Towards a mLearning Training Solution to the Adoption of a CPOE system

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Abstract. Computerized Physician Order Entry (CPOE) has been introduced as a solution that can fundamentally change the way healthcare is provided, affecting all types of healthcare stakeholders and improving healthcare decisions, patient outcomes, patient safety and efficiency. However, a relatively small proportion of healthcare organizations have implemented CPOE systems, due to its technological complexity and to its low acceptance rate by healthcare professionals who largely disregard the value of CPOE in efficient healthcare delivery. An online training facility embedded within a CPOE service may increase the likelihood of its adoption by healthcare professionals as it offers them guidelines on how to perform each task of the CPOE service. In contrast to CPOE, on the other hand, handheld devices and other mobile technologies have showed an increased adoption rate. This paper considers a CPOE service that can be accessed by authorized healthcare professionals through their mobile devices anytime anywhere, and allows embedded training content, which has been developed through a learning management system (LMS) to be presented to the user automatically upon request.

Keywords. Healthcare information services; CPOE; mobile health; user training.

Introduction

Computerized physician order entry (CPOE) has been described as a technology that can improve the quality of health services, including the reduction of medication errors and adverse drug events that are on the top of the worldwide list of the factors contributing to the mortality of hospitalized patients [1,2]. One approach to alleviating the problem of medication error occurrences is for hospitals to implement a CPOE system for entering both diagnostic and therapeutic patient care orders, so that to reduce adverse drug events and to contain costs by increasing resource utilization and lowering the average length of hospital stays [1-3]. Despite the significant benefits of CPOE, hospitals have not yet adopted the technology to a large extent due to the complexity of the task and the high costs incurred. An additional important factor is the low acceptance rate by healthcare professionals due to their resistance to change [4]. Successful adoption of the CPOE service is mission-critical but in order to be achieved requires a major change in hospital operations and a severe commitment from hospital staff to attain the vision for change.

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The adoption (or lack of adoption) of any technology can be viewed using a theoretical framework of diffusion research, according to which individuals use several factors to decide whether to adopt a new technology, including the relative advantage, the ability to observe the impact, the compatibility with current practice and the complexity of the technology [4, 5].

Along these lines, key to the CPOE adoption can be for healthcare professionals to deal with change and to concede the relative advantage of this technology solution by observing the impact to the quality of care provided [4]. Also, healthcare professionals should be motivated by a 'healthcare professional-friendly' and task-oriented CPOE service that helps them accomplish their own tasks. A major part of the solution to the persistent problem of the CPOE service adoption by healthcare professionals and stakeholders alike should be the availability of an effective user training process based on technology-enhanced learning techniques that may render them knowledgeable users that appreciate the CPOE value in addition to facilitate them using the service with ease. The approach adopted need to take into account the fact that healthcare professionals are, in general, reluctant to devote more time and effort to explore IT systems and become comfortable and efficient with their use.

The CPOE can be more profitable if it is accessible from healthcare professionals, anytime and anywhere. To this end, this paper discusses the idea that a CPOE service can be offered through handheld devices such as smartphones and PDAs that have the capability to create, store, retrieve and transmit data in real time, across wireless networks [6]. Mobile technologies compress time and distance and, hence, have followed a significantly high adoption curve in healthcare. As mobile technology has advanced, mobile healthcare informatics (mHealth) applications are being developed and made available to smart portable devices [6,7,8].

On these grounds, this paper focuses on empowering CPOE adoption by healthcare professionals by providing online training material embedded into the CPOE service and offered through mobile devices based on the "what and when needed" principle. To this end, mLearning (mobile Learning) techniques are used so that training requires less effort and time while it provides task-oriented content that is always available through a quick access and full search functionality. Hence, training is incorporated into the CPOE service and, thus, viewed as part of the decision support process [8,9]. The development of mobile online training as part of a mHealth solution, the CPOE service in particular, can be considered as an acceptance incentive by healthcare professionals leading to significant improvement to the healthcare provided.

1. Motivating Scenario

The basic motivation for this research stems from our involvement in a project concerned with healthcare professional training on a CPOE service with the objective to increase its likelihood of acceptance and to assimilate and perform efficiently the CPOE procedures. The need for CPOE adoption motivated this work and provided the context for the development of the mobile online training material to be embedded into a mobile CPOE service. To illustrate the main principles of the training approach proposed, a CPOE scenario is described regarding an emergency situation that concerns the stabilization of a patient with chest pain, breathing difficulty and abdominal pain. In addition to the patient, the scenario involves a physician, a clinical pharmacist, a laboratory and a radiology department of a hospital:

- The physician accesses the CPOE mobile application through his handheld device and reads the summary record of his/her current patient
- The physician considers radiological imaging and laboratory evaluation
- The physician draws a therapeutic plan for the patient
- The healthcare plan is stored into the CPOE service in order to be available to healthcare professionals
- The physician orders more examinations and the examinations are shown as pending in the CPOE service
- If no more examinations are necessary the physician prescribes the necessary drugs
- The CPOE service checks for appropriate dosage, therapeutic duplication, drugdrug and drug-allergy interactions and alerts the physician for a prescription change
- The prescription is shown as pending in the CPOE service
- The physician re-evaluates the patient and the CPOE service in a timely manner
- Other healthcare professionals check the CPOE service and the patient condition in a timely manner.

2. Online training within a mobile CPOE service

CPOE has not been introduced recently in the healthcare domain. However, the rate of adoption is very low, mainly due to the fact that healthcare professionals are not convinced about the advantages that may occur from its use. Consider a CPOE service which is provided to healthcare professionals through their handheld and mobile devices via a wireless network. Online training is embedded into the CPOE service and activated by clicking the online learning button, providing the healthcare professionals with a clear picture of the clinical order process as well as optimal opportunities to practice with the sequence of the constituent activities of appropriate materials using the appropriate content (including multimedia) and continuing its reinforcement.

To enable healthcare professionals not only acquire knowledge about the training/learning objects but also learn the relations between them, a technologyenhanced learning technology is used that manages the administration of complete online training and provides authoring, sequencing, and aggregation tools that structure the content [10]. The Learning Content Management System (LCMS) as a subcomponent of a Learning Management System (LMS) promotes a complete integration of a technology-enhanced learning system, it is used to author and edit the content and it functions as an environment where developers can create, store, reuse, manage and deliver learning content from a central object repository [10].

The prototype learning system described in the proposed approach is represented in figure 1 and it consists of an LMS system called Docebo LMS, which is an opensource LMS/LCMS that offers several capabilities [11].

In particular, the implemented training content is embedded into the CPOE service and is accessible online by all authorized users that can access the mobile CPOE service via a wireless network. Docebo LMS permits the enabling or disabling of the contents of different course menus, thereby modifying the learning environment, while it also embeds multimedia content to enhance the learning material. It also includes a collaborative area which contains a wiki function that enhances cooperation and collaboration among healthcare professionals, anytime, anywhere. Finally, through the Docebo LMS, healthcare professional activities can be monitored through integrated reports that enable the LMS administrators use statistics to observe which pages have been browsed and which didactic models have been used and with what frequency. This function can be used as a means for improvement and sustainability of the online training content so that it can be changed dynamically to adapt to the learning needs of the healthcare professionals.

The main focus of the LCMS used is on achieving personalized learning on demand to drive performance, by delivering content to healthcare professionals to solve business problems. Thus, according to the motivated scenario, the healthcare professional can access the LCMS that is embedded into the CPOE service, in order to solve possible issues regarding the healthcare plan that should follow. The most critical issue is that the online training is accessible by his handheld or mobile device at the point of care. To this end, high quality of healthcare is provided, while redundant time, effort and cost are avoided.



Figure 1. The architecture of the training material embedded into the CPOE scenario

3. Results

The online training approach proposed in this paper is concerned with using a LMS/LCMS to develop and embed an online training process into a CPOE service so that to offer online training through handheld, mobile devices operating via a wireless network. Thus, the training content enables users to search through the LMS for learning objects/constructs, understand their meaning and usage with the help of the supportive text and the multimedia content and navigate to associated constructs.

The main advantages of the proposed approach are CPOE adoption and ease of use without further education and training, simply by pressing the online training button into the CPOE service. The CPOE service is accessible from authorized healthcare professionals anytime and anywhere through mobile technologies. Hence, healthcare professionals can reduce the time to plan a therapy and enter an order; also, they can reduce the distance to plan execution by the nursing staff since they are able to plan and send the therapy through their mobile devices away from the patient. Therefore, access to patient data is accelerated and efficiency of healthcare delivery is improved. More importantly, healthcare professionals can share standardized and best practice medical protocols, thus improving the quality of care provided.

4. Concluding remarks

In recent years, mHealth has been holding great promise for better public health, as it allows creating, storing, retrieving and transmitting data in real time across wireless networks to improve patient safety and the quality of care. Nevertheless, moving to effective deployment of mHealth technologies requires overcoming a series of challenges. This paper takes the stance that implementing a CPOE service may contribute to cost containment and healthcare quality improvement, that CPOE adoption by healthcare professionals is a necessity, that effective training is a factor of paramount importance towards user acceptance of IT and that a mobile, online training aid embedded into the CPOE service may provide the training system perceived "easeof-use" and "usefulness" required in order to facilitate CPOE adoption. Thus, an approach to structuring and providing training content in CPOE services as an online training system is proposed and a prototype has been developed which is available through mobile technology and it is based on a LMS embedded in the CPOE service.

Currently the prototype is being tested with regard to user convenience and increase of the CPOE service use rate based on intention. Due to the encouraging – thus far – results, it is intended to evaluate it more extensively using various healthcare processes so that to set mobile training technology find its acceptance for a broader use in healthcare informatics.

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