

# Chapter X

## Simulations to Assess Medication Administration Systems

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### ABSTRACT

*A range of new technologies/information systems are increasingly being used by nurses in healthcare organizations. These technologies/information systems are being implemented in clinical settings in order to reduce errors associated with the medication administration process. At present, few published articles report empirical findings on the effects of using electronic medication administration systems where nurses' work is concerned. This chapter reports that there are both intended and unintended consequences, associated with implementing such systems in the clinical setting. Simulation methods can be used to assess the impact of integrating new technology/information systems into the nurses' work environment prior to full-scale implementation of a health technology/information system. Simulations as an evaluative tool emerged from a direct need to assess unintended and intended consequences of health information systems upon nurses' work before systems are fully implemented. Simulations, as an evaluative methodology, emerged from the cognitive-socio-technical literature. Methods for analyzing workflow and conducting simulations of user behavior can be used to assess and improve the cognitive-*

*socio-technical fit of technologies/information systems. They can be used to identify work and workflow problems (i.e. unintended consequences) involving health technologies/information systems as they are designed, developed, procured, purchased and implemented. Nurse informatician use of simulations to assess and test health technologies/information systems will allow nurses to determine the impact of a new software and/or hardware upon aspects of nurses' work before its implementation to allow for appropriate system modifications.*

## **INTRODUCTION**

A recent focus on reducing medication error during the medication administration process has led to the introduction of many new technologies aimed at streamlining and supporting nurses' work in order to reduce errors made in the clinical setting. This streamlining has led to the use of new technologies such as the medication administration system (MAS), bar code reader, radio frequency identification device (RFID) and wireless medication administration cart. Although there have been many publications that have espoused the benefits of using each new technology, few studies have examined the implications of integrating these technologies into the work environment (e.g. Borycki, Kushniruk, Kuwata, & Kannry, 2006; Kushniruk, Borycki, Kuwata & Kannry, 2006). For example, a recent search conducted by the authors involving the search engine Medline using the key terms "electronic", "medication administration system" and "nurse" (i.e. May 2008), revealed few published articles (i.e. less than 10) reporting empirical findings about the effects of using electronic MAS upon nurse's work. In contrast, a plethora of opinion pieces and anecdotal accounts have been published. Furthermore, only a few studies have attempted to identify empirically based methods that could be used to predict the effects of MAS upon nurses' work before implementation.

Simulation methods are a promising methodology that can be used to assess the impact

of integrating a new technology/information system into the work environment prior to its implementation (e.g. Kushniruk et. al., 2006). Simulation as an evaluative tool emerged from a direct need to assess unintended and intended consequences of health information systems upon health professional work. Historically, simulations have been used in a number of industrial settings including aviation. Simulations can be used to evaluate device functionality, a software's ability to integrate into the work environment, and the interactions between software, hardware and its human operators in real world situations (Gaba, 2000; Issenberg, McGaghie, Petrusa, Gordon & Scalese, 2005). Industries that have effectively employed simulation in the development and testing of hardware and software for the real world include aviation (e.g. use of flight simulators to train pilots on the use of new aircraft), nuclear power (e.g. simulations of nuclear accidents to maintain software and hardware user competency and skills in responding to a unique or unusual crisis) and the education of health professionals (e.g. using programmable mannequins to train nurses on clinical skills and develop competencies prior to entering real world settings) (Issenberg et al., 2005). The use of simulations in the study of health technologies/information systems upon nurses' work prior to their being implemented in clinical settings is a relatively new application. Even so, simulations show considerable promise as a tool for studying the effects of technology/information systems upon nurse cognition and social interactions before their implementation.

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