

Health Informatics: An Introduction

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Abstract

Health informatics is a growing field that employs computer and information science into health sector towards providing higher quality patient care through better management and availability of information. However, the terminology of health informatics is poorly understood and not even agreed upon by academics and professionals. This paper will discuss and elaborate the field of health informatics including various terminologies and definition as well as the benefit for health sector and its challenges.

Keywords: *Health Informatics, Medical Informatics Bioinformatics, Electronic Medical Records (EMR), Electronic Prescribing Systems (EPS)*

1. Introduction

The rapid advancement of computer and information science applications and the expertise of health professionals have created a movement geared towards providing higher quality patient care through better management and availability of information. This is the world of health informatics, and in every hospital, clinician's office, health-related facility and organization, health informatics has taken on an increasingly important role.

However, as a growing field, the terminology of health informatics is poorly understood and not even agreed upon by academics and professionals in the field (Hersh2009). The biggest ongoing problems in the field is the extreme variability in the word(s) the precede "informatics" and seen as "adjective problem". The terms medical informatics, biomedical informatics, clinical informatics, health-care informatics, public

health informatics, nursing informatics sometimes are used interchangeably. Are those terms really have the same meaning or just because of national traditions or language in difference countries (Hasman, Haux & Albert 1996)? What is and what for is health informatics?

This paper attempted to elaborate on what is Health Informatics, its term meaning and various related terms used by the scholars. In addition, subsequent section will discuss about the potential benefit for health sector when using Informatics approach and what kind of systems included in this field as well as the implementation challenges.

2. Definition of Health Informatics

Health Informatics is an emerging discipline within healthcare. Many definitions were in use over the past four decades, which reflect either a perspective of its use or a description of the

work area undertaken by the staff involved. Two terms often use interchangeably are “Health Informatics” and “Medical Informatics” in which were known come into use around 1973 (Protti 1995).

Mikhailov et al. (1967) advocated the term “Informatics” as names for the “theory of scientific information”, and they argued that the terminology is for a broader meaning, including study of the use of information technology in various communities and of the interaction of technology and human organizational structures. They defined informatics as:

“the discipline of science which investigates the structure and properties (not specific content) of scientific information, as well as the regularities of scientific information activity, its theory, history, methodology and organization”. — (Mikhailov et al. 1967)

Informatics study the representation, processing, and communication of information in natural and artificial systems in which including computational, cognitive and social aspects (Fourman 2002). By combining the word, as in medical informatics, health informatics, will denotes the specialization of informatics to the management and processing of data, information and knowledge in the specified name.

Several formal definitions of medical/health informatics were given, which were evolving over the time. The term “Medical Informatics” was introduced as a MeSH term in 1987, and is

defined in MEDLINE as (DeShazo, LaVallie & Wolf 2009):

“The field of information science concerned with the analysis and dissemination of medical data through the application of computers to various aspects of health care and medicine.”

Meanwhile, Greenes & Shortliffe (1990) described medical informatics as:

“The field that concerns itself with the cognitive, information processing, and communication tasks of medical practice, education, and research, including the information science and the technology to support these tasks”

Hasman et al. (1996) also proposed the definition for medical informatics as:

“The discipline concerned with the systematic processing of data, information and knowledge in medicine and health care.”

The term “Health Informatics” defined by Al-Shorbaji (2001) as:

“an umbrella term used to encompass the rapidly evolving discipline of using computing, networking and communications methodology and technology - to support the health related fields, such as medicine, nursing, pharmacy and dentistry”

Al-Shorbaji (2001) attempt to provide definition that covers a very large domain which includes clinical and administrative messaging, reference retrieval, operation and management of health services, patient information, health education and promotion, epidemiological surveillance, health status monitoring, clinical decision support, image and signal analysis, modeling and telemedicine.

The Department of Health (2002) UK provided alternative definition for health informatics as:

“The knowledge, skills and tools which enable information to be collected, managed, used and shared to support the delivery of healthcare and to promote health.”

Wyatt & Liu (2002) emphasized the definition of health informatics on information management rather than technology as:

“The study and application of methods to improve the management of patient data, medical knowledge, population data and other information relevant to patient care and community health.”

Coiera (2003) in his book “Guide to Health Informatics” defines health informatics as “*the study of information and communication systems in healthcare*”. It focuses on understanding the fundamental nature of the system and the principles which shape them, developing interventions and underlying method-principles for system improvement as well as evaluating these interventions in healthcare.

According to several definitions above, Health/Medical informatics can be understood as a field that concerns with the use of computer, information and communication systems to support various aspects of practice in health-related fields.

Recently, a new broader term is introduced to cover the comprehensive meaning as “Biomedical and Health Informatics” by Hersh (2009) and Mantas et al. (2010). Hersh (2009) defines the term as “the optimal use of

information, often aided by the use of technology, to improve individual health, health care, public health, and biomedical research”. He provides a taxonomy of the field as can be seen from Figure 1.

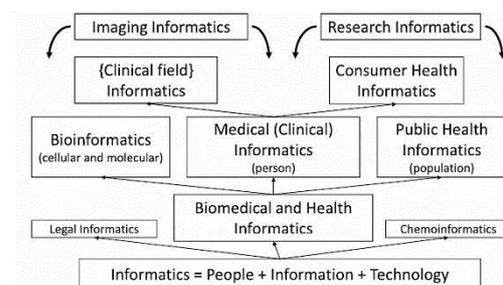


Figure 1: Taxonomy of biomedical and health informatics field (Hersh 2009).

3. Benefit from Health Informatics

As defined in the previous section, health informatics concern with information and communication technology in the health care environment. By employing such technology, several benefits could be obtained, either for clinical practice or directly for patients (Health Dept, UK n.d.). Following are those benefits:

- Support for better clinical delivery. Health informatics could help to deliver a good quality of patient care. It is done by (Health Dept, UK n.d.): (1) providing immediate access to accurate information at the point at which it is needed. (2) Facilitating joined-up care by enabling the secure sharing of clinical information across a variety of organizations and care settings. (3) Improving access to high quality and reliable clinical information,

for patients and clinicians alike. (4) Improved medical technology helps clinicians to deliver safe and appropriate care, which directly improves service quality and patient health outcomes.

Despite the fact that there is still much to be done, the use of application such as electronic medical record have proven to be of real value to clinical delivery (Health Dept, UK n.d.).

- Better knowledge management & improving patient care.

Making the best use of informatics in health care services for health data collection such as electronic medical record, would provides better quality, breadth and depth of information for both at individual as well as for large scale level. At individual level, with the availability of good quality data, will assist clinicians and patients to make better decision, and more responsive to the situation. It is also possible to provide a shareable experience among clinicians. At the large scale, it will provides the ability to carry out de- tailed analysis on a large volume of patient data results in a better understanding of the populations health needs and the interventions that are required (Health Dept, UK n.d.). Well-protected electronic environment provided by the technology offer secure patient information and provide better data access management. In addition, it can prevent

data duplication happen by ensuring the same information is not collected and recorded several time by different people and department, as we all know that health care sector usually can be seen as a collaborative work.

Overall, by utilizing all the information provided by the system, would drive quality, improve operational efficiencies, and assist with the evaluation of clinical interventions when looking at ongoing service improvements. It will also reduce costs and continuously improve the delivery of healthcare as well as improving patient care.

4. Application Examples

Several type of information systems are applied in health care environment that support health care activities ranging from operational support, management of patient data, health information dissemination as well as strategic information systems. Following are some of the application:

- *Electronic Medical Record.*
An electronic medical record (EMR) or some times referred to computer based patient record (CPR) or electronic patient record (EPR) is a computerized medical record created in health-care organization such as a hospital or physician's office. It is simply the computer replacement for existing paper medical record systems. The emergence of this system mostly due

to the drawback of this existing one has. The amount of patient data stored becomes large and complex, and by using paper-based solution, it will need more and more space to keep it along with the time. It is also common that every healthcare provider has their own patient data with certain format, which could make it difficult to share among other practitioners, inaccessible, duplication, and sometimes unintelligible except to those who created the record. Moreover, it might be not available to the owner of the data due to misplaced, lost or being used by someone else (Coiera 2003). The EMR system is intended to overcome those mentioned drawback and make the available information, as it should be.

The EMR provides mechanisms for capturing any information during the clinical process, securely manage and store, and permits retrieval of that information by those with a clinical need. By means of that, several advantages could be obtained such as reduction in storage space, open possibility for simultaneous access on certain records, ease of information searching and sharing, and make possible for the data records to be use in variety clinical research activities.

However, some seen EMR is beyond than that, as defined by Institute of Medicine of United States. EMR was defined as “an

electronic patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge, and other aids”. The EMR represent all information and communication system that could be made available to support clinical activities (Coiera 2003), starting from systems for order management, digital image archiving and retrieval, messaging among workers in healthcare system and administrative purposes.

- *Electronic Prescribing Systems.*

Electronic prescribing or **ePre-scribing** is a system for managing prescriptions electronically, from the healthcare provider to the pharmacy. This system offers a paperless solution that provides ability to electronically send error-free, accurate and understandable prescriptions directly to pharmacy from the point-of-care. It means that this system could help reducing the risk associated with traditional prescriptions system (hand writing) such as medication errors due to miss-translated (unreadable), unknown code or others possible cause of errors. Introduction of this kind of system into the clinical environment could improve the quality of health-care delivery (patient care), and of course could enhancing patient safety.

- *Computerized physician order entry (CPOE).*

CPOE or sometimes referred to *Computerized Provider Order Entry* is an electronic entry process of physicians instructions for patients' treatment, particularly in-patients, under their care. This order mechanism utilizes the computer network to communicate to medical staff or to the department such as pharmacy, laboratory, or radiology, which are responsible for fulfilling the order. Many benefits could be obtained by employing this system in clinical environment. CPOE could decrease delay in order completion, reduce errors related to handwriting or transcription, provides possibility for order entry at point-of-care per off site, provides error checking for duplicate or incorrect doses or tests, and simplifies inventory and posting of charges. By using this system, verification and clarification requests will be enhanced by improved communication and collaboration amongst the health care team.

- *Telemedicine*

Telemedicine is the use of information and communication technologies in order to facilitate clinical health care remotely. It attempts to provide an easy access for medical services consistently due to the distance barriers. It is also used to save

lives in critical care and emergency situations. The main point of this system is exchange of information at a distance, whether that information is voice, an image, and elements of medical record or commands to surgical robot. (Coiera 2003).

Various definitions actually exist associate with this system. Some other sees telemedicine restricted only to interactions between doctors and patients. The term "*Telehealth*" or "*Telecare*" are usually used to indicate a broader context that involve all healthcare professionals. However, the use of the term is not isolated only from their definition, sometimes they are used interchangeably (Coiera 2003).

Tele-consultation, which the meaning is self-explained, is being used increasingly in areas of the developing world where lack of expert resources, or low of population density. As an example: sending medical images (X-rays) to be reported upon remotely, often cross-countries between healthcare provider.

Tele-monitoring also emerges, in which providing medical support to special care baby units to social care for the elderly people.

The enormous change in the last couple of years, is the use of the web. From the

perspective of the patient/consumer, they now have 24 hours free access to doctors and various therapies, health and lifestyle information, service and support that available on the web. This kind of solution, take place or facilitate by the web, usually known as **eHealth**.

The problem with this kind of systems are they usually tend to be technology driven rather than demand driven, the problem that need to be solved, from the clinical perspective. This makes the problems that are not encompassed by the technology remain unsolved. In fact, many solutions of communication problems are not technological, but more social aspect which related to the human and organizational changes (Coiera 2003).

▪ *Clinical Decision Support Systems.*

Decision support system is usually related with Artificial intelligence (AI). Basically make the computer to attempt to carry out some of the processing that the user does when converting data into information. In medicine, it is used originally to assist clinicians with task like diagnosis. However, intelligent systems today are found for supporting medication prescribing, in clinical laboratories and educational settings, for clinical surveillance, or in data-rich areas like the intensive care setting (Coiera 2003).

There are three categories for the potential benefits from CDSS according to Coiera (2003) :

- **Improved patient safety**, e.g. by utilizing computerized medication order-entry system, it increase the safety of the patients by reducing medication errors and adverse drug events, increasing the proportion of appropriate and safe prescribing decisions.
- **Improved quality of care**, e.g. by increasing clinicians' available time for direct patient care, improved compliance with clinical pathways and guidelines, facilitating the use of up-to-date clinical evidence, improved clinical documentation and patient satisfaction.
- **Improved efficiency in healthcare delivery**, e.g. by reducing costs through faster order processing, reductions in test duplication, decreased adverse events, and changed patterns of drug prescribing favoring cheaper but equally effective generic brands.

5. Challenges

Introducing a new system into an organization to a complex medical environment

more than a matter of deployment process. It requires ongoing changes in design to cope with unique characteristics of the user and the context setting, training, testing and re-training all users. Thus, the main challenges of health informatics is to get healthcare providers committed to the widespread implementation of the various information technology components, organized readiness of the user for the system, technically and socio-culturally, as well as the resources support. Financial issues are one of the resource need to be considered. Lack of funding often leads the implementation process to failure.

6. Conclusion

Health informatics is a growing field, in which the terminology and its meaning still evolving over the time, either in narrow perspective or broader. In general, health informatics can be understood as a field that concerns with the use of computer, information and communication system to support various aspect of practice in health related field.

Nowadays, health informatics has taken an important role in health care sector. It gives better quality of clinical delivery, better knowledge management, information sharing as well as improving patient care and safety. Some of the application that give these benefits including electronic medical record, electronic pre- scribing systems, Computerized physician order entry, Telemedicine, and clinical decision

support systems. Even with all the advantages that health informatics contributes; a number of challenges need to be dealt with including implementation process as well as financial support.

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