

Computers in Emergency Medicine

IMPLEMENTATION OF AN EMERGENCY DEPARTMENT COMPUTER SYSTEM: DESIGN FEATURES THAT USERS VALUE

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Abstract—Background: Electronic medical records (EMRs) can potentially improve the efficiency and effectiveness of patient care, especially in the emergency department (ED) setting. Multiple barriers to implementation of EMR have been described. One important barrier is physician resistance. The “ED Dashboard” is an EMR developed in a busy tertiary care hospital ED. Its implementation was exceptionally smooth and successful. **Study Objectives:** We set out to examine the design features used in the development of the system and assess which of these features played an important role in the successful implementation of the ED Dashboard. **Methods:** An anonymous survey of users of the ED Dashboard was conducted in January and February 2009 to evaluate their perceptions of the degree of success of the implementation and the importance of the design features used in that success. **Results** were analyzed using SPSS software (SPSS Inc., Chicago, IL). **Results:** Of the 188 end-users approached, 175 (93%) completed the survey. Despite minimal training in the use of the system, 163 (93%) perceived the system as easy or extremely easy to use. Users agreed that the design features employed were important contributors to the system’s success. Being alerted when new test results were ready, the use of “most common” lists, and the use of color were features that were considered valuable to users. **Conclusion:** Success of a medical information system in a busy ED is, in part, dependent on careful attention to subtle details of system design. © 2011 Elsevier Inc.

Keywords—medical informatics; software design; emergency medicine; hospital information systems; computerized medical record system

INTRODUCTION

High-acuity patients, the lack of predictability of patient flow, and overcrowding are commonly reported in emergency departments (EDs) (1). These conditions can pose important challenges to providing care in a timely manner and may increase the risk of providing care of sub-optimal quality (2). The demand for emergency services cannot be controlled and is increasing in many parts of the world (3).

One intervention that could improve efficiency and quality of care in the ED setting is the implementation of electronic medical records (EMRs). Studies have shown that EMRs can improve both patient care and efficiency (4). Over the past few years, policymakers have pushed the adoption of EMRs as a means to cut the cost of health care, increase the efficiency of the health care system, improve quality of medical care, and increase patient satisfaction. Both Presidents Bush and Obama have called for universal adoption of EMRs and proposed legislation to encourage hospitals and medical practices to migrate to EMRs as part of their efforts to improve the health care system.

However, adoption of EMRs has been slow. A recent survey of United States hospitals showed that only 2% of acute care hospitals have comprehensive electronic records systems, and approximately 10% have what can be described as a basic system (5). Physician resistance is considered one of the more substantial barriers to adoption of EMRs, and clarity of design can be one reason for problematic implementation (6–9).

The American University of Beirut Medical Center (AUBMC) is a teaching hospital and referral center in Beirut, Lebanon. The ED, like most urban EDs, struggles to control problems with overcrowding and patient flow. Although the administration had been considering implementing an EMR for several years, none was purchased, primarily due to financial barriers. In 2005, we began to develop a computer system in house that would effectively track patients and improve other aspects of ED processes. The system was programmed using FoxPro (version 9 SP2; Microsoft Corporation, Redmond, WA) and runs on personal computers running Microsoft XP Professional over a Transmission Control Protocol/Internet Protocol intranet (a networking protocol allowing multiple computers to communicate). The result of our work was the AUBMC “ED Dashboard.”

When development of the ED Dashboard was complete, the developers set a plan for phased implementation and training of users. However, we were extremely surprised to find that training and phased implementation were not necessary; the system essentially “auto-implemented.” We were interested in gaining a better understanding of why the implementation of the ED Dashboard was so successful. We therefore decided to examine the design features used in the development of the system (Table 1)

and assess which of these features users valued and could therefore have played an important role in the successful implementation of the ED Dashboard (Figures 1–3) (10).

METHODS

An anonymous self-administered questionnaire was distributed to a convenience sample of end users between February and March 2009. A small paragraph explained the purpose of the study. The questionnaire consisted of two pages and included requests for some demographic information, information about previous experience with computers, questions about their previous use of medical information systems (“Users of electronic medical informatics”), and questions about the ED Dashboard. We utilized Likert scales to assess user perceptions. Completion of the questionnaire was entirely voluntary, consent being implied by completion. Participants were assured anonymity and that their answers would have no bearing on future evaluations. To ensure anonymity, the authors stepped out of the room the participants were in while questionnaires were distributed, completed, and collected. The study was approved by the Institutional Review Board at the American University of Beirut.

Table 1. Design Features Employed

Design Feature Employed	Description	Desired Effect
Virtual ED	ED displayed as cubicles approximating actual layout (Figure 1). When patients admitted to actual cubicle they are entered into a virtual cubicle on the ED Dashboard. As patients are moved, virtual selves are moved on Dashboard.	Increased level of organization of patients in minds of clinicians
Reactivity vs. proactivity	Dashboard interrogates LIS and RIS every 20 s. If new results found, “LAB” or “RAD” buttons turn red in patient’s virtual cubicle. Once reviewed, buttons turn green. New result – button turns red again. See Figure 2.	Clinicians reacting to results delivered in real time rather than proactively seeking results with possible consequent delays
Use of color	Background colors specify different ED sections. Patient assessed as being in pain leads to entire cubicle flashing red. ESI score color-coded within virtual cubicle (Figure 2).	Pattern recognition facilitating assimilation
Most-common lists	Most commonly ordered studies identified from existing laboratory/radiology databases. When orders placed, most common studies presented first (Figure 3). Less commonly ordered studies require search function.	Faster/easier ordering of vast majority of studies
Minimizing clicks	Conscious effort to minimize clicks at every opportunity. Radio buttons or checkboxes preferred over typing or dropdown menus. Optimizing displayed data to avoid resizing of windows or scrolling.	Easier navigation of system

ED = emergency department; LIS = Laboratory Information System; RIS = Radiology Information System; ESI = Emergency Severity Index (10).

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