implementing HCT in clinical settings:

- What is the degree of clinician support for the product?
- Were all the right professions and professionals involved?
- Was there adequate MD involvement?
- Will this product increase retention of the RN workforce by (a) providing a safety net against clinical error, (a) saving the RN time in documentation and routine care tasks, and (a) simplifying the work flow?
- What other purchases of HCT take priority over the product being considered? How does this product support the organization's strategic plan?
- What new model of care can be developed to augment a clinical transformation?
- How can the current work flow and patient care be redesigned to maximize the use of the proposed HCT?
- Will there be enough end-user support?
- Were all the costs of implementation and maintenance considered?
- When considering monitoring devices and the CIS, has electronic data transfer to the clinician and the EHR been considered?
- How feasible is this transfer?

- How well does the HCT improve communication and collaboration between caregivers?
- Will the proposal affect patient satisfaction positively?
- Will the proposed system support the empowered consumers seeking knowledge about their health and self-care?

Clinical transformation involves both clinical and non-clinical improvements supported by information technology, but not driven by it. By using IT to drive significant quality and improvement requires an integrated process for implementing the technology in daily practice so the system augments the clinical environment rather than hindering it. The IT system should maximize clinician time in clinical care through a user friendly interface which increases patient safety, produces positive outcomes, and meets organizational goals and business plans. “Buy-in” is required from all disciplines and clinical stakeholders if the system is to be utilized in the most efficient and effective manner. For physicians, clinical decision support can help to guide and assist in decision making as well as providing greater access in the reception of clinical data from external devices.

Above all else, and HIT system should provide the following functions defined by the IOM:

- Improve patient safety
- Support delivery of effective patient care
- Facilitate management of chronic conditions
- Improve efficiency
- Provide feasible implementation

Discussion

Smith only provides options for HIT functionality, not plans for implementations. His definition of IT is rather broad including functions for finance, accounting, patient registration, human resource system support, pharmacy and radiology support, clinical decision support, education, and reference.

The article states options like CPOE, PACS, medication administration management, revenue cycle management, patient web-based education, robot dispensing of medication, and computer bar codes have all been successfully implemented in clinical settings.

User factors that must be addressed mainly stem from user-friendly interfaces, but more importantly, buy-in from key users is essential to system success. Payer pressure, coding requirements, chronic workforce shortages, as well as regulatory and accreditation pressures are all driving the need for HIT. However, the author does not state potential costs or savings other than a general statement saying the benefits of HIT will far outweigh the costs.

Industry Reports

35. Article: *Preventive Medicine and the Electronic Health Record*

Anderson, G. K. (2004). Preventive medicine and the electronic health record. *Medscape Public Health & Prevention*, 2(2).

Primary Author's Credentials/Affiliations

M.D.; past President of the American College of Preventive Medicine and Aerospace Medical Association, former Chairman of the American Board of Preventive Medicine
Currently President and CEO of Oceania, Inc.
Industry

Purpose/Objectives

To articulate the value of the EMR to gather and analyze health and medical care data in the continued quest to prevent disease and injury and promote health.

Study Design

N/A (Expert Report)

Results/Main Finding

N/A

Recommendations/Summary

N/A

Discussion

Cites rapid advancement of technology as a key indication that HC organizations are ready to begin employing EHRs in clinical settings; funding for EHR implementation is cited as a major problem; current system of financial support does not provide organizations with incentives to adapt new technology to current practices; few studies on the relationship between quality of care and cost of implementing such technologies; strengthening patient-caregiver relationships are highlighted as a major advantage of EHRs since technology provides more accurate diagnoses and decision support for practitioners; EHRs can improve communication nation-wide regarding diseases, bioterrorism, and unsafe foods and substances.

36. Article: *Financial Analysis Projects Clear Returns From Electronic Medical Records*

Schmitt, K.F., and D.A. Wofford. (2002). Financial analysis projects clear returns from electronic medical records. *Healthcare Financial Management*, 56(1), 52-57.

Primary Author's Credentials/Affiliations

JD, MHA, MBA; ECG Management Consultants
Industry

Purpose/Objectives

To provide a cost-benefit analysis of an electronic medical record to determine the financial benefits.

Study Design

The cost-benefit analysis was conducted for an integrated EHR system in hospitals and other outpatient clinical settings with at least 400 employed physicians.

This study established a clinical advisory team to conduct this analysis made up of 24 team members with representatives from all departments: radiology, pharmacy, physicians, medical record staff, information technology department, patient care services, and other managers. EHR functions that were implemented in this environment were lab/radiology order entry, pharmacy entry, medical record documentation, and charge capture.

Results/Main Finding

Since the study focused on financial outcomes, positive return on investment and the physician acceptance determined the success of the EMR system.

The analysis clearly suggests that the electronic medical record is a sound financial investment. By the third year, financial benefits will outweigh the costs and will continue to increase over the next seven years.

However, the tendency to hold out for newer, better, and cheaper products tends to slow the implementation of EHR systems in large-scale hospitals. Also the fear of vendor support hinders HIT adoption.

The cost-benefit analysis identified several cost components an organization must consider before implementing EHR systems:

- Lab and radiology order entry: Savings from ancillary staff to process orders.
- Pharmacy order entry: Reduction in adverse drug events, reduction in capitated drug benefit costs, reduction in pharmacy FTEs to process orders, improved formulary compliance.
- Documentation: Reduction in documentation costs related to redundant manually transcribed data such as social and past medical history.
- Availability of information: Reduction in creating, filing, searching, pulling and transporting charts.
- Charge capture: Faster submission of claims, elimination of manual data entry; reduction in staff who batch and track charge slips, enhanced charge capture; recovery of lost revenue from incomplete documentation, delayed/missing charge slips, poor management of beneficiary notices and denied claims.
- Lost physician productivity during the implementation time.

Recommendations/Summary

Based on previous EHR implementations, the authors provide several lessons these institutions learned to deal with problems in the adoption of the technology:

- Involve users in the process.
- Keep financial analysis close to home.
- Avoid attempts to quantify areas where data might be hard to access or unavailable.

- Be aware of areas such as clinical outcomes.
- Numbers do not tell the whole story.
- Other benefits might include areas that might not translate into staffing reductions but may ultimately increase productivity and quality such as:
 - Decreased risk of malpractice lawsuits or compliance.
 - Enhanced management reporting and feedback to physicians.
 - Improved negotiating positions with insurers through better HEDIS scores by better management of patient populations.
 - Reduced errors and better clinical decision due to instantaneous patient data access.
 - Enhanced ability to practice team medicine.
 - Improved physician/patient satisfaction.

Other questions which should be used to assess technological organization readiness:

- How technologically savvy are the physicians and administrators?
- What is the organization's culture regarding decision making?
- Will a consensus need to be achieved before the EMR is accepted or will the decision reside with a few individuals?
- Does the organization value group-oriented behavior or is it more individualistic?
- Will this behavior enforce the use of the EMR or will it adopt a more laissez-faire approach?
- What will the organization most want to achieve by implementing the EMR?
- Has the organization received external pressure to automate its clinical processes (i.e. recruiting issues; competitor actions)?

Ultimately, some benefits will take priority over others and this prioritization will drive the implementation schedule, workflow revisions, and financial results.

Discussion

The authors provide an excellent amount of information regarding decision-making before and during EHR implementation. While the cost-benefit analysis indicates that financial returns can be expected, other barriers such as technological competence and physician acceptance are essential to successful electronic health record system adoption.

37. Article: *Promoting Health Information Technology: Is There A Case For More-Aggressive Government Action?*

Taylor, R., A. Bower, F. Girosi, J. Bigelow, K. Fonkych, and R. Hillestad. (2005). Promoting health information technology: Is there a case for more-aggressive government action? *Health Affairs*, 24(5), 1234-1245.

Primary Author's Credentials/Affiliations

RAND Corporation
Nonprofit research

Purpose/Objectives

To explore possible federal policies to speed up the implementation of health information technology to maximize the potential benefits to the healthcare industry. The authors

discuss how policy implementations could affect HIT adoption based on their study findings and suggests policy options which could be taken.

Study Design

A literature review was conducted surveying textbooks, peer-reviewed publications, newspapers, conference presentations, and federal and industry papers. This effort was designed to define the current rate of HIT adoption, barriers to implementation, issues affecting use and effectiveness of the technology, as well as current and potential policies affecting implementation. The authors began their investigation with the seven-point policy strategy recommended by the Institute of Medicine (IOM) in 1991, the eleven-point agenda created by the National Committee for Vital and Health Statistics (NCVHS) in 2001, and the agenda developed by the Office of the National Coordinator of HIT (ONCHIT) in 2004 comprised of twelve strategies and four goals. Out of these different policy initiatives, strategies were selected which minimized HIT barriers and maximized the potential benefits the technology has to offer. Interviews and on-site visits were conducted to study the affects these policies had on present HIT implementation.

Results/Main Finding

The report cites three key elements which must exist in order for HIT implementations experience potential gains: widespread provider adoption of standard-based EHR systems, improved connectivity among providers and patients, as well as a strong focus on the improvement of quality and performance efficiency. The research indicates that EHR diffusion is actually accelerating compared to other industries adopting HIT. Although there are discrepancies in the adoption rates among different healthcare settings, the authors state these differences are not significant. A large problem to interconnectivity remains the lack of standards in access to patient care data and risk-adjusted performance reports. Four distinct market failures have been identified which are primary causes of this lack of interconnectivity: a) A disconnect between financial sources and those who benefit from HIT, b) lack of incentives for interoperable, standardized HIT systems, c) no incentives to act as innovator to be the first to adopt HIT technology and share experiences with other healthcare institutions, d) no structure or methods to either collect or compare providers' performances.

The research suggests that "EMR diffusion is accelerating without aggressive government intervention" (p. 1238). However, the ignorance to interoperability standards and data sharing create additional barriers to determine the impact federal policies can have on wide-spread HIT implementation.

Recommendations/Summary

Due to the fact the federal government is the primary financial source of healthcare, the federal government has a direct interest in enacting policies to speed up the acceleration of HIT adoption to maximize financial and productivity benefits. The authors cite four potential types of HIT incentives: payment differentials for providers, cost differentials for consumers, direct reimbursements to providers, and shared withholds from providers. However, the recommendation for a fifth model is made for a budgeted accountable delivery system.

Other recommendations are made as follows:

- Reduce the costs for effective EHR system adoption – The research indicates that financial or non-financial incentives that reduce the cost of EHR

- Direct subsidies for EHR system acquisition – Although the cost of subsidies will vary from institution to institution depending on the healthcare setting, a potential benefit-to-cost ratio over 15 years would approximately be 5:1 if started in 2006.
- Direct subsidies for network development – The more interoperable an EHR system is, the lower the costs should be. Therefore, healthcare settings should be recommended to implement systems which boast common networking standards and infrastructures enabling information sharing and provider linking.

Policy options are divided into three separate groups:

- Stay the course – Policies designed to create the necessary information and infrastructure to support HIT implementation and adoption. Possible options in this group include certification, performance metrics, and common HIT frameworks and structures.
- Accelerate market forces – Investments and incentives designed to overcome specific market failures. Pay-for-use programs, risk- and gain-sharing contracts, and education can combat many of the barriers HIT is currently experiencing.
- Subsidize change – Options like grants for start-up costs, the development of organizations and tools, and the creation of information networks can create long-term changes in current EHR implementation practices and prevailing attitudes.

Discussion

While the authors have identified many different federal policies to speed up EHR implementation, many of the potential benefits cited in this report are based on preliminary cost benefit analysis. Market dynamics can drastically alter the success of financial incentive initiatives due to the large variability of the stakeholders, social organization, needs, and expectations of the healthcare industry. The authors conclude by indicating gradual and incremental federal policy could be more effective at achieving long-term change.

38. Article: *The Diffusion and Value of Healthcare Information Technology*

Bower, A. (2005). *The Diffusion and Value of Healthcare Information Technology*. Santa Monica: RAND Corporation.

Primary Author's Credentials/Affiliations

Not given.

Purpose/Objectives

To present a HIT diffusion model to predict implementation rates of healthcare institutions nationwide. This report cites the rapid implementation of information technology in other sectors of business, providing diffusion rates and models.

Study Design

N/A (Industry Report)

Results/Main Finding

N/A

Recommendations/Summary

An interesting aspect of this discussion states that IT adoption never reaches a full 100 percent. The author identifies factors which affect the diffusion of technology: type of innovation, industry, academic discipline, level of analysis, and academic objective. According to the article, very little work has been done to identify how these variables predict certain diffusion paths. Bower lists three approaches for determining a diffusive model to statistically predict HIT technology based on "empirical EHR adoption data." The chosen method utilizes an inductive approach that analyzes diffusion curves from other industries to provide a theoretical model.

When defining the EHR diffusion model, several variables or external factors must be taken into account: the three perceived attributes of the innovation (relative advantage, compatibility, and complexity), external influence like promotion and marketing, social pressure activated by peer group networks, network externalities, degree of specialization of the innovation, and government policy.

In the discussion of general IT adoption, Bowers states that literature indicates the diffusion model can be accelerated with improved training, increased physician involvement in development, and obtaining physician buy-in before purchase. Although research has not determined how government policy affects technology diffusion, Bower believes federal involvement can speed up implementation. However he identifies three different sources of potential market failure: imperfect information, market power, and externalities.

Discussion

While this report discusses HIT implementation in broad terms, the author emphasizes the need of physician buy-in before any EHR can be successfully utilized. EHR systems must integrate the three attributes (relative advantage, compatibility, and complexity) in order to be a viable consumer information tool in the healthcare industry.

39. Article: *The State and Pattern of Health Information Technology Adoption*

Fonkych, K., & Taylor, R. (2005). *The state and pattern of health information technology adoption*. Santa Monica: RAND Corporation.

Primary Author's Credentials/Affiliations

Credentials not provided

Report sponsored by Cerner Corporation, General Electric, Hewlett-Packard, Johnson & Johnson, and Xerox
Industry

Purpose/Objectives

To estimate the current level and pattern of HIT adoption in hospitals and physician practices and to evaluate factors that affect this diffusion differences.

Study Design

Secondary data analysis on the HIMSS-Dorenfest database (2004) to derive a population-wide adoption level of administrative and clinical HIT applications.

Sample and setting: Database includes majority of U.S. community hospitals with 100 beds or over including 90% of non-profit, 90% of for-profit and 50% of government

owned (non-federal) hospitals; database under represents small rural hospitals. Database represents just under 25% of U.S. physicians practicing in office settings that are owned, leased or managed by hospitals or integrated healthcare systems; biased toward larger practices that may have access to technology through parent organizations.

Intervention: N/A

Results/Main Finding

EMR upper-bound adoption, defined as having made a contractual commitment to adopt, is between 20-30% for hospitals and 12% for physician practices; the overall rate of adoption is growing, especially in non-profit organizations. For physicians, practices with over 30 physicians are 3 times as likely to adopt an EMR as is a solo practitioner (remember, data on physicians is limited to practices that are owned or operated by healthcare delivery systems).

Pattern of HIT adoption differs significantly between for-profit and non-profit; adoption of major clinical HIT systems such as EMR, CPOE and PACS is significantly lower in for-profits even when controlling for other factors; smaller non-profits w/high share of Medicare and Medicaid patients or that are contract-managed have significantly lower adoption rates; small ambulatory practices are slow adopters of ambulatory EMR; managed care increased the probability of adopting EMRs and CPOE; HIT adoption spreads within a short time across integrated delivery systems.

Further data analysis is reported as raw and population-adjusted estimates of clinical HIT adoption for the following: partially integrated inpatient EMR; upper-limit inpatient basic EMR, inpatient CPOE, radiology PACS, and ambulatory EMR. Also reported adoption rates for for-profit as compared to non-profit hospitals, by size and rural status of hospitals, by majority of minority of Medicare patients, by managed care status, degree of competition, community and quality orientation of hospital, link to primary care.

Administrative IT systems for billing, scheduling and inventory management and systems in radiology, laboratory and pharmacy department for medication dispensing are in wide spread use but little progress has occurred in adopting clinical IT such as the electronic medical record.

Recommendations/Summary

The differences between for-profit and non-profit may suggest that the largest barrier to adoption may be other factors, such as the business case, not the lack of access to capital. Slow adoption rates in smaller provider organizations, especially those with disproportionate share of government-pay patients, suggests that that may need special policy considerations.

For the purposes of this analysis, the authors determined that the basic inpatient EMR system should include at a minimum: computerized patient records (CPR), clinical decision support (CDS) and clinical data repository (CDR). The upper bound of an EMR estimate does not require that these components be from the same vendor; the lower bound of inpatient EMR requires that all 3 come from the same software vendor to ensure integration. A measure for "partially-integrated EMR" was established with the CPR and CDR provided by the same vendor.

Adoption is defined as either having just purchased an HIT application by signing contracts with a vendor or has an application already installed; thus the measures presented here better identify the organizations that have not yet made a purchase decision. Clarified that there is no strict definition of what "adopted" or "implemented" means in terms of HIT and the depth of use; range is from deciding to invest and searching for options to maximal use of its full potential by all providers.

Identify two major levels at which technology is adopted: (a) the organizational level at which HIT is invested in and installed and (b) the clinical level at which the users (doctors, nurses, etc..) decide weather or not to incorporate the technology into their daily practice.

Discussion

The comprehensive 68-page report provided a sound methodology for determining rates of adoption in hospitals and physician practices. Comparisons with other studies related to adoption rates were presented and overall, the rates found in this study were comparable and/or more reasonable than those in other studies. Results provide policy makers with good information when considering legislative initiatives to address HIT diffusion and adoption.

40. Article: *A Call To Action On Technology*

Derr, J. (2004). A call to action on technology. *Provider*, 31-35.

Primary Author's Credentials/Affiliations

Credentials not provided
American Healthcare Association
LTC Industry

Purpose/Objectives

To call LTC leaders to take a leadership to drive HIT adoption by long-term care providers, describe objectives on the national HIT initiative, describe what providers should consider and what can be done now.

Study Design

N/A (Industry Report)

Results/Main Finding

N/A

Recommendations/Summary/Summary

By taking a leadership role in HIT in LTC, providers can become autonomous without having to rely on regulatory agencies like Medicare and Medicaid. Potential benefits include reduction in medical errors, better diagnosis, more hands-on time for nurses, continuity of information across various care settings, and individual diagnostic care planning. Issues include language standards and interoperability. The author suggests that LTC providers move forward by developing IT strategic plans and getting involved with IT planning groups.

Discussion

Article is a good overview of the nation-wide IT initiative and a good wake up call to LTC providers. The author's suggestion for LTC providers to initiate a strategic IT plan is certainly valid.

41. Article: *Extrapolating Evidence of Health Information Technology Savings and Costs*

Giroi, F., Meili, R., & Scoville, R. (2005). *Extrapolating Evidence of Health Information Technology Savings and Costs*. Santa Monica: RAND Corporation

Primary Author's Credentials/Affiliations

Credentials not provided

Report sponsored by Cerner Corporation, General Electric, Hewlett-Packard, Johnson & Johnson, and Xerox

Purpose/Objectives

To extrapolate savings at the national level, project savings into the future for HIT, identify benefits and costs of HIT, and suggest incentives for adoption of HIT.

Study Design

Complex methodology utilizing a framework to scale empirical evidence on the effect of HIT at the national level and to project it into the future; a key element of this framework is a projection for the rates of adoption of HIT in the inpatient setting and in the ambulatory/outpatient setting.

Results/Main Finding

Overall, there are significant, large benefits associated with HIT adoption with estimates approaching \$80 billion annual savings nation-wide; benefits are substantially larger than costs with mean yearly costs estimated at \$7.6 billion; inpatient EMRs are much more expensive than ambulatory EMRs; most of the cumulative 15-year cost is due to maintenance costs; savings to ambulatory EMRs account for only one-fourth of the total savings; net benefits are very small in the first "few years" because of the delay between implementation and the full realization of savings.

Recommendations/Summary

Incentives programs in the form of subsidies to hospitals, per-encounter subsidies to physicians and subsidies to lower the price of EMR systems; incentive programs are more likely to be cost-effective if they start early and do not last long, but are sizable.

Discussion

This comprehensive, 110 page report provides a complex analysis of costs and benefits to the healthcare system. The focus was on acute care and outpatient physician practices. Long-term care was not included in the analysis.

Case Reports

42. Article: *A Cost-Benefit Analysis of Electronic Medical Records in Primary Care*

Wang, S. J., B. Middleton, L. A. Prosser, C. G. Bardon, C. D. Spurr, P. J. Carchidi, A. F. Kittler, R. C. Goldszer, D. G. Fairchild, and A. J. Sussman. (2003). A cost-benefit analysis of electronic medical records in primary care. *The American Journal of Medicine*, 114(5), 397-403.

Primary Author's Credentials/Affiliations

MD, PhD; Department of Information Systems, Partners Healthcare System, Harvard Medical School
Academia

Purpose/Objectives

To study the potential net financial benefits and costs of implementing an electronic health record system in a primary care setting.

Study Design

A qualitative cost-benefit study was conducted to determine the financial factors of EHR system implementation. The study, conducted at Partners Healthcare System, studied implementation factors at this institution as well as others identified through a literature review. Benefits were measured on the basis of net financial gain or loss as well as the cost per physician during a 5 year period. This study also aimed to identify potential cost barriers when implementing EHR systems. Successful implementation was determined by a positive return on EHR investment capital.

The study divided the cost benefits into three separate categories: payer-independent, capitated reimbursement, and fee-for-service reimbursement. The authors defined the costs of the study model as: software license fees, implementation costs, support, hardware, and productivity loss during the first three months. Savings integrated into the model were: chart pull savings, transcription savings, prevention of adverse drug events, drug savings, laboratory savings, radiology savings, charge capture improvement, and billing error decreases. The authors suggested other potential areas of savings but did not include them in their defined cost model: malpractice premium costs, storage and supply costs, generic drug substitutions, increased provider productivity, decreased medical records staff, increased reimbursement from accurate evaluation and management coding, and decreased claims denials from inadequate documentation. Overall, the authors indicated that greater proportion of capitated patients yield greater total returns.

Results/Main Finding

The research indicated that savings of EHR systems were primarily generated through medication expenses and improved billing practices, reducing errors in both areas. Overall, the cost-benefit study showed that implementation of EHR systems in a primary care facility can yield positive financial benefits. However, the more EHR features and functions are used, the greater the financial benefits experienced by a healthcare

organization. The authors indicate that positive return of investment can be experienced in the second year of EHR implementation, but ROI is greater as the time horizon increases.

Because of improvements in the quality of patient care and safety, the LeapFrog group, one of the nation's largest coalitions of employers, has considered utilizing outpatient EHR systems as the next standard in healthcare purchasing contracts.

Recommendations/Summary

The results from the Harvard Medical Study indicate that once medical insurance begins to shift to a more cost-sharing approach, patients may actively seek care from providers who employ electronic health records as a means of controlling costs and improve quality of care. Although variables of time and finances differ in every healthcare institution, the authors advocate the adoption of electronic health records as a means of financial productivity.

Discussion

This study indicates positive financial benefits from institutions utilizing electronic health record systems in daily practice. However, the authors do identify several limitations to their study, particularly in regards to productivity. While the cost-benefit study was the primary focus of this study, the facilities of the study model experienced a three month loss of productivity. Although this study was designed to aid healthcare organizations make decisions in primary care facilities, the authors indicate similar benefits may be seen in specialized care settings.

43. Article: *The Mini Electronic Medical Record: A Low-Cost, Low-Risk Partial Solution*

Chambliss, M. L., Rasco, T., Clark, R. D., & Gardner, J. P. (2001). The mini electronic medical record: a low-cost, low-risk partial solution. *Journal of Family Practice*, 50(12), 1063-1065.

Primary Author's Credentials/Affiliations

MD; Department of Family Medicine, School of Medicine, University of North Carolina—Chapel Hill; Greensboro Area Health Education Center; Moses Cone Health System Practice

Purpose/Objectives

To describe cites one family practice clinic's experience with a self-constructed EHR.

Study Design

N/A (Case Report)

Results/Main Finding

N/A

Recommendations/Summary

The authors created their own system using Microsoft Access 97 to counter problems they identified with commercial EHR offerings including high cost, disruption of clinical workflow, and inadequate vendor support; they cited keys to success as ease of implementation, physician acceptance, operating time, easy interoperability with existing patient information, and reliability. Functions included in the system were an electronic

front sheet for the patient chart for ICD-9 codes, chronic medications and allergies, reminders for prevention procedures, the ability to display completion rates for key prevention items, ability to check on critical combinations of diagnoses and medications, and legibility and accessibility of key parts of a patient's chart.

Discussion

The authors acknowledge that the program they developed would not be appropriate for interface with other locations and provider networks; the ability to access the full chart electronically and to change the current process of dictation of daily notes was not important to the group in the short-term. They believe the program can serve as a bridge to a future commercial EMR once the market has matured.

44. Article: *Just-in-Time Delivery Comes to Knowledge Management.*

Davenport, T. H., & Glaser, J. (2002). Just-in-time delivery comes to knowledge management. *Harvard Business Review*(80), 107-111.

Primary Author's Credentials/Affiliations

Credentials not provided; Accenture's Institute for Strategic Change, Cambridge, MA and Partners Healthcare System, Boston, MA
Academia

Purpose/Objectives

To describe how "just-in-time" knowledge has been embedded into the daily work for physicians as knowledge workers through an EMR system created by Partners Healthcare System (the teaching hospital system for Harvard Medical School).

Study Design

N/A (Case Report)

Results/Main Finding

N/A

Recommendations/Summary/Summary

Authors discuss the strong need for knowledge support in HC; for example a physician must be able to track massive amounts of complex information in a day's time; providing knowledge support through technology is one key to assisting clinicians to provide safer and more effective care. Suggest the following areas as important to successful create and implement an EMR with knowledge support: (a) support that there was a definite reason to change, which was provided by the IOM's report on medical errors; (b) use the best experts in the field to create and maintain an up-to-date knowledge base; (c) prioritize processes and knowledge domains (for example, Partners choose physician order entry as the priority process to computerize with knowledge support); and (d) include physicians as knowledge workers in the final care decisions with the machine providing recommendations rather than commands; (e) a cultural of measurement is important for success of the system implementation; and (f) the right combination of knowledgeable IT professionals and knowledge workers (physicians) and executives who are able to work together to create a system that works for all groups.

Discussion

The article makes a strong case for knowledge support (vs. decision support) and discusses indicators of success including error detection rates. The keys for success are important when considering physician buy-in for EMRs.

45. Article: *Information Everywhere: How the EHR Transformed Care at VHA*

Graham, G., Nugent, L., & Strouse, K. (2003). Information everywhere: How the EHR transformed care at VHA. *Journal of AHIMA*, 74(3), 20-24.

Primary Author's Credentials/Affiliations

RHIA; Veterans Health Administration

Purpose/Objectives

To describe the VistA (Veterans Health Information System and Technology Architecture) program which integrates applications like pharmacy, radiology, laboratory, dietetics, progress notes, billing, and patient administration into a single system and how HIM supports the system.

Study Design

N/A (Case Report)

Results/Main Finding

N/A

Recommendations/Summary/Summary

The system has provided immediate access to patient information, elimination of duplicate orders, increased patient safety, and improved information-sharing; because of the success of EHR storage, these systems now have records containing dozens, if not hundreds, of notes which make them difficult to search for a particular note; this problem has highlighted the need for standardization in coding and information storage for quick retrieval; patient education is supported by using EHR data to educate patients regarding the progress of their health; IT has virtually eliminated all paper record keeping in VHA health facilities; stress the need for HIM professionals involvement when implementing EHRs to ensure interoperability with pre-existing systems.

Discussion

Provides an excellent overview of the VHA's very successful EMR/EHR system.

46. Article: *Physician Buy-In for an EMR*

Hier, D. B. (2002). Physician buy-in for an EMR [Electronic Version]. *Healthcare Informatics*. Retrieved November 16, 2005.

Primary Author's Credentials/Affiliations

MD; University of Illinois at Chicago Medical Center
Academia

Purpose/Objectives

To summarize lessons learned about physician buy-in for an EMR.

Study Design

N/A (Case Report)

Results/Main Finding

N/A

Recommendations/Summary/Summary

Author describes 20 lessons for gaining physician buy-in: 1) Physicians are obsessed with system speed; 2) outdated and poorly maintained hardware will bring a lot of complaints; 3) Don't make physicians wait for a workstation; 4) electronic communication and forwarding documents within an EHR system improves efficiency and security; 5) institutions want to save money and physicians want to save time so both groups have different expectations; 6) re-using information is more efficient than re-entering it; 7) physicians want "one-stop shopping" – all necessary information available in one location with the ability to share it with a variety of clinical settings; 8) standard formatting and documentation can be facilitated through the use of templates; 9) order sets speed data entry; 10) physicians' computer skills are not a barrier to EMR adoption; 11) mandating participation in the EMR works; 12) dictation is an effective way of bringing nontypers into the EMR fold; 13) Internet access to the EMR is a physician-pleaser; 14) The EMR's "inbox" feature facilitates communication; 15) an integrated prescription writer saves time; 16) voice recognition is not quite ready yet; 17) an EMR prevents some common medical record deficiencies; 18) the interface between various systems (billing, registration, etc.) can minimize the re-entry of pre-existing data and the inclusion of additional technologies (bar code scanners, blood pressure monitors) will automate even more data entry; 19) advances in expert systems and data mining will increase the value of patient repositories; 20) physician leaders need support from the top.

Discussion

The lessons presented in this article provide valuable information to devise strategies to gain physician buy-in for EMR implementation at any setting.

47. Article: *Implementing an EMR System: One Clinic's Experience*

Smith, P. D. (2003). Implementing an EMR system: One clinic's experience. *Family Practice Management, 10*(5), 37-42.

Primary Author's Credentials/Affiliations

MD, University of Wisconsin Department of Family Medicine Practice

Purpose/Objectives

To discuss potential EHR implementation strategies in a variety of practice settings. The author cited the implementation of such a system in a small family practice at the University of Wisconsin's Department of Family Medicine.

Study Design

N/A (Case Report)

Results/Main Finding

Based on the University of Wisconsin's Department of Family Medicine's experience with EHR implementation, the author considers successful implementation of HIT when the system ensures accurate medication lists, legible notes and prescriptions, immediate

availability of charts, decreased chart pulls, and lower transcription costs. A medical practice must have a good implementation plan before the technology is adopted to ensure specific ways to combat a variety of problems. Unfortunately, specific measures of success cannot be developed due to the variability of each clinical setting.

The primary barrier to EHR implementation discussed is the organizational barrier of current medical practice operations. Physicians and staff must be ready to completely change how a practice operates on a daily basis in order to properly utilize electronic medical records. Therefore, physician “buy-in” is especially important because these individuals will often be the first and primary “champion” of the technology. To convince other clinical staff, the electronic documentation system must be user friendly, meeting the needs of clinic and practice personnel.

Recommendations/Summary

The author lists several strategies which can be used to provide an easier implementation transition period. Smith suggests system administrators set clearly defined goals of the capabilities of the electronic record system and the responsibilities of its users. A project manager should be selected to manage the implementation process; however, strong physician leadership is required which can be facilitated through a “physician champion” who has a strong desire for project success. Project managers and potential users should visit practices which have implemented similar software and systems to gain some perspective before attempting to install similar systems in their own practices. A detailed analysis of personnel workflow should be conducted to determine how the EHR technology will impact the productivity of clinical staff. Because of the drastic transition, there should exist a high level of staff flexibility during the implementation process.

Project managers and system administrators should consider several different factors before EHR implementation:

- Workflow analysis and redesign: This analysis should determine the function of every job in order to understand how tasks were accomplished with the old system and procedures. This effort should also identify how the new system will improve efficiency and workflow.
- Facility modification: System administrators should identify the most advantageous hardware installation. For example, managers should consider where staff will need access terminals to enter or search for data. The hardware setup should also assure ergonomically appropriate keyboard height and optimal monitor-viewing height.
- Hardware installation: Decisions about desktop machines vs. mobile notebooks and other wireless technologies will have to be made. System administrators must consider all options and make choices based on a practice’s specific needs.
- Software configuration: To ensure a secure electronic health record system, security with limited access for various portions of the record should be implemented depending on the role of the user (lab data management, physician, system administrator, etc). Templates should also structure textual elements of the record that prompts the user to enter data properly to document the medical encounter. However, developing these templates requires considerable time and effort. Back-up systems can be utilized to ensure safe maintenance of clinical data.

- Data transition: The entering of old patient data from paper records will depend on the time and money as well as the needs and desires of the office. This may mean scanning, filing additional paper charts, as well as destroying old paper records for security concerns.
- Training: Managers should conduct initial basic skills assessments of clinical staff to determine the technological competence. Basic skills training should be given at different times (3 months, 2 months, one week) before bringing the system online. On-site support provided by “power users,” staff members who have received additional training for problem solving, can combat initial staff problems with the EHR system.

Discussion

The author provides some specific guidelines for developing strategies to combat initial problems or issues which may arise shortly after EHR implementation. The key issue of EHR implementation is physician acceptance of the technology because they will more than likely have to provide support and convince practice staff to use the system. Workflow analysis and understanding the daily practices of all staff members is integral to tailoring an EHR system to these practices, rather than having the documentation system be a hindrance.

48. Article: *EHR and the Return on Investment*

Health Information Management Systems Society (HIMSS). (2003). EHR and the return on investment. Retrieved October 21, 2005 from <http://www.himss.org/content/files/EHR-ROI.pdf>.

Primary Author’s Credentials/Affiliations

Not given.

Purpose/Objectives

To examine how return on investment has been calculated utilizing tangible and intangible benefits in hospitals and private practices.

Study Design

N/A (Case Report)

Results/Main Finding

The focus of this article questions why HIT has been so slow being adopted in medical practices. The authors identify several factors which determine the success or failure of EHR implementation: improved quality and safety of patient care, reduced lengths of stay, increased efficiency and timeliness of care, avoidance of adverse events in medication prescriptions, improved treatment protocols, accuracy and completeness of notes. Other advantages of HIT include instant availability of charts which provides rapid and informed responses to patients’ questions via telephone. The communication and education modules of HIT enhance patient understanding and satisfaction, while enabling disease management by gathering extensive data about patient populations quickly and effectively.

The authors identify three different areas to determine HIT value:

- Financial: Advantages of HIT yield decreased administrative, clinical staffing and resource requirements. Revenue enhancements allow for improved billing practices and charge capture and well as productivity gains from increased volume. For example, radiology and lab request turnaround time, reduced LOS from timeliness and completeness of clinical data all produce quicker diagnosis and treatment as well as the prevention of duplicate ancillary tests
- Clinical: Through better adherence to clinical protocols and improved clinical decision making through real-time alerts, clinical decision support, cost efficient drug selection, laboratory usage, and clinical pathways help to reduce ordering and pharmacy errors.
- Organizational: Provider satisfaction measured in formal surveys can be used to factor user needs and expectations into HIT systems. Clinical protocols can expedite the ordering of radiological tests, while reducing the costs of chemotherapy and medications associated with the documentation of clinical encounters. For example, dictation and the length of time to post the note to the clinical record is reduced through the use of an HIT system as are amounts of repayment to payers for non-compliant documentation or ineligible services and the reallocation of nursing time from manual documentation tasks. Intangible benefits in this area also include error prevention and risk mitigation promoting organizational good will. Measured decision support triggers and number of orders have been proven to change as a result.

Recommendations/Summary

In addition to identifying three different areas of HIT value, the authors cite several cost components an organization must consider: patient safety, reduction in LOS, staffing efficiency gains, improved adherence to medication protocols, ease of regulatory reporting, simplified physician referrals, and increased capture of allowed billable expenses.

Although healthcare organizations spend less than three to four percent of their budgeted capital on information technology, non-implementers cite cost avoidance rather than revenue enhancements as a benefit for not implementing HIT. Other barriers that must be overcome are IT staff members who don't believe in positive return of investment once the technology is implemented.

Discussion

Although the authors tout the financial benefits of HIT implementation, no specific timeframe is given when adopting organizations can expect to experience cost savings. The report states that healthcare organizations have achieved return on investment through HIT expenditures and will continue to experience significant returns on their investments.

49. Article: *Why I Love My EMR*

Soper, W. D. (2002). Why I love my EMR. *Family Practice Management*, 9(9), 35-38.

Primary Author's Credentials/Affiliations

MD, MBA; Family Practice Management – Editorial Board
Practice

Purpose/Objectives

To report on one private physician practice's experience with implementing electronic medical records.

Study Design

N/A (Case Report)

Results/Main Finding

N/A

Recommendations/Summary

The author states initial conversion from paper patient records to electronic health records may be painful and frustrating; however, it is important for clinical staff to be reminded that the long-term results provided by EHR systems is worth the short term pain and inconvenience. In terms of savings, Soper states the electronic health system implemented in his practice paid for itself in one year. Other savings associated with HIT implementation is an elimination of transcription costs, paper records, file clerk, wasted space, and time spent searching for paper records. The system also boasts an improved reimbursement method by providing billing staff with immediate access to records in order to substantiate claims and denials. The income per visit increased by improved documentation supporting more aggressive coding and associated charges like surgical trays and injections being automatically added to a patient's bill.

While many physicians cite issues of expense, confidentiality, safety, and HIPAA violations, the author provides suggestions to counter these concerns. Soper lists user-factors to consider when adopting HIT systems in clinical practices. Among these factors is the issue of time devoted to learning the new system. However, once this training is completed, the system contributes to improved patient care through the use of documentation templates when asking patients necessary questions. These templates also automatically list prescription allergies and appropriate dosages which are all available with a few clicks of a mouse. Other advantages of EHR systems are the ability to print legible and complete prescriptions as well as access to comprehensive patient information which assists in reducing the chance of pharmacy error.

Although many physicians prefer dictating physician notes rather than electronically inputting patient data into the systems, Soper recommends the use of a transcriptionist to enter the data into the EHR system. For physicians who simply refuse to use electronic health record systems in daily practice, the author recommends providing such doctors with a bonus in addition to the cost savings from the EHR system. The system should accommodate features like voice entry for those physicians who do not want to learn to use a keyboard. Although the EHR system may add an additional three minutes to the patient encounter, physicians must understand that the charts are complete when the patient leaves the room as opposed to spending time at the end of the day searching for charts in order to sign off on the documentation.

Discussion

Although Soper is very optimistic about implementing an EHR system in a family practice setting, he identifies several recommendations to combat physician resistance in a long-term care setting. Financial incentives and system adaptability offer two

methods of convincing reluctant physicians to use an electronic health record system which may be implemented in a nursing home or other long-term care facility.

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