Quid Pro Quod: enhancing patient safety via minimizing human-computer interactions errors

Abstract

The present describes an initial research project aiming at **enhancing patient safety**. The overall goal is to **minimize human-computer interactions errors** that may occur via the use of Medical Information Systems (MIS) in health care units. The main idea is to extend the approach on design of usability and safety issues of generic medical devices, or safety critical systems design, to the problem domain of patient safety in the design of MIS. An understanding of errors and patient safety issues is presented and how these issues contribute to interaction errors in MIS. A plan of the research programm and related questions is presented. Is is expected that the outcome of a case study will be used for testing an evaluation framework, in development, that will take into account a rapid method for improving these aspects regarding the software development process.

Keywords: Human-factors, Medical Information Systems, Patient Safety, Human-computer interaction, Information Design.

1. The Problem

To (electronically) prescribe a wrong drug is fairly easy: a slip of a mouse-click is enough. How often do interaction errors like these generate wrong prescriptions? What costs are involved? What can be done to prevent or, at least, avoid them? Do software developers and designers realized the importance of the issue? What can be done to improve their software development efforts regarding preventing interaction errors?

The present describes an initial research programm aiming at **enhancing patient safety**. The overall goal is to **minimize human-computer interactions errors** that may occur via the use of Medical Information Systems (MIS) in health care units.

First we wish to measure what kind of and how often do (electronically) prescription errors occur. Next we will research what may cause them and how to develop barriers for avoiding their occurrences regarding Human interaction in Medical Information Systems. The target outcome is to reduce erroneous prescriptions and improve patient safety.

The next sections will give some insights about background research made so far about errors, ePrescription, and how we plan to contribute for reducing them.

2. Human Computer Interaction Errors

Medical Information Systems (MIS) is a complex world of software intensive systems that nowadays populate health care units giving support to their professionals in regular tasks. MIS have replaced traditional paper-supported information systems and are now the primary technology for information (re)presentation, processing and interaction. For example, paper written prescriptions have been replaced with Computerized Physician Order Entry (CPOE) or ePrescribing software typically processed via personal computer interaction. These systems can be integrated with Electronic Health Record (EHR) software systems used by clinicians to enter, modify, review and report patient conditions. Moreover, Picture Archiving and Communication Systems (PACS) are being used and, in some situations, even Computerized Decision Support Systems (CDSS) may also assist these professionals in their tasks.

The usage of these software intensive systems has elevated Human-Computer Interaction (HCI) reliability and fault tolerance issues into prominence. In the health area domain, human error was brought to public attention with the 1999 Institute of Medicine report, being considered as one of the major causes of adverse events on patient safety [1]. Human-computer interaction errors are a cause of adverse events introduced by the usage of these intensive software systems. These new errors, their risks and consequences, are not yet completely identified and systematized.

The concern with errors in medicine is systematically approached using a model of hierarchical sets, and inner sub-sets, revealing different levels of concern, in which, the individual level is at the core. Zhang states that errors can occur due to various factors at the level of Human-technology interaction, right next to the core level of the individual [2]. The author defends that the design of medical devices and systems must make certain (Human-computer

interaction) medical errors impossible, or, at least, minimize its probability. The use of information technology brings new kind of errors in medical area that ought to be prevented.

The builders of these software intensive systems are technicians who have to master the complexities of software languages and development process. Software engineers need norms or guidance in order to build more reliable software against these possible faulty aspects in HCI. For example, a miss-click in a similar named commercial drug is enough for originating a *quid pro quod* mistake, known as a Adverse Drug Event (defition taken from [3]).

Errors can be prevented by designing systems that make it hard for people to do the wrong thing and easy for people to do the right thing [1](preface). The proportion of adverse events attributable to errors that may have been prevented was found to be superior than 50% [1] (pp. 26, chapter 2) . The number of deaths due to preventable adverse events exceed the deaths attributable to motor vehicle accidents, breast cancer or AIDS [1](pp. 26, chapter 2).

3. Electronic Prescription issues

An adverse event is an injury caused by medical management rather than the underlying condition of the patient. An adverse event attributable to an error, as Human-Computer Interaction error, is a "preventable adverse event" [4].

Reason developed a well-recognized system for human error classification based on observations from industries that have become highly reliable such as aviation and nuclear power [5].

The medication process can be categorized into five broad stages: prescription, transcription, preparation, dispensation and administration. An error can occur at any point in this process. A medication error is any error in the medication process (whether there are adverse consequences or not). Studies indicate that medication errors account for 78% of serious medical errors [6] [3].

4. How to Avoid Interaction Errors

Many features about errors and accidents in other areas are also found in health care area but there are important differences. In most other areas, when an accident occurs the worker and the company are directly affected.

Think about an airplane crash or an accident in a nuclear central. In the health care domain, the injure may happen to a third party — the patient. Furthermore, generally the injure occurs to only one patient at a time, and not to large groups of people making the error less visible.

Evaluating and predicting patient safety in health care software interaction use is critical for developing interventions to reduce such errors either by redesigning software or, if redesign is not an option, by training users on the identified trouble spots in the software. Preventing errors and improving safety for patients require a systems approach in order to modify the conditions that contribute to errors [1](pp. 49, chapter 3).

The research programm will address the following questions: 1. How frequently do ePrescriptions errors occur? 2. What factors contribute to ePrescrptions errors? 3. What are the costs of ePrescrptions errors? 4. Do software engineers have a clear perception of safety risks in health care software development process? 5. What norms/guidelines/methodologies would help diminishing the rate of ePrescrptions errors?

Our hypothesis rely on adapting a methodology that will enable software developers to easily build barriers against Human-computer interaction errors thus enhancing patient safety.

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