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EDITORIAL

Design of Health Information Systems

Varadraj P. Gurupur[a*], Thomas TH Wan[a], Donna Malvey[a] and Donna Slovensky[b]

[a] *Department of Health Management and Informatics, University of Central Florida, Orlando, FL, USA*
[b] *School of Health Professions, The University of Alabama at Birmingham, Birmingha*m, AL, USA

This special issue is intended to generate new knowledge as well as provocative research questions. Application is showcased in several articles. This collection of papers permits researchers throughout the world to gain insight and understanding of what others are doing in their fields and possibilities for future study.

In the past, multidisciplinary research teams often came together by pure chance. A biologist, an engineer, and a medical doctor might run into one another at the local sandwich shop at a university. Over time, they came to discuss their work. After more time, they might see possibilities for combining their disciplines to solve a complex problem. Evolving rom the chance luncheon encounters came a new discovery or means of applying new knowledge. However, we can no longer depend on such opportunistic encounters. Researchers need more determined methods of coming together, such as special issue journals in order to assure occasions for multidisciplinary scholarship.

The world seems to be constantly changing. We cannot follow the leader and do more of the same. We have to seek knowledge and identify scholars and pathways to discovery. In today's world, doing more of the same is a recipe for failure. We must challenge ourselves and others to collaborate with those who think broadly and differently about the world. The research landscape for STEM fields is undergoing especially dramatic and rapid change. Universities, governments, and private sector enterprises are funding research endeavors to capitalize on existing knowledge and new developments. Furthermore, applied research is coming under the spotlight. Increasingly our technological developments are enabling research to move quickly beyond the theoretical into real-world applications.

Mobile phones have enhanced our communication and most certainly our research capabilities, including opportunities to work with scholars round the world. 3-D printers offer the potential to produce cars that cost less and can be produced rapidly without the need for a factory of skilled workers (Malvey & Slovensky, 2014). 3-D printers have already grabbed news headlines for the production of bionic arms. The "Internet of Things" has been a guiding force demonstrating the many possibilities enhanced connectivity beyond our individual lives.

The complexity involved in designing health information systems (Plsek & Greenhalgh, 2001) has many facets. Some of the most challenging facets include: a) designing the human-machine interface between the system and the user, b) assuring the system's ability to capture and enhance the relevant body or bodies of knowledge, c) designing the system to adapt to new methodologies or discoveries in biomedical informatics, and d) designing for compliance with standards, trends in technology, and statutory regulations. The articles selected for this special issue explore current knowledge and research corresponding to these facets.

* Corresponding author. Email: varadraj.gurupur@ucf.edu.

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Generally speaking, health information systems are used to capture, store, retrieve, and use knowledge relevant to an existing biomedical problem (Gurupur *et al.*, 2014; Gurupur *et al.*, 2012). To this end, the health information system must have the ability to allow functioning of conceptual frameworks used for experiments that include both randomized and non-randomized trials. In other words, a "good" information system must support using and enhancing the body of knowledge for a specific disease or disorder. This leads to the idea of health information systems evolving or migrating to knowledge systems that enable decision-making and are not merely repositories for data storage and retrieval. The statutory regulations on meaningful use of Electronic Health Records includes requirements for development of Decision Support Systems for clinicians. Thus, this is an important area of investigation for both researchers and system developers,

Regarding statutory regulations, it is important to acknowledge that different countries have established slightly different sets of standards for implementation and use of Electronic Health Records. In this special issue, we feature an article that briefly describes some differences between health information system implementation in the United States and Canada. Although the statutory regulations may be different, the challenges involved in designing and deploying health information systems to support the efficient and effective delivery of healthcare are very similar. This suggests the possibility of developing common technological frameworks geared towards addressing the inherent challenges in healthcare system design.

The design of health information systems must also acknowledge the economic implications of healthcare delivery. Intended reduction in healthcare costs can be a major driver for the design and development of healthcare information systems, as many studies have shown that introduction of an information system can reduce costs associated with human labor. To achieve these labor efficiencies, information system designers and developers must consider the myriad processes and workflows associated with healthcare delivery to tailor a solution to delivery system requirements. These workflows and processes are likely to evolve and change over time owing to innovations in medical science and associated technologies, as well as management innovations and new applications of biomedical informatics.

In this special issue we feature two articles that focus on development of new technology applied to cancer detection, illustrating that innovations in machine learning, neural networks, and data semantics can effectively aid the development of robust decision support tools for clinicians. The advancement in the aforementioned areas of science provides an impetus to the development of newer systems that can take advantage of these improvements in technology capability. Evidence has shown that decision support tools are usually associated with the development and refinement of knowledge bases. Improvements associated with XML-based technologies have greatly improved the techniques involved in knowledge development. Therefore, the opportunities associated with the improvements in analysis of the knowledge stored in the knowledge bases is a key area of focus for this special issue.

The main factors that affect the design and development of healthcare delivery systems include: a) statutory regulations, b) existing processes and workflows, c) financial constraints or incentives, and d) user requirements. Additionally, the following systems or subsystems effectively aid the implementation of a healthcare delivery system: i) decision support systems, ii) systems used for data storage and retrieval, and iii) biomedical equipment. The two main components of decision support would be knowledge analysis and storage while data storage and retrieval will include components such as database systems, data mining, and natural language processing. More details on this topic have been discussed in one of the articles in this special issue.

In this special issue, the 1st paper titled, "Designing the right framework for healthcare decision support" discusses the essential components of a healthcare decision support system. The authors discuss some essential and important issues associated with the decision support mechanisms of healthcare systems in both Canada and United States.

The 2nd paper discusses a novel technique of using computer aided diagnosis for early detection of skin cancer. Here the authors discuss the use of color constancy and skin lesion analysis for the same. The

authors have provided information on the required mathematical analysis to perform the aforementioned process. The paper is titled, "Early skin cancer detection using computer aided diagnosis techniques."

The 3rd paper is titled, "The effect of health education on clinical and self-reported outcomes of diabetes in a medical practice." Here the authors attempt to analyze the causal mechanisms that lead to improvement in self-management of diabetes by patients suffering from it. This analysis is performed using components such as knowledge, educational intervention, attitude, practice of self-care management, and clinical outcomes.

The 4th paper titled, "Automatic cotton wool spots extraction in retinal images using texture segmentation and gabor wavelet." This article describes the algorithms and used for detection of cotton wool spots that is an indication of hypertensive retinopathy. A comparison of the proposed algorithm with some of the existing methods is described here.

The 5th paper titled, "A new approach of cup to disk ratio based glaucoma detection using fundus images" describes a procedure to analyze glaucoma exposure by computing cup to disk ratio. In this article, the authors have described their process in great detail and also provided results of this technique using specificity, sensitivity, and global accuracy.

The 6th paper describes the existing gaps and drawbacks in the systems used for long-term and post-acute care. This description is provided to the reader using a hypothetical story. At the end of the article the authors describe the possible solutions to the problems described in it. The articles is titled, "transitions of care: a patient-centered perspective of health information systems that support post-acute care."

Overall, we can conclude that the design and development of healthcare delivery systems is inherently complex. However, this complexity can be managed effectively if we employ a "divide and conquer" approach whereby this complexity is analyzed in its sub-parts and every part is analyzed independently in detail. The articles in this special issue contribute to our understanding of selected sub-parts of the larger system.

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Author Biographies

Varadraj P. Gurupur, PhD is an Assistant Professor with the Department of Health Management and Informatics, University of Central Florida. He received his undergraduate degree in Computer Science and Engineering from Mangalore University, India in the year 2002. Dr. Gurupur received his Master of Science in Computer Science in 2005 and PhD in Computer Engineering in 2010 from the University of Alabama at Birmingham.

Thomas TH Wan, PhD is an Associate Dean with the College of Health and Public Affairs, University of Central Florida. He is a distinguished researcher in the area of Healthcare Informatics with a publication record of over 100 journal articles in his area of expertise.

Donna Malvey, PhD is an Associate Professor with the Department of Health Management and Informatics, University of Central Florida. She has worked for the department since 2003. Prior to that, she worked at the University of South Florida, the University of Arkansas at Little Rock, the University of Alabama at Birmingham and Marshall University.

Donna Slovensky, PhD is a Senior Associate Dean with the School of Health Professions, The University of Alabama at Birmingham. Her research interests include strategic use of information resources, Consumer and purchaser use of health provider outcomes information, and Outcomes assessment using clinical and administrative data.