Defining the Functional Requirements for the NFC-Based Medication Administration and Clinical Communication System

Maali Alabdulhafith
Faculty of Computer Science
Dalhousie University
Halifax, NS, Canada
maali@cs.dal.ca

Srinivas Sampalli
Faculty of Computer Science
Dalhousie University
Halifax, NS, Canada
srini@cs.dal.ca

Abstract— **Failure to confirm the 'five rights' of medication administration, verify contraindications, and effectively communicate with healthcare professionals are three major causes of bedside medication administration (BMA). These causes can be addressed by developing an efficient system integrated with wireless technology such as Near Field Communication (NFC). The long-term purpose of this research is to design a sufficient NFC-based system to overcome the major causes of BMA errors. Before we can design the system, we must first determine its functional requirements. Therefore, in this paper, we used theoretical and practical sources to form a clear picture of the BMA procedure. We identified the essential methods used in nursing practice to ensure safe BMA, and their limitation. Accordingly, we drew an initial technical concept of the system functions that will help us design the system.**

Keywords— NFC; medication errors; mhealth.

I. INTRODUCTION

Medication errors are a significant cause of morbidity and mortality. The Canadian Institute for Health Information reported 70,000 preventable medication errors occur annually and 33% of these errors result in death [1]. A study has shown that 41% of medication errors happen during the bedside medication administration (BMA) stage [2]. The major causes of BMA errors are the failure to (1) confirm the five *rights*[1]; (2) verify contraindications[2]; and (3) effectively communicate with other healthcare professionals [3][4][5].
Information technology and wireless interventions can be used as a solution to reduce the number of BMA errors. Near Field Communication (NFC) is a short-range wireless technology that transfers data between NFC-enabled devices (e.g. NFC-enabled smartphones) and NFC tags. The accessibility and simplicity of using NFC to identify objects increased its application in several areas of healthcare [6]. However, there is a limited literature on its use in the BMA process. We previously had utilized the NFC technology to prevent BMA errors related to known drug allergies and interactions [7]. The

technology was well received by the end users (nurses), which encouraged us to expand our study.

The long-term purpose of this research is to design a sufficient NFC-based system to overcome the major causes of BMA errors. Before we can design the system, we must first define its functional requirements, that is what the system should do and how it should do it. Thus, at this stage of our research, we used theoretical and practical sources to define the functional requirements of our NFC-based Medication Administration and Clinical Communication System (NFC-MACC). Our initial results helped us to comprehend the required steps taken in nursing practice, and the methods used to ensure safe medication administration (MA). It also highlighted some of the associated challenges.

II. RELATED WORK

A. Current Automated Medication Administration Systems

Different wireless technologies have been introduced and used in hospitals to help nurses in confirming the five *rights,* such as Barcode Medication Administration (BCMA) and Radio Frequency Identification Medication Administration (RFIDMA) [9][10]. Both technologies are used to identify the patient and the medication to confirm the five *rights* of MA and have shown a promising result in reducing the rate of medication errors. However, studies reported a number of technical and usability issues associated with their use, such as failing scanner, slow and inconvenient scanning, unreadable barcode or tags, difficulty in using the systems at the bedside due to their large size, and electromagnetic interface problems[3] [9][10].

In addition, in case of medication error, neither systems have an option to alert team members other than the nurse; and they do not support contraindication verification.

B. Current Communication Intervention Methods

---

[1] Giving the *right medication* to the *right patient* in the *right dose* by the *right route* at the *right time* [3].
[2] A condition or disease that serves as a reason to strictly stop a certain medication [11].

[3] For full explanation of BCMA and RFIDMA and how NFC technology overcome their limitations please refer to our previous study [7].

IEEE
computer
society