Health Care Informatics: A Vital Discipline in Health Information Technology

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Information technology has been advancing at rates so rapid it is difficult for any individual or organization to keep abreast and maintain currency with new innovations. It requires knowledge, effort, and monies for adaptors to harness information technology to serve the goals of its organizations and industry. Health care, one of the most prominent of industries serving millions in the United States and billions in the world has an obligation to adopt and use technology to advance health and serve the healthcare needs of people worldwide.

Health care informatics, a new specialty in the health care industry provides an opportunity to:1) improve the delivery of health care, 2) advance the research opportunities of providers, and 3) promote the education of both providers and consumers. This paper illustrates why health care informatics is essential to the health care industry and discusses issues related to adoption, diffusion, and implementation of information technology in health care into clinical practice, research, and education.

Informatics and Health Information Technology

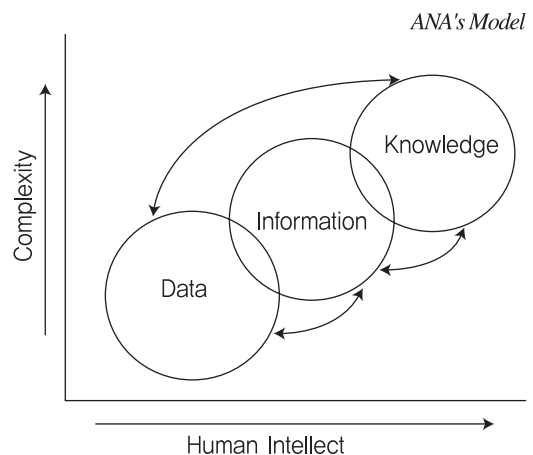### Definition of Informatics in Health Care

Informatics has been defined by various organizations. The American Medical Informatics Association (AMIA) defines informatics as "all aspects of understanding and promoting the effective organization, analysis, management, and use of information in health care. While the field of biomedical and health informatics shares the general

scope of these interests with some other health care specialties and disciplines, biomedical and health informatics has developed its own areas of emphasis and approaches that have set it apart from other disciplines and specialties."[1] The American Nurses Association (ANA) more specifically defines nursing informatics (a subspecialty of health informatics) as " … facilitating the integration of data, information, and knowledge to support patients, nurses, and other providers in their decision−making in all roles, and settings. This support is accomplished through the use of information structures, information processes, and information technology."[2] Clearly, both definitions subsume the application of information technology, specifically health information technology (HIT), which is "the application of information processing involving both computer hardware and software that deals with the storage, retrieval, sharing, and use of health care information, data, and knowledge for communication and decision−making."[3]

Data, Information, and Knowledge

Data are transformed into information− data organized or interpreted− and information into knowledge− the application of a combination of instincts, ideas, rules, procedures, and information− with multiple feedback loops.[2] The transformation of data to knowledge can be obtained from a non− clinical area of practice as well as a clinical practice for different patient populations such as individuals, families, and communities.[2](p.22)

Data competence is required to take advantage of the veritable explosion of patient information, to identify trends and problems, and to guide clinical decision making for

ANA's Model

1) American Medical Informatics Association. Available at http://www.amia.org. Accessed 7/23/07.
2) American Nurses Association. Scope and standards of nursing informatics practice. Washington, DC: American Nurses Publishing; 2001.
3) Brailer D. Thompson T. Health information technology strategic framework. Washington, DC. Dept. HHS; 2004.

patient care.[4] With patient information in hand and data competence, health care providers at all levels can more effectively plan, deliver, monitor, and evaluate health care services. Effective and efficient decision—making requires standardized, accurate and timely operational management information. Administrators in health care need to understand how to integrate and interpret clinical, financial, and statistical data.[5] Informatics in health care supports the efforts of health care providers to improve the quality of care by optimizing information management and communication, focusing on "delivering the right information to the right person at the right time."[2(p.23)]

Change and Health Information Technology

All is constantly changing in our societies, our professions, and our daily lives. The pace of this change appears to be accelerating, and this change process may be expensive in terms of time and energy. Informatics is change, and health care informatics is a driving force in the change process. Understanding of change makes possible to effectively plan and implement change in organizations and other systems. There is a relationship between the organization, its information systems, and the change process. Health information systems (HIS) that provide for the management and processing of patient—centered data, information, and knowledge have a major impact on structure and function of health care delivery systems. In addition, the HIS is expanding into an integrated delivery network (IDN). Therefore, the question how the organization and its people— individuals and communities— respond to new ideas, new information systems, and clinical practice through HIT should be critically considered by the health care providers.

Benefits of Health Information Technology and Electronic Health Record

Health care rather lags in its efficient use of HIT applications while government, education, and industry are benefiting from information technology and its many applications. It is estimated that the United

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4) Nolan MT. Improving patient care through data competence. Nurs Econ. 2000;18:5.
5) Wiest DA. Application of a decision—making model in clinical practice. Top Emerg Med. 2006;28(2).

States spends $17 billion to $42 billion annually on health care applications, including maintenance, upgrades, and installations.[6] It has also been projected that the health care industry can benefit from the experience of other industries and realize savings upwards of $112 billion annually in ambulatory settings in the form of in-office reduction and interoperability.[7] Although the initial investments are costly, it is estimated that hospitals could realize a return on their investment (ROI) of $7 to $15 million annually, mainly through utilization of nursing time, decreased adverse drug events, and drug guidance.[8]

While HIT in its broadest sense encompasses all aspects of information technology in health care, for the purposes of this article the discussion will be confined to the electronic health record (EHR) which is an important component of the HIT. Recently, the Institute of Medicine (IOM) identified core components of the EHR: 1) patient information data, 2) results reporting, 3) order entry, 4) decision support, 5) electronic communication and connectivity, 6) patient support, 7) administrative processes, and lastly, 8) population management.[9] Currently in the United States, although the majority of hospitals have some form of an electronic record, less than 10% have computerized physician order entry (CPOE).[10] In contrast, other countries have been more successful with implementation of components of the EHR, particularly in ambulatory care settings. For example, Sweden has 90% adoption, Norway has over 90% adoption, and the Netherlands and Australia have greater than 50% adoption.[11] [12] The United Kingdom has used financial incentives to encourage

6) Health Information Technology Leadership Panel Final Report. The Lewin Group. (March 2005). Available at http://www.hhs.gov/healthit/HITFinalReport.pdf. Accessed 7/23/07.
7) Johnson D, Milsten J, Bates D, Middleton B. The value of health care information exchange and interoperability. Boston (MA): Center for Information Technology Leadership; 2004.
8) Kaushal R, AK Jha, C Franz, et al. Return on investment for a computerized physician order entry system. JAMIA. 2006;13(3): 261~266.
9) Institute of Medicine. 2003. Key capabilities of an electronic health record system. Washington, DC. July 31.
10) Ash JS, Bates DW. Factors and Forces Affecting EHR System Adoption: Report of a 2004 ACMI Discussion. JAMIA. 2005;12(1): 8?12.
11) Ash JS. A Cross-Site Qualitative Study of Physician Order Entry. JAMIA. 2003;10(2): 188–200.
12) Treweek S. (2003). The potential of electronic medical record systems to support quality improvement work and research in Norwegian general practice. BMC Health Services Research. Available at http://www.biomedical central.com/1472–6963/3/10. Accessed 7/23/07.

adoption of an EHR and has documented 90% adherence to an electronic record. The major role of government in subsidizing and regulating heath care in these countries may account for the success in the implementation of an EHR and the application of HIT.

In addition to the cost benefits provided by the automation of the health record, numerous other advantages have been cited. A government report in 2004 outlined a number of advantages specifically related to CPOE including reduction of medication errors, decreased dosage errors, and prescribing with improved accuracy.[13] Also, the EHR can facilitate access to clinical guidelines and best practice via clinical decision support systems (CDSS), which provides analysis and advice to support a choice. A true CDSS allows practitioners to enter their assessments at the bedside and then use the computer to analyze those assessments and recommend diagnoses.[14(pp 110-111)] Integration of clinical guidelines and research in the EHR enables health care providers to make clinical decisions based on current research and evidence and ultimately promotes evidence-based practice.

In turn, a data reservoir of patient outcomes and care strategies can provide an invaluable research repository for clinicians and researchers to support data mining techniques. These applications require interoperability and integration of systems with constant maintenance and oversight by multidisciplinary staffs including technical support and clinical informatics specialists.

The EHR, while promoting safety and providing valuable research data and information, supports other aspects of the quality of care. The potential for the longitudinal record enables both patients and providers to have access to health care data and encounters over a life span. Continuity and comprehensive care is thus supported and consumers have the tools to become active participants in their care and treatment.

Strategies for Implementing Health Information Technology and Electronic Health Record

In considering strategies for successful

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13) Report to the Congress: New Approaches in Medicare (2004). MedPac. Available at: http://www.medpac.gov/publications%5Ccongressional_reports%5CJune04_ch7.pdf. Accessed 7/24/07.
14) Hannah KJ, Ball MJ, Edwards MJA. Introduction to nursing informatics (Second Edition). New York: Springer-Verlag; 1999.

implementation of HIT and an EHR, an awareness of barriers to success is helpful. One of the dominant themes in the literature underscores the high cost of purchase, implementation, and maintenance. Initial costs vary from a low estimate of $1,000,000 for a small hospital setting to $10,000,000 for a larger medical center. This does not take into account the additional costs for the diffusion to ambulatory and primary health care facilities associated with the hospitals.

In the area of costs, therefore, government participation is essential. In the United States, although the government supports Medicare and Medicaid services, private insurers funded by both employers and employees provide most health care services. Of the $316.5 billion allocated for health care in the federal government Medicaid plan, less than 1% is allocated for HIT.[15] In contrast, many European countries provide monies to support the infrastructure needed for the implementation of HIT. The United Kingdom has initiated a National Programme for IT (NPfIT).[16] The plan includes: 1) a national data repository of patient information available to all health care providers, 2) electronic scheduling of appointments, 3) e−prescribing that facilitates electronic flow of all prescriptions from physician to pharmacy and the government agency that manages payment, and 4) improved broadband communication across the National Health Service (NHS).

Cost being the major factor, other issues need to be addressed for successful deployment of HIT specifically the EHR. Case studies emphasize the endorsement by and involvement of end−users from initial planning through deployment.[17] [18] Considerations such as data entry and system response time are crucial. If end−users experience delayed system response, interrupted workflow, and inefficient screen design, they will rebel against the system. Therefore, usability testing during

15) Rosenbaum S, MacTaggart P, Borzi M. Medicaid and health information: current and emerging legal issues. Health Care Financing Review 2006−2007;28: 21−29.
16) National Health Service. 2004. Making IT happen: Information about the national programme for IT. London, UK: NHS.
17) Fullerton C. Aponte P. Hopkins R. Bragg D. Ballard D. Lessons learned from pilot site implementation of an ambulatory electronic health record. Baylor University Medical Center Proceedings. 2006;19: 303−310.
18) Salsbury Lyons S Tripp−Reimer T. Sorofman B. DeWitt J. BootsMiller B. Vaughn T. Doebbeling B. Infromation technology for clinical guideline implementation: Perceptions of multidisciplinary stakeholders. JAMIA. 2005;12: 64−71.

development provides an opportunity to examine the response of end-users and make adjustments accordingly.

Furthermore, the most effective implementation of an EHR involves a shift in organizational culture, so sufficient project management and planning is essential. A multidisciplinary staff that includes administrators, clinicians, informatics specialists, and technical support must buttress cultural changes that involve reorganization and the attainment of new skills. A successful project manager will allow for communication among all team members, monitor milestones, and act as a liaison with clinicians, administrators, and developers. A major training, education and technical support infrastructure is needed to sustain success throughout deployment, implementation, and usage for all EHR users.

Conclusion

The challenge facing health care informatics is to successfully implement new tools in organizations. The development of technological and information infrastructures will ultimately enhance patient-centered care within IDN. Undoubtedly, the future of the health care system is dependent upon the effective and efficient use of HIT. To be successful, government must become more involved, particularly in the United States where cost sharing is an undeniable necessity. The benefits of a comprehensive HIT structure will far outweigh its costs. But again success is dependent upon collaboration of the private and government sectors with involvement of informed health care consumers.

With the development of sophisticated technologies and the complexity of health care data and information, the specialist in clinical informatics plays a key role in the design and deployment of these systems. The combined knowledge of information technology and clinical processes positions the informatics specialist in a unique role with a set of knowledge and skills that can determine the success or failure of system development and implementation in health care. Although the number of informatics specialists is on the rise, there is a need for more prepared specialists, faculty, and informatics education programs.[19] Since technology has the strong influence on the work of informatics

19) McCormick K. Delaney C. Brennan P. Effken J. Kendrick K. Murphy J. Skiba D. Warren J. Weaver C. Weiner B. Westra B. Guideposts to the future-an agenda for nursing informatics. JAMIA. 2007;14: 19-24.

specialists, their roles are continually evolving. Therefore, it is common that informatics specialists collaborate with other health care providers and become a key as a change agent practicing in interdisciplinary environments.

Furthermore, empowered health care consumers are demanding access to quality health care. One of the leading online health portals in the United States, for an instance,

WebMD with 35 million visitors per month and $170 million in annual revenue[20] supports the growing trend of consumer-driven and patient-centered health care delivery systems. With informatics competency achieved through computer and information literacy, health care providers therefore must have a leadership role in the design, implementation, and evaluation of HIS for clinical practice, education, administration, and research. GSST

20) Health Management Technology. 2007;April: 10.