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A Few Words about Medical Informatics

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ABSTRACT

Medical informatics is a scientific discipline that deals with the theory and practice of information processes in medical work, where information processes mean the coverage, transmission, storage and conversion of data. In other words, medical informatics is a scientific discipline that deals with the processing of all types of data in medicine.

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Introduction

Medical informatics is the use of computer-based technology with information management to provide patient care [1]. Physicians have embraced many areas of computer technology but have been slow to apply our technology-based information management skills in the care of patients. There are many reasons physicians have been reluctant to fully use the technology for patients, in spite of the laudable claims by politicians, the media, and various organizations. First, doctors are trained to take a scientifically verifiable approach to any new process that affects our patients. From journal clubs in residency training, they learned that every exciting claim is not what it appears to be. Facts and conclusions are not always true just because they were published in a journal or printed in a popular newspaper. Today scientific approach is made even more difficult because of direct-to-consumer advertising by various healthcare vendors. As clinicians, doctors have a moral, ethical, and legal obligation to patients to filter through the hype. Doctors must carefully determine which programs, medications, and devices really improve patient care and patient safety. Consequently, this deliberate approach is frequently misunderstood by many in the healthcare arena who do not understand why every doctor does not have an electronic medical record in his or her office. The medical informatics pressure on physicians will intensify in the near future. Financial cost is the second major reason for the average physician's reluctance to fully adopt technology-based information management systems. Doctors have seen a yearly decline in their reimbursement for patient services during the past decade. This financial decline has been combined with a loss of control in a healthcare environment that is highly regulated and dominated by managed care. There must be stronger incentives for physicians to increase their involvement.

Technology

For decades, health care providers and organizations have relied on paper medical charts to document a patient's history, diagnostics, and treatment [2]. But what happens when critical information recorded on paper is illegible, misfiled, or lost or damaged in a natural disaster like Hurricane Katrina? The risk to the patient increases if accurate, complete information about his or her medical information is not available. In the first decade of the 21st century, health care providers and organizations have been shifting to the use of electronic health records, stored on computers and on network infrastructures, as a more reliable method of maintaining patient health information.

Most patients do not realize how much personal health information is exposed in a vast electronic network. Computerized information helps diagnose disease, organize research data, and monitor patient conditions, while transmitting that information to health insurers, clinical research organizations, pharmaceutical benefits managers, and others.

In the last 20 years, an increasing focus on the need for informatics and analytics in public health has resulted in a growing investment in information systems [3]. This investment has generated a myriad of new tools for different public health activities and jurisdictions, including tools and systems developed by federal, state, and local governments, as well as research organizations. Advances in electronic reporting and interoperability, computer technology, biotechnology (e.g., genetic sequencing), and other methods (e.g., social network analysis and geographic information systems) have put pressure on the informatics discipline and public health practitioners alike to translate these advances into common practice. This pressure has been particularly acute for the surveillance and management of infectious diseases with pandemic or bioterrorism potential.

HCIT

New forms of HCIT (healthcare information technology) applications will have to evolve in order to assist healthcare providers and managers in meeting new challenges [4]. Ultimately, these new technological solutions will be the driving force in altering the traditional static, hierarchical organizational structures into team-based, highly productive, learning, and intelligent organizations—in essence, the manifestation of the evolving CAS (Complex Adaptive System) concept in today's complex multiprovider health organization services environment.

Nonetheless, the current lack of standards and absence of systems interoperability continue to challenge the successful deployment and adoption of innovative health IT applications; however, a large part of HCIT implementation success oftentimes hinges on what happens during its software design and development stage. Indeed, just like any new construction project, the failure of an HCIT software development project may simply be the result of dwindling commitment from the project sponsor(s) and the associated consequences: poor HCIT vision and leadership, inadequate project management expertise, ambiguities with respect to user needs and requirements, unsettled conflicts between HCIT project team members, unanticipated budget cuts, and/or other possibilities such as mishandlings in the complexities of the HCIT software development process. This, then, warrants a discussion of open source software (OSS)—an emerging trend in HCIT software development that has recently gained considerable attention among healthcare practitioners, health systems analysts, and researchers.

In the coming years, health information technology interoperability will alter the ways in which medicine is practiced. The diffusion of knowledge on how different medical tools, new techniques, clinical protocols, and health informatic methodologies can be effectively applied to help patients depends on a means through which these knowledge elements can be shared in a convenient fashion among care provider institutions. One of the chief contributions of interoperability, therefore, lies in its role of aiding the decision makers, whether they are clinicians, administrators, or even patients, in intelligently capturing, integrating, and processing the most relevant and critical data, information, and knowledge from scattered sources. Moreover, not only will these interoperable HCITs help care providers and their affiliated healthcare institutions in responding quickly and flexibly to patients' changing needs, but the synergistic effect of the medical knowledge diffusion will also lead to new discoveries in science and medicine. As a result, interoperable systems will impact the future practice of medicine in America, leading to more abundant, accessible, affordable, and accountable health care.

In the next few years, there will certainly be even more HCIT innovations, especially considering the learning and experience we would have gained with the implementation, use, and adoption of interoperable HCITs. With increased knowledge, there will be an evolution of new HCIT applications such as Internet-based HCIT systems, which can be used to educate different groups of the US population on preventive and self-care, new scientific discoveries about aging and health, and warnings about unhealthy lifestyle practices such as drug abuse and addiction, smoking and excessive drinking habits, and work stress and overeating—ultimately leading to more healthy Americans. New advances in client-server technology, AI-based decision support systems, hyperlink processing and computer networking, computer animation and multimedia technology, robotics, and other areas will also drive new research and practices in HCIT informatics and telematics.

eHealth

The term eHealth first appeared in the literature in the 1990s but has since been increasingly and inconsistently used [5]. The widespread use of the term suggests it is a significant concept that is commonly understood despite the lack of a precise definition. The World Health Organisation encompasses the two universal themes and defines eHealth as 'the use of information and communication technologies for health to, for example, treat patients, pursue research, educate students, track diseases and monitor public health.' The Scottish Government suggests eHealth is an umbrella term with wide parameters and is defined as 'the use of information, computers and telecommunications to meet the needs of individuals and improve the health of citizens'.

Within this definition of eHealth it is recognised that there are many evolving terms encompassed, such as health informatics, nursing informatics, information communication technology, assistive technology, telemedicine, telenursing, telecare, telehealth, electronic patient record, and they are often used interchangeably. It is not possible to cover them all in depth here; however, it is important that there is an understanding of the broad principles of the key terms, in order that technology can be used appropriately within the community.

Nursing Informatics

Nursing informatics is "a specialty that integrates nursing science, computer science, and information science to manage and communicate data, information, knowledge, and wisdom in nursing practice" (ANA, 2008.) [6]. The American Nurses Association (ANA) first recognized nursing informatics as a specialty nursing practice in 1992. However, nurses have been working to advance the field of nursing informatics for the last several decades. More recently, the field of nursing informatics has shown dramatic growth. As a result of that growth, nurses will have new opportunities in roles as informaticists within health care organizations that did not exist decades ago or even a few years ago (depending on the health care organization). The roles will span from an executive level as a Chief Nursing Information Officer (or Chief Information Officer) to a Nurse Informaticist as part of a Clinical or Nursing Informatics Department within the health care organization or working in an industry role with an EHR (Electrinic Health Records) vendor or other HIT company. Nurses also have the opportunity to become board certified by the American Nurses Credentialing Center (ANCC) in Informatics Nursing.

The opportunities for nurses as informaticists will continue to expand in health care organizations as the use of EHRs and emerging technologies continue to become integral to the delivery of patient care. The dependency on electronic solutions requires an understanding of the nursing science, computer science, and information science in order to critically evaluate and integrate new technologies into the health care organization. Understanding these scientific domains is part of the role of a nurse informaticist. The opportunities to work as a nurse informaticist within a health care organization may range from a Chief Nursing Information Officer and/or a Chief Information Officer to that of an entry level informaticist. Additionally, the presence of Clinical or Nursing Informatics Departments as part of the organizational structure of health care organizations will continue to grow across the nation.

EHR

Electronic health records (EHR), also known as electronic medical records (EMRs), continue to be one of the most controversial yet important topics in health informatics [7]. As an essential component of the national health information technology (HIT) strategy and healthcare reform, widespread adoption of EHRs will likely help reform the delivery and quality of medical care. However, EHRs also present many new challenges. There are mixed reports as to whether the adoption of EHRs will consistently produce improved medical quality and patient safety or reduce healthcare costs. Some question whether improvement in medical care due to EHR use will take many years to occur and whether only large, integrated delivery network–type healthcare organizations will experience these gains.

There is no universally accepted definition of the electronic health record. Informally, the EHR is a digital collection of patient health information compiled at one or more meetings in any care delivery setting. A patient's record typically includes patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports. The term EHR is often used to refer to the software platform that manages patient records maintained by a hospital or medical practice. Formally and historically, the EMR is the EHR in one location or office and is owned and operated by the healthcare provider or system. Personal medical records (PMRs) is a term used that represents electronic medical records that are owned and maintained by the individual patients themselves. Other terms such as computerized medical record (CMR), electronic clinical information system (ECIS), and computerized patient record (CPR) are rarely used.

EHRs are, at their simplest, digital (computerized) versions of patients' paper charts. But EHRs, when fully up and running, are so much more than that. EHRs are real-time, patient-centered records. They make information available instantly, and most importantly are universally and securely accessible to authorized persons. These systems bring together in one place everything about a patient's health.

EHRs can (1) contain information about a patient's medical history, diagnoses, medications, immunization dates, allergies, radiology images, and lab and test results; (2) offer access to evidence-based tools that providers can use in making decisions about a patient's care; (3) automate and streamline providers' workflow; (4) increase organization and accuracy of patient information; and (5) support key market changes in payer requirements and consumer expectations.

Bioinformatics

The term informatics describes a field that is focused on the structured storage, retrieval, and optimal use of information and data [8]. Bioinformatics is defined in the National Institutes of Health's (NIH) technology glossary as "the study of the inherent structure of biological information and biological systems. It brings together biological data from genome research with the theory and tools of mathematics and computer science". Generally the term bioinformatics is used to describe methods of information organization, analysis, and retrieval in general biology. The focus of bioinformatics has predominantly been on genetics, proteomics, and cellular data. Conversely, medical informatics describes the analysis and dissemination of medical data through the application of computers to various aspects of health care and medicine. The focus in medical informatics is on clinically specific information processing and exchange challenges in the realm of patient care. Biomedical informatics encompasses both medical informatics and bioinformatics. The field brings together bioinformatics, imaging informatics, clinical informatics, and public health informatics, covering the diverse domains of molecular and cellular research, tissue and organ research, patient research, and population research.

The specialization of fields in biology and medicine demonstrates the need for somewhat different structures for storage and retrieval of data. Although many of the needs overlap, many are different. For biologists, the need for structured information and integration across a number of domains drives development. There are many tools available on the Internet for genome-wide information and analysis systems and gene nomenclature. Some of the most popular are the National Center for Biotechnology Information (NCBI) databases, GeneCards®, the UCSC Proteome Browser, the Ingenuity Pathways Analysis Systems, HUGO gene nomenclature committee, and the Gene Ontology consortium (GO). Each of these information and analysis systems provides a piece of the overall biological puzzle and provides ways of integrating information collected from them. For clinical researchers and hospitals, the need for a structured medical record accessible to, ideally, any medical practitioner who might require it during the course of research or patient treatment, patient confidentiality, and security are the driving developmental factors. Both de-identification and/or anonymization of human subject datasets, and when they are required, are debated topics atthe federal level and directly impact information storage and exchange developers.

Many software programs today rely on databases [9]. Nowadays any new database has his own associated software to address integration and standardization issues. Today, they are mostly used in applied research and especially in the very wide field of omics. Some technological innovations are demonstrating their success in accompanying patients in heavy care episodes, especially in surgery or oncology. More recently, academic initiative are exploring translational medicine. The objective of this transversal medicine is to transform the results of basic research in life science into new tools and methods in clinical management. Today the great variability and diversity of exploitable medical data make it difficult to standardize and then integrate, notably since it is necessary to bring together all the medical and biomedical experts to promote their interpretation. It is thus necessary to consolidate suitable integration methods and paths. In most projects initiated, technologies are arranged in series to ensure the exploitation of data. Indeed, a specialized web host, operating system and databases are associated to provide medical experts with an overview of the care episode. The National Institutes of Health (NIH) has benefited from all the new technologies that can be used to launch a program called "Big Data to Knowledge" (BD2K). In fact, the NIH's ambitionis to exploit large-scale health data by implementing an IT initiative that would consolidate training programs tailored to new medical experts. The NIH BD2K program seeks to position health data science at the heart of biomedical research in the 21st century. Other areas exist in the data treatment concerning rare diseases. In Europe, Orphanet and Inria have collaborated to create Orphamine, a tool for the collection and processing of rare diseases data, allowing general visualization of Orphanet data for specialists. Finally, the Internet giants are also at the forefront of health innovation, especially Google, which stands out in data science. Indeed, they seek to exploit health data to know the daily health conditions of patients, and to move from rare and monogenic models to common diseases. It is notably Google's verily, Duke an Stanford Universities who are involved in such research. However, those pathologies are much more multifactorial and polygenic, and this is nowadays still a complex challenge.

Biological Database

A biological database is simply a collection of biological data that is organized in a specific and useful way [10]. Bioinformatics databases are very large, accessible by computer on the Internet, and must be continuously updated with new information, revisions, and corrections in order to be maximally useful. The computerized interfaces to the databases are designed to be user friendly and they allow researchers to ask for and receive information from the database online. In the terminology of bioinformatics, a request to the database is known as a query and the information obtained from a query to the database is a result.

The advent of bioinformatics databases has led to a new research approach called database mining, which is similar to mining for gold as it involves sifting through a tremendous amount of starting material to find comparatively tiny amounts of valuable “ nuggets. ”In bioinformatics, the starting material is the vast amount of information in the database(s), and the nuggets are the few pieces of data that are of interest to a particular researcher. In bioinformatics research, each bit of data is a potential nugget; different researchers sifting through the same starting material are looking for very different nuggets. Most important, however, to make it possible to sift through information to find valuable nuggets, the data must be present in an orderly database. Biological databases are maintained by a number of private and government organizations, both in the United States and elsewhere in the world.

Biological databases typically contain collections of nucleic acid sequences (DNA or RNA), protein sequences, genome sequences, and literature resources, but many databases also contain information relevant to answering specific biological questions. These databases have become invaluable tools for researchers worldwide.

Law Aspects

Healthcare in cyberspace is more common with widespread use of the Internet to manage and treat a patient’s medical problems [1]. A growing number of physicians are using web-based computer technology to treat patients in virtual medical offices. Cybermedicine is defined as the Internetdriven practice of medicine wherein the patient and the doctor communicate through electronic mail. This process of cybermedicine brings a unique array of medical legal issues. The issues can be divided into general corporate liability issues and physician practice liability issues.

Corporate liability issues tend to involve hospitals and physicians as an entity. The most common areas of legal issues raised in cybermedicine are the following:
- Web-based marketing by healthcare organizations
- Web-based marketing and product support by pharmaceutical companies and manufacturers
- Health-oriented interactive advice sites by physicians and other providers

Many doctors’ offices now have websites either individually or by affiliation with a hospital or medical group. A basic passive website may not add significantly to a clinician’s liability exposure, providing the information on the site is truthful and accurate. However, when the site becomes more interactive with the potential patient, the doctor’s liability exposure may increase.

Cybermedicine is a new area of the law that is still in its infancy. In contrast to corporate liability, success against individual doctors can be challenging for the average plaintiff because the patient will need to show foreseeable injury on the part of the defendant provider. Traditionally, the practice of medicine involves physically seeing the patient, taking a medical history, and doing an appropriate physical examination. In cybermedicine, the doctor interacts with the patient only through e-mail. Patients like it because it is less expensive and they do not have to wait for an appointment. Nevertheless, the American Medical Association has raised concerns about the quality of care given to the patient. It is not considered standard of care to evaluate patients and prescribe their treatment without doing an appropriate physical examination.

Lack of a verifiable physical examination is the main problem. Some patients may misrepresent their symptoms online just to get drugs. If there is no examination, the provider cannot verify that the patient is telling the truth. Physician credentialing is another major legal issue with cybermedicine. In hospitals and other healthcare organizations where physicians treat patients, the providers’ credentials are verified to document that the doctor is who he says he is and that his stated credentials are true. The Joint Commission, which accredits healthcare organizations, mandates all physicians be thoroughly credentialed. Presently, in cybermedicine, there is no good way to credential providers and document that the people who say they are doctors on line really are qualified physicians.

Conclusion

Since knowledge is an important factor in solving medical problems, it can be said that medical informatics deals with procedures for handling medical data, information and knowledge for the purpose of solving medical problems and decision-making in health care and can be made available to a wide range of users and medical service providers via computer networks. In addition, it deals with the methodology of searching medical literature.

References

1. Choctaw WT (2008) Avoiding Medical Malpractice, Springer Science + Business Media, LLC, New York, USA 47-52.
2. Kazmier J (2009) Health Care Law, Delmar, Cengage Learning, Clifton Park, USA164.
3. Abernethy NF, Carroll LN (2016) “Effective public health data visualization” in Blazes, D. L.; Lewis, SH (eds: “Disease Surveillance - Technological Contributions to Global Health Security”, CRC Press, Taylor & Francis Group, Boca Raton, USA, pp75.
4. Tan J, Tan J (2011) Healthcare Information Technologies in an Era of Healthcare Reform: A Complex Adaptive System Perspective in Wolper, LF (ed): “Health Care Administration - Managing Organized Delivery Systems, Fifth Edition”, Jones and Bartlett Publishers, LLC, Sudbury, USA, pp392-394.
5. Bain H (2018) “eHealth” in Chilton S, Bain H (eds): “A Textbook of Community Nursing, Second Edition”, Routledge, Taylor & Francis Group, Abingdon, UK, pp343.
6. Kelley T (2016) “Electronic Health Records for Quality Nursing and Health Care”, DEStech Publications, Inc., Lancaster, USA, pp388-389.
7. Griffin PM, Nembhard HB, DeFlitch CJ, Bastian ND, Kang H, et al., (2016) “Healthcare Systems Engineering”, John Wiley & Sons, Inc., Hoboken, USA, pp121-122.
8. Keator DB (2009) “Management of Information in Distributed Biomedical Collaboratories” in Astakhov, V (ed): “Biomedical Informatics”, Humana Press, Springer Science+Business Media, LLC, New York, USA, pp2-3.
9. André A, Vignaux JJ (2019) “Precision Medicine” in André, A (ed): “Digital Medicine”, Springer Nature Switzerland AG, Cham, Switzerland, pp55-56.
10. Fitzgerald-Hayes M, Reichsman F (2010) “DNA and Biotechnology, Third Edition”, Academic Press, Elsevier, Burlington, USA, pp154.