Chapter I
Emerging Approaches to Evaluating the Usability of Health Information Systems

Andre W. Kushniruk
University of Victoria, Canada

Elizabeth M. Borycki
University of Victoria, Canada

Shige Kuwata
Tottori University Hospital, Japan

Francis Ho
University of Victoria, Canada

ABSTRACT

It is essential that health information systems are easy to use, meet user information needs and are shown to be safe. However, there are currently a wide range of issues and problems with health information systems related to human-computer interaction. Indeed, the lack of ease of use of health information systems has been a major impediment to adoption of such systems. To address these issues, the authors have applied methods emerging from the field of usability engineering in order to improve the adoption of a wide range of health information systems in collaboration with hospitals and other healthcare organizations throughout the world. In this chapter we describe our work in conducting usability analyses that can be used to rapidly evaluate the usability and safety of healthcare information systems, both in artificial laboratory and real clinical settings. We then discuss how this work has evolved towards the development of software systems ("virtual usability laboratories") capable of remotely collecting, integrating and supporting analysis of a range of usability data.

INTRODUCTION

A wide variety of health information systems have appeared in healthcare (Shortliffe & Cimino, 2006). Although, such innovation promises to revolutionize healthcare there are a number of critical problems and issues related to their development, deployment and acceptance by end users that are related to human-computer interaction (HCI). Usability of health information systems refers to the degree to which they are useful, effective, efficient and enjoyable (Sharp, Rogers, & Preece, 2007). Lack of system usability has been a major impediment to adoption of health information systems. Indeed, perhaps in no other field have issues related to HCI come more to the fore when attempting to introduce information technologies than in healthcare. It has been previously argued that issues of HCI may be the most serious barrier to successful implementation and adoption of information technologies in healthcare (Kushniruk & Patel, 2004). Strenuous demands are placed on healthcare professionals and end users of health information systems making the need for usable systems critical in healthcare. Health information systems must be designed to consider not only technical aspects but also the complex information needs, cognitive processing and limitations of human users of such systems.

One of the main areas of concern revolves around the following question: how can we ensure that the health information systems we develop are usable, meet user information, support work needs and are safe? The design of health information systems that are intuitive to use and that support human information processing is essential. This has become increasingly recognized as more and more complex software and hardware applications appear in healthcare. Furthermore, as the complexity and variety of healthcare situations in which this technology is deployed increases, issues related to ensuring that health information systems will support local work activities and practices in healthcare are becoming critical. Closely related to issues of usability are issues related to healthcare safety, with the need to ensure that new devices and information systems increase patient safety and facilitate healthcare work. In addition, applications targeted to health consumers (e.g., patients and lay people) are also being developed at an increasing rate. It is essential that these systems be usable and that the information and advice they provide is both understandable and safe. Improved understanding of issues related to human cognitive processes that are part of human-computer interaction in healthcare is needed so that we can develop more effective health information systems.

In order to be able to determine if systems developed in healthcare are usable and safe methods of analysis are needed that can be used to characterize the information needs and processing of users of these systems. A wide variety of techniques and methods have appeared from applied psychology that can be used in health information system evaluation. One powerful method involves application of "think aloud" protocols. This involves the recording of subjects as they verbalize their thoughts while interacting with computer systems (Ericsson & Simon, 1993). In addition, video recordings of user interactions with systems can also be collected to provide a more complete picture of the interaction between humans and health information systems, as will be described in this chapter (Kushniruk & Patel, 2004). In addition to assessing the interaction with systems such methods can also be applied to assess the information needs of healthcare workers in order to form the basis for design of systems that better match both information needs and human information processing capabilities.

This chapter describes the evolution of our work in the development of practical and efficient approaches to assessing of the use and usability of new and emerging health information systems. This chapter begins with a discussion of cognitive aspects of human interaction with health information systems. This is followed by