Health Informatics – Introduction

HASSAN A. AZIZ

"During the past few decades the volume of medical knowledge has increased so rapidly that we are witnessing an unprecedented growth in the number of medical specialties and subspecialties. Bringing this new knowledge to the aid of our patients in an economical and equitable fashion has stressed our system of medical care to the point where it is now declared to be in a crisis. All these difficulties arise from the present, nearly unmanageable volume of medical knowledge and the limitations under which humans can process information."

Marsden S. Blois
Information and Medicine
The Nature of Medical Descriptions, 1984

Hassan A. Aziz, PhD, MLS(ASCP)cm, *College of Arts and Sciences, Qatar University, Doha – Qatar*

Address for Correspondence: Hassan A. Aziz, PhD, MLS(ASCP)cm, *Associate Dean for Academic Affairs, Director and Associate Professor of Biomedical Science, College of Arts and Sciences, Qatar University, P.O. Box: 2713, Doha – Qatar, 00974-4403-4783, Hassan.Aziz@qu.edu.qa*

INTRODUCTION

Health informatics is a wide-ranging science incorporating the complex mixture of people, organizations, illnesses, patient care and treatment. It is a scientific field that deals with the storage, retrieval, sharing, and optimal use of biomedical information, data, and knowledge for problem solving and decision making. The field touches on all basic and applied fields in biomedical science and is closely tied to modern information technologies, notably in the areas of computing and communication. Health informatics looks into ways to optimize clinical knowledge creation, sharing and application to deliver better healthcare and to promote health.

The emergence of medical informatics as a new discipline is due in large part to the rapid advances in computing and communications technologies, an increasing awareness that the knowledge base of biomedicine is essentially unmanageable by traditional paper-based methods, and a growing conviction that the process of informed decision making is as important to modern biomedicine as is the collection of facts on which clinical decisions or research plans are made.

A term is currently used is Big Data. The term describes large and exponential growth and availability of data. These data could be structured or unstructured data. This is well defined as data that adhere to the following four articulated criteria. The first criteria is volume, which is considered to be an ever-increasing amount. With the emergence of various storage devices and the reduction of the storage cost it is made increasingly possible to manage this large volume of data. However, strict evaluation of the large volume of data is very relevant by the analytics. The second criteria is velocity, as the data is generated in an exceptionally high speed and therefore needs to be managed in a timely manner to be retrieve good analysis. Thirdly, big data have a huge variety as various different types of data are collected e.g. data from laboratory, pharmacy, radiology, financial transaction/billing etc. This will also increase the amount of unstructured data. The fourth criterion is veracity of the data. The big data are to be gathered from trustable sources well recognized under the healthcare system.

There is an information hierarchy that is important in the information sciences, as depicted in the pyramid in Figure 1. Data are observations reflecting differences in the world. They are unorganized and unprocessed facts. Information is aggregation of data that makes decision making easier, thus meaning can be attached and contextualized. Information often answers questions such as what, who, when, where. Knowledge is information that is justifiably believed to be true. It is an understanding gained through experience and it answers the 'how' question. Finally, wisdom represents principles by integrating knowledge and answers 'why' questions.
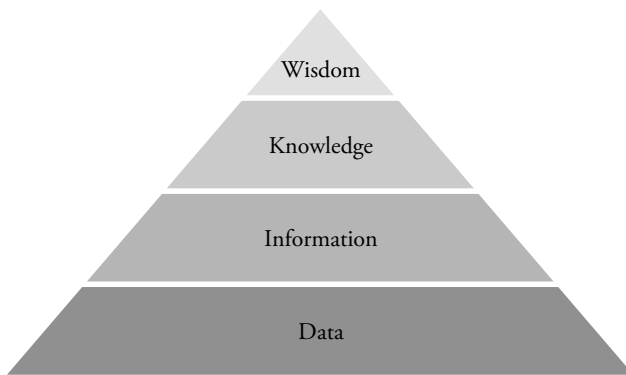
Figure 1. Information Hierarchy Pyramid

In order to do useful computation, one has to segregate some part of the physical world and create a conceptual model. The definitions of what concepts are relevant are defined in the conceptual model and other information is considered as irrelevant. The conceptual model created is used to design and implement a computational model. A conceptual model for a given criteria such as diabetes would include information such as the patient name, weight, blood glucose levels, and HbA1c values. These data are relevant and are part of the conceptual model while this information will be used in the computational model to perform the analytical representation of the data. Therefore, there should be rules that govern the mapping of the information in terms of numbers or symbols into the computational analysis. This will enable correct capture and preservation of meaning of the data provided.

The nation's healthcare system is undergoing a transformation in an effort to improve quality, safety and efficiency of care. On Feb. 17, 2009, President Obama signed the American Recovery and Reinvestment Act (ARRA) of 2009. The act, more known as the Recovery Act, is a critical measure to modernize the nation's infrastructure, one of which is the "Health Information Technology for Economic and Clinical Health (HITECH) Act". The law provides major opportunities for the Department of Health and Human Services (DHHS), its partner agencies, and the States to improve the nation's healthcare through health information technology (HIT) by promoting the meaningful use of electronic health records via incentives.

The ARRA authorizes the Centers for Medicare & Medicaid Services (CMS) to provide reimbursement incentives for physician and hospital providers who are successful in becoming "meaningful users" of an Electronic Health Records (EHR). Meaningful use is defined by the use of certified EHR technology in a meaningful manner to ensure that the certified EHR technology is connected in a manner that provides for the electronic exchange of health information to improve the quality of care.

The concept of meaningful use rests on the "5 pillars" of health outcomes policy priorities, namely:
- Improve quality, safety, efficiency, and reduction of health disparities
- Engage patients and families in their health
- Improve care coordination
- Improve population and public health
- Ensure adequate privacy and security protection for personal health information

In order to encourage widespread EHR adoption, promote innovation and to avoid imposing excessive burden on healthcare providers, meaningful use was showcased as a phased approach, which is divided into three stages that span 2011 (data capture and sharing), 2013 (advanced clinical processes) and 2015 (improved outcomes). The incentive payments range from $44,000 over 5 years for the Medicare providers and $63,750 over 6 years for Medicaid providers (starting in 2011). Participation in the CMS EHR incentive program is totally voluntary, however if physician and hospital providers fail to join in by 2015, there will be negative adjustments to their Medicare/Medicaid fees starting at a 1% reduction and escalating to a 3% reduction by 2017 and beyond.

The degree to which health informatics can deliver on the promises to improve healthcare delivery depends greatly on how the emerging information technologies are deployed and managed. This series of articles will shed a light on a few challenges for the implementation of a successful healthcare information system such as regulatory environment and changes in healthcare consumerism and issues facing information technology adoption within various healthcare settings.