Chapter 13
Human Factors in Dynamic E-Health Systems and Digital Libraries

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ABSTRACT

E-health systems and digital libraries deal with human health, requiring fast responses and real-time decision-making. Human intervention can be seen in the whole life cycle of biomedical systems. In fact, relations between patients, nurses, lab technicians, health insurers, and physicians are crucial in such systems, and should be encouraged when necessary. However, there are some issues that affect the successful implementation of such infrastructures. Man-machine interaction problems are not purely computational and need a deep understanding of human behavior. Many integrated health knowledge management systems, have employed various knowledgebases and ontologies as their conceptual backbone to facilitate human-machine communication. Ontologies facilitate sharing knowledge between human and machine; they try to capture knowledge from a domain of interest; when the knowledge changes, the definitions will be altered to provide meaningful and valid information. In this chapter, we review and survey the potential issues related to the human factor in an integrated dynamic e-health system composed of several interrelated knowledgebases, bio-ontologies and digital libraries by looking at different theories in social science, psychology, and cognitive science. We also investigate the potential of some advanced formalisms in the semantic web context such as employing intelligent agents to assist the human user in dealing with changes.

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"When dealing with people, remember you are not dealing with creatures of logic, but with creatures of emotion, creatures bristling with prejudice, and motivated by pride and vanity"

Dale Carnegie (1888-1955)

INTRODUCTION

During the last two decades, many advances in healthcare have required the development of artificial intelligence (AI) techniques in the biomedical domain. Several biomedical systems, such as Acute Care Systems, Medical Decision Support Systems, Educational Systems, Quality Assurance and Administration, Laboratory Systems, Medical Imaging, and so forth, are recruiting large digital libraries, knowledge-bases and ontologies (Gruber, 1993) as their backbone to facilitate human-machine communication and capture knowledge from the domain of interest. When the knowledge changes the definitions will be altered to provide meaningful and valid information. E-health systems and digital libraries deal with human health, requiring fast responses and real-time decision-making. These systems usually have a very complex structure, with many elements tightly coupled to one another and organized in distributed, lattice-like networks. In such structures, changing one component can have unpredictable effects on the whole system. As can be seen from state-of-the- art change management in existing biomedical knowledge-bases and digital libraries, this problem is inadequately addressed by available tools and algorithms, mostly because dealing with change is mainly a social, linguistic, and philosophical problem, rather than computational one. A key issue in managing current dynamic biomedical systems relates to users' behavior and the cultural and disciplinary assumptions (Forsythe, 1998), which can determine the success or failure of a system. The change management phase in current systems is largely addressed implicitly, and followed with human supervision and intervention.

Human intervention can be seen in the whole life cycle of biomedical systems. In fact, relations between patients, nurses, lab technicians, health insurers, and physicians are crucial in such systems, and should be encouraged when necessary. The human contribution improves rationality and plays an important role in controlling the quality of the results. However, there are several applications where human intervention is difficult, impossible, or simply undesirable (Flouris et al, 2006) (e.g., due to security issues). Also, differences in background knowledge, views, or preferences are other obstacles for consensus between people. In this sense, a result might not be accurate or reproducible. In addition, the system's outcome might be highly dependent on human behavior, which makes it difficult for evaluation in terms of efficiency or correctness.

The existing well-known biomedical systems and digital libraries usually affect large and heterogeneous groups of people, with different levels of background knowledge and dissimilar interests. Therefore, an efficient user-centered approach, along with psychological and organizational proficiency should be taken to reduce the behavioral side-effects and successfully manage changes in healthcare applications. An ideal e-health system should be able to automatically coordinate human factors, processes, tools and knowledge-bases while coping with different changes. There are some issues that affect the successful implementation of such infrastructures. In this paper, we review and survey the role of the human factor in a dynamic e-health system, and we address following issues:

- The organizational and social impacts of human-driven changes in e-health systems;
- Different sources of change;
- Human errors due to change and alteration;