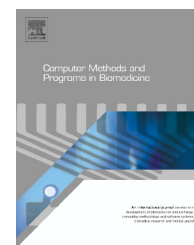




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# Impact of a computerized provider radiography order entry system without clinical decision support on emergency department medical imaging requests

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## ARTICLE INFO

### Article history:

Received 22 August 2015

Received in revised form

1 February 2016

Accepted 2 March 2016

### Keywords:

Diagnostic imaging

Emergency service

Hospital

Medical order entry systems

## ABSTRACT

**Background and objective:** The adoption of computerized physician order entry is an important cornerstone of using health information technology (HIT) in health care. The transition from paper to computer forms presents a change in physicians' practices. The main objective of this study was to investigate the impact of implementing a computer-based order entry (CPOE) system without clinical decision support on the number of radiographs ordered for patients admitted in the emergency department.

**Methods:** This single-center pre-/post-intervention study was conducted in January, 2013 (before CPOE period) and January, 2014 (after CPOE period) at the emergency department at Nîmes University Hospital. All patients admitted in the emergency department who had undergone medical imaging were included in the study.

**Results:** Emergency department admissions have increased since the implementation of CPOE (5388 in the period before CPOE implementation vs. 5808 patients after CPOE implementation,  $p = .008$ ). In the period before CPOE implementation, 2345 patients (44%) had undergone medical imaging; in the period after CPOE implementation, 2306 patients (40%) had undergone medical imaging ( $p = .008$ ). In the period before CPOE, 2916 medical imaging procedures were ordered; in the period after CPOE, 2876 medical imaging procedures were ordered ( $p = .006$ ). In the period before CPOE, 1885 radiographs were ordered; in the

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<http://dx.doi.org/10.1016/j.cmpb.2016.03.006>

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period after CPOE, 1776 radiographs were ordered ( $p < .001$ ). The time between emergency department admission and medical imaging did not vary between the two periods.

*Conclusions:* Our results show a decrease in the number of radiograph requests after a CPOE system without clinical decision support was implemented in our emergency department.

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## 1. Introduction

### 1.1. Background

The adoption of electronic health records and computerized physician order entry (CPOE) is an important cornerstone of health care policy. Computer-based order-entry systems are well suited to provide clinical decision support (CDS) to physicians during their regular work flow. In a systematic review, Georgiou et al. [1] revealed the potential for CPOE to contribute to effectiveness gains in imaging services. Computer-based order-entry may be a means to improve quality and its use in clinical practice has been associated with improvements in physician ordering patterns [2]. Evidence has been presented that 10–20% of medical imaging procedures are unnecessary [3] and CPOE has a positive effect in reducing unnecessary exams [4]. However, these studies were performed on CPOE with embedded CDS to remind physicians of the rules of good practice. Georgiou et al. [1] have shown that the studies reporting on the impact of CPOE without CDS were not as conclusive. It remains unknown whether a CPOE implementation without CDS changes clinicians' ordering patterns.

### 1.2. Importance

Changes in our emergency department (ED) have evolved from using a paper imaging form, written in a few seconds, to submission of an electronic request, which requires medical information to be completed by the requester. Although the electronic requirement was not considered burdensome and was easily completed, the electronic request took longer than the paper form to submit [5]. Indeed, it is often easier to ask for medical imaging than to critically think through the diagnosis [6]. Moreover, indications for radiographs like abdominal radiographs (AXRs) are rare (free intra-peritoneal air, air fluid levels in obstruction) [7] and guidelines found AXRs are of limited use in the evaluation of acute abdominal pain in the ED [8]. Our hypothesis is that the implementation of this new computer form might result in a decrease in requests for medical imaging, particularly radiographs.

### 1.3. Goals of this investigation

The main objective of this study was to investigate the impact of implementing a CPOE system without CDS on the number of radiographs ordered for patients seen in the ED. Secondary objectives were to investigate the impact on the number of CT scans, ultrasounds, and MRIs, and on the time taken between admission and medical imaging.

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## 2. Methods

### 2.1. Study design

This single-center pre-/post-intervention study was conducted in January, 2013 (pre-intervention period) and January, 2014 (post-intervention period) at the ED at Nîmes University Hospital. Our facility consists of an 870-bed (medicine, surgery, and obstetrics), university-affiliated tertiary care hospital with 76,000 inpatient admissions, 317,000 ambulatory visits, 75,000 ED visits, and 120,000 patient visits per year in the department of medical imaging.

### 2.2. Participants

All patients seen in the ED who had undergone medical imaging were included in the study. We did not have access to databases for examinations performed by non-radiologists, Doppler, scintigraphy, PET scans, or PET-MRI studies, hence they were not included. Since interventional procedures often require direct consultation with radiologists, these examinations were also not included in the analysis.

### 2.3. The medical imaging computer-based order entry system

Before medical imaging CPOE system implementation (pre-intervention period), all medical imaging was ordered by the physician using paper forms. The requests were done in a few seconds (the time to write two or three sentences), and often contained little medical information. In June 2013, the ED and the Department of Medical Imaging went live on a Web-enabled CPOE system (Cyberlab, MIPS, Gent, Belgium). Emergency department physicians and residents are able to request imaging orders using the CPOE, which requires more medical information to be completed for each imaging request. The new requests take longer to complete—approximately 2–4 min (cf. Annexes 1 and 2). Upon entering a password-protected login, the physician or resident creates an order for specific medical imaging from predetermined structured menus. The export of clinical data between software programs is not automated.

### 2.4. Measurements

For our study, the data collected were: age, gender, mode of arrival to ED, Canadian Triage and Acuity Scale (CTAS) on arrival, type and number of medical images, and time between ED admission and medical imaging performed. Medical and administrative information concerning the admission

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