Understanding the Difference Between Healthcare Informatics and Healthcare Data Analytics in the Present State of Health Care Management

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Abstract
The purpose of this article is to perform a scientific analysis of the definitions associated with healthcare informatics and healthcare data analytics. Additionally, the authors attempt to redefine the scientific pursuit of healthcare informatics and healthcare data analytics. This commentary can assist the thinking of informaticians and data analysts working in healthcare management and practice. The authors also provide a brief insight on the possible future direction of informatics and analytics associated with healthcare.

Keywords
healthcare informatics, healthcare data analytics, scientific inquiry, managerial applications

Introduction
Health Informatics and associated data analytics has largely evolved in recent times. This is especially true in United States where healthcare providers relied heavily on paper records about a decade ago.1 Additionally, Health Information Management was considered a specialization of library science where individual health record managers were trained in assembling and organizing health care records. There has been a paradigm shift in this process with the inception of HITECH Act of 2009. This statute laid down the foundation of this much needed and necessary paradigm shift in healthcare data management processes. This shift also bolstered the need to advance the science and technology associated with healthcare records management facilitating a convergence of computer science, statistics, health care management, and biomedical engineering.

For more than a decade, researchers, informaticians, software developers, clinicians, and many others have attempted to define health informatics and have stumbled upon many definitions. Many non-profit organizations associated with healthcare information systems and management have attempted to define health informatics. Wan2 defines health informatics research as, “a scientific endeavor that applies information science, computer technology, and statistical modeling techniques to develop decision support systems for improving both health service organizations’ performance and patient care outcomes.” In this definition he outlines the techniques that are applied to this discipline, the outcome, and the purpose. While the definition outlines the involvement of information science, computer technology, and statistical modeling, it also identifies the fact that the synthesis of decision support systems is an essential denouement of the processes involved. Finally, the definition identifies improved healthcare delivery as the core purpose. While this definition clearly defines the outcome and the purpose the idea of techniques that apply to health informatics research namely: information science, computer technology, and statistics can be somehow perceived as both nebulous and esoteric. This is mainly because there are a few clear definitions available to define these techniques. Therefore, there is a critical need for a definition that also provides a framework3 that involves data flow, its transformation into required information, the information then being processed into

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knowledge, and finally the acquired wisdom that drives the decision making of decision support systems to achieve the outcome of improved healthcare.

The United States National Library of Medicine\(^4\) defines health informatics as, “the interdisciplinary study of the design, development, adoption and application of IT-based innovations in healthcare services delivery, management and planning.” Here the definition hovers around the idea of synthesizing and developing software systems\(^5\) and their associated lifecycle models that describes the maintenance which involves corrections, additions, and improvements.\(^6\) Another important term used in this definition is “interdisciplinary\(^7\)” which indicates that health informatics encompasses health services, management, and information technology development. Here it is important to note that this definition has a slight digression from the concept of data flow and transformation into more abstract forms as discussed to that of developing information systems for the purpose of healthcare delivery, management and planning. Therefore, both the perceived outcome as well as the purpose revolves around these concepts. In other words, the key purpose of healthcare informatics is to assist healthcare managers do a better job in optimizing the care outcomes and performance.

Saba and McCormick\(^8\) define healthcare informatics as, “the integration of healthcare sciences, computer science, information science, and cognitive science to assist in the management of healthcare information.” Once again, this definition is interdisciplinary in nature indicating the convergence of many fields of study for the purpose of helping management of healthcare information. Now that we have analyzed 3 important definitions associated with healthcare informatics we can conclude that the definition for healthcare informatics needs the following key ingredients: a) convergence of disciplines that are associated with data flow and processing, b) systems thinking, c) purpose of the tasks performed in this discipline, and d) a required critical outcome. With these ingredients in mind we can define healthcare informatics as, “a transdisciplinary study of the data flow and processing into more abstract forms such as information, knowledge, and wisdom along with the associated systems needed to synthesize or develop decision support systems for the purpose of helping the healthcare management processes achieve better outcomes in healthcare delivery.”\(^7\)

Here it is important to note that there exists another term commonly known as healthcare data analytics that is often confused with healthcare informatics. Healthcare data analytics deals with various methods used in processing data for healthcare.\(^9\) In some ways healthcare data analytics is a part of the larger whole (healthcare informatics). In healthcare data analytics we are only concerned about various ways of manipulating, synthesizing, describing, and assessing data while not taking into consideration the associated systems and its development and maintenance. Healthcare data analytics is more strongly associated with the science of data analysis in terms of data manipulation, data semantics, data mining, and statistics. Therefore, we can define healthcare data analytics as “a study of methods and techniques to analyze data, discover new information and knowledge, link data in terms of its semantics, and describe data to other informaticians, managers, and other stakeholders.”

By delineating the conceptual soundness and methodological rigor of scientific inquiry, either performing healthcare informatics research or healthcare data analytics, one must realize the commonalities of these two new fields. First, the systems thinking of healthcare research must be grounded in substantive theories.\(^9\) The logic of scientific inquiry is built upon the integration of inductive and deductive logics. An inductive approach is to gear towards the problem-solving effort whereas a deductive approach is conducting hypothesis testing and theory validation. Second, the integration of macro-level (e.g., ecological, organizational, and contextual) determinants and micro-level (e.g., behavioral and personal) determinants of health generates a transdisciplinary approach or perspective of health and healthcare research. Thus, the confirmatory nature of both healthcare informatics and data analytics enables scientists to advance new knowledge and develop high-tech oriented predictive models. Third, the utilitarian approach of both informatics and analytics enables practitioners and scientists to formulate person-centric care modalities, using artificial intelligence techniques.\(^7\)

There is also a need to explore the use of the design-process-outcome science to target specific population groups for promoting appropriate care management and preventive measures. For instance, in a shared decision making model, a physician must first understand the patient’s needs and their environment, including family members, life events, family interactions, work and cultural background, etc. Patient-centered care means when making clinical decisions and treating patients, a provider needs to inform and involve patients and their families and provide coordination and integration of various health and social services.\(^10\) The care provider also offers physical comfort and psychological support, understands the patient’s conception and culture of the disease impact, and applies the principles of disease prevention and behavioral change to influence patients. Therefore, a professional practice is based on careful assessment of patient’s needs before making a clinical decision for the patient. More specifically, in the entire diagnosis and treatment phases, a provider will assess the knowledge, motivation, attitude and preventive practice (KMAP) of a patient toward a specific disease. Thus, the formation of a treatment plan with clear goals and implementation strategies is made jointly by both physician and patient. Patients coupled with self-care capabilities are enhanced by health education and support services/interventions can help optimize better outcomes through the use of health information technologies such as tele-health or mobile health mechanisms.\(^11,12\) The continuous tracking and monitoring treatment outcomes enable to perform telephone consultations and communications. In addition, the use of email and web-based monitoring and decision support system could maximize the effectiveness of the continuity and coordination of care.\(^13\)

Overall, in this article the authors have redefined healthcare informatics and healthcare data analytics, and indicated a need
for systems thinking and user-centered design to improve healthcare outcomes. The authors hope that the insight and the arguments presented in this article will bolster research and innovation with an improved perspective on the topics discussed.

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