Chapter 26
Use of Clinical Simulations to Evaluate the Impact of Health Information Systems and Ubiquitous Computing Devices Upon Health Professional Work

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ABSTRACT

Health information systems, and in particular ubiquitous computing devices (UCD), promise to revolutionize healthcare. However, before this can be widely achieved UCD need to be adapted to fit the information, workflow and cognitive needs of users of such devices. Indeed systems and devices that are not developed appropriately may inadvertently introduce error in healthcare ("technology-induced error"). This chapter describes an approach to applying clinical simulations to evaluate the impact of health information systems and ubiquitous computing devices on health professional work. The approach allows for an assessment of "cognitive-socio-technical fit" and the ability to modify and improve systems and devices before they are released into widespread use. The application of realistic clinical simulations is detailed, including the stages of development of such simulations (from the creation of representative clinical environments to subject selection and data collection approaches). In order to ensure the success and widespread adoption of UCD, it is argued that greater emphasis will need to be placed on ensuring such systems and devices have a high degree of fit with user's cognitive and work processes.

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INTRODUCTION

Health information systems (HIS) and in particular ubiquitous computing devices (UCD) have promised to revolutionize healthcare. Early research in this area demonstrated the value of integrating varying HIS and UCD into clinical settings in terms of improving the quality of patient care and reducing medical error rates (e.g. Bates et al., 1999; Chaudry et al., 2006). More recent research has called into question some of these findings. Some researchers have identified that poor cognitive, social and technical fit may influence some implementations of HIS and UCD and be the cause of health professional adoption and appropriation failures (Borycki et al., 2009a). In healthcare the hospital and clinic costs associated with implementing and re-implementing a HIS and UCD can be significant. There is a need to develop new evaluation methodologies that allow for testing of differing constellations or groupings of HIS and UCD prior to their implementation in clinical settings to reduce the likelihood of costs being associated with health professional adoption and appropriation failure. The authors of this book chapter will introduce a novel methodology that can be used to evaluate the cognitive-socio-technical fit of HISs and UCD prior to their implementation in real world clinical settings. This may prevent poor adoption and appropriation of these technologies. The authors will begin this chapter by first introducing the reader to the literature involving HIS and UCD successes and failures. This will be followed by a brief introduction to the theory of cognitive–socio-technical fit as applied to HIS and UCD in clinical settings. Following this, the authors of the book chapter will describe the new and emerging area of HIS evaluation involving the use of clinical simulations. This section of the book chapter will not only describe the background and rationale for using clinical simulations to evaluate HIS and UCD, but will also describe the steps in the evaluation method and provide examples from the authors' work. The authors will use examples from their previous research to illustrate the use of clinical simulations as an evaluation methodology for HIS and UCD.

The application of clinical simulations to the evaluation of HIS and UCD was pioneered by the authors and builds upon their previous work in the areas of clinical simulation and usability engineering (e.g. Borycki et al., 2009b; Kushniruk et al., 1992). Clinical simulations as applied to HIS and UCD evaluation in health informatics have their origins in the medical education and usability engineering literatures. Clinical simulations, when applied to the evaluation of a technology(ies), borrow from medical education, where clinical simulations are used to train physicians and evaluate their competency as health care practitioners (Issenberg et al., 1999). The author's work also extends the usability literature to clinical simulation by using many of the methods and analysis approaches employed by usability engineers to collect, record and analyze data involving HIS and UCD. Unlike the clinical simulation and usability literatures, clinical simulation when applied to the evaluation of HIS and UCD involves a more holistic evaluation of technology's impact upon the cognitive-socio-technical fit of health professionals' work. Lastly, this work also adds to the scientific knowledge in health informatics by identifying a new methodological approach that can be used by health informaticians to evaluate cognitive-socio-technical fit prior to HIS and UCD release and implementation. This approach has not been described elsewhere in the mainstream health informatics evaluation literature (e.g. Anderson & Aydin, 2005; Friedman & Wyatt, 2006; Shortliffe & Cimino, 2006) and is emergent in nature.