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Review

Classification of antecedents towards safety use of health information technology: A systematic review

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ABSTRACT

Objectives: This paper provides a systematic review of safety use of health information technology (IT). The first objective is to identify the antecedents towards safety use of health IT by conducting systematic literature review (SLR). The second objective is to classify the identified antecedents based on the work system in Systems Engineering Initiative for Patient Safety (SEIPS) model and an extension of DeLone and McLean (D&M) information system (IS) success model.
Methods: A systematic literature review (SLR) was conducted from peer-reviewed scholarly publications between January 2000 and July 2014. SLR was carried out and reported based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) statement. The related articles were identified by searching the articles published in Science Direct, Medline, EMBASE, and CINAHL databases. Data extracted from the resultant studies included are to be analysed based on the work system in Systems Engineering Initiative for Patient Safety (SEIPS) model, and also from the extended DeLone and McLean (D&M) information system (IS) success model.
Results: 55 articles delineated to be antecedents that influenced the safety use of health IT were included for review. Antecedents were identified and then classified into five key categories. The categories are (1) person, (2) technology, (3) tasks, (4) organization, and (5) environment. Specifically, person is attributed by competence while technology is associated to system quality, information quality, and service quality. Tasks are attributed by task-related stressor. Organisation is related to training, organisation resources, and teamwork. Lastly, environment is attributed by physical layout, and noise.
Conclusions: This review provides evidence that the antecedents for safety use of health IT originated from both social and technical aspects. However, inappropriate health IT usage potentially increases the incidence of errors and produces new safety risks. The review cautions future implementation and adoption of health IT to carefully consider the complex interactions between social and technical elements propound in healthcare settings.

Contents

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1. Introduction

Patient safety refers to the freedom from medical error and accidental harm [1]. The Institute of Medicine (IOM) defines patient safety as the prevention of harm to patients [2]. It is often concern with medical error, adverse event, and preventable injury. A more recent definition from Vincent through his book on Patient Safety [3], highlighted patient safety as prevention of errors and improvement of adverse effects, or injuries to patients associated with the process of care. These three definitions presented no major differences on their definition of patient safety. Generally, patient safety is associated to the prevention from errors and harm. This study adapts the inclusive definition of patient safety articulated by IOM [2], and Vincent [3] whereby explicates patient safety as "the prevention of errors and harm to patient associated with the process of care". Thus, health information technology (IT) safety use is associated with the prevention of errors that could inflict harm to patient within the care process from the use of health IT.

Health IT is the overarching term applied to various information and communication technologies used to collect, transmit, display, or store patient data [4]. Wide range of different health IT emerged in healthcare systems. There are various types of health IT which include hospital information systems (HIS), electronic health record (EHR), computerized physician order entry (CPOE), electronic prescribing (e-prescribing), clinical decision support systems (CDSS), and bar-coded medication administration (BCMA). Many developed countries such as the United States of America (US), United Kingdom (UK), Australia, and Canada have proactively encouraged the implementation of health IT to enhance patient safety [5,6]. Indeed, Malaysia as a newly developed country has achieved significant progress in the development and utilisation of IT in the healthcare sector. The Malaysian Ministry of Health (MOH) under the Tele-health Flagship Applications has embarked on introducing the electronic HIS in several public hospitals known as the Total Hospital Information System (THIS) project [7].

Health IT objectives include the ability to diminish errors rate by preventing errors and adverse events while assisting a more quick feedback, and by tracking and providing responses about adverse events [8]. A previous study [9] conducted in a private hospital and two academic medical centre in US to investigate the effects of integrated electronic safeguards applications on medication errors. Their study revealed CPOE integrated with CDSS resulted in decreasing of prescribing errors rate, particularly for allergy detection omissions, excessive dosing, and incomplete or unclear orders. The systems implemented in each hospital interface to several other hospitals' computer systems, which provided information on laboratory results; radiology, and patient census. The systems provide order entry alerts such as allergy detection, therapeutic duplication, and inappropriate therapy. Besides, the systems were customised according to the hospital's requirements. Medication information technology team (MITT) led by the pharmacy director and several representatives from the hospital staffs and vendor was established in each hospital. The objective of MITT was to assist with implementation planning and provide input on the systems customization. In addition to the MITT, each hospital established a physician-led multidisciplinary team to identify operational workflow changes, and develop related policies and procedures. Hence, the quality of health IT that met the end users' requirement as well the involvement of end users during the implementation of health IT in addition to the systems developer led to the success of health IT implementation in reducing errors.

Although evidence showed that health IT can improve patient safety, there are also growing evidence indicating that health IT seemed to foster errors rather than reduce possibilities of errors [10]. IOM highlighted in "Health IT and Patient Safety: Building Safer Systems for Better Care" that the potential risks of patient safety associated with use of health IT as a result of improperly designed or implemented [11]. In addition to the IOM report, recent studies from 2012 to 2014 have revealed that the use of health IT may contribute to errors and pose risk to patients. One of the study conducted in 2012 by Abramson et al. [12] describe doctors' experience transitioning between locally developed EHR with minimal CDSS to a newer, commercial EHR with more robust CDSS for electronic prescribing (e-prescribing) at an academic-affiliated