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Does an integrated Emergency Department Information System change the sequence of clinical work? A mixed-method cross-site study

Joanne Callen^{a,*}, Ling Li^a, Andrew Georgiou^a, Richard Paoloni^b,
Kathryn Gibson^c, Julie Li^a, Michael Stewart^a, Jeffrey Braithwaite^a,
Johanna I. Westbrook^a

^a Centre for Health Systems and Safety Research, Australian Institute of Health Innovation, UNSW Medicine, The University of New South Wales, Kensington, Sydney, NSW 2052, Australia

^b Director of Emergency Medicine, Concord Repatriation and General Hospital, Concord, Sydney, NSW 2139, Australia

^c Rheumatology Department, Liverpool Hospital, Sydney, NSW 1871, Australia

ARTICLE INFO

Article history:

Received in revised form

26 August 2014

Accepted 27 August 2014

Keywords:

Medical history taking

Hospital information systems

Information seeking behaviour

Emergency care information systems

Evaluation studies

ABSTRACT

Objectives: (1) to describe Emergency Department (ED) physicians' and nurses' perceptions about the sequence of work related to patient management with use of an integrated Emergency Department Information System (EDIS), and (2) to measure changes in the sequence of clinician access to patient information.

Methods: A mixed method study was conducted in four metropolitan EDs. Each used the same EDIS which is a module of the hospitals' enterprise-wide clinical information system composed of many components of an electronic medical record. This enabled access to clinical and management information relating to patients attending all hospitals in the region. Phase one – data were collected from ED physicians and nurses ($n=97$) by 69 in-depth interviews, five focus groups (28 participants), and 26 h of observations. Phase two – physicians ($n=34$) in one ED were observed over 2 weeks. Data included whether and what type of information was accessed from the EDIS prior to first examination of the patient.

Results: Clinicians reported, and phase 2 observations confirmed, that the integrated EDIS led to changes to the order of information access, which held implications for when tests were ordered and results accessed. Most physicians accessed patient information using EDIS prior to taking the patients' first medical history (77/116; 66.4%, 95% CI: 57.8–75.0%). Previous discharge summaries (74%) and past test results (61%) were most frequently accessed and junior doctors were more likely to access electronic past history information than their senior colleagues ($\chi^2 = 20.717$, d.f. = 1, $p < 0.001$).

Conclusions: The integrated EDIS created new ways of working for ED clinicians. Such changes could hold positive implications for: time taken to reach a diagnosis and deliver treatments; length of stay; patient outcomes and experiences.

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* Corresponding author. Tel.: +61 2 93853867; fax: +61 2 93858280.

E-mail address: j.callen@unsw.edu.au (J. Callen).

<http://dx.doi.org/10.1016/j.ijmedinf.2014.08.010>

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1. Introduction

Information management in the Emergency Department (ED) is challenging. Care is delivered by teams, interruptions are routine, and patients present at any time with a range of problems requiring attention [1–5]. In this fast-paced, information intensive environment it is critical that physicians and nurses are able to communicate effectively with each other and with consultants and laboratories external to their department. It is often proposed that easy access to patients' clinical information, past and present, will lead to quicker and more appropriate diagnoses and treatment. ED clinicians are particularly vulnerable to having limited information available on patients they are treating, with one study identifying at least one information gap in 32.2% (95% CI 29.4–35.2%) of 1002 visits to a teaching hospital ED [6]. The potential of information and communication technology (ICT) to facilitate the management of health information has long been recognised [2,7–10]. However, adoption of Emergency Department Information Systems (EDISs) has been slow [11]. Even with the provision of incentives for meaningful use [12] fewer than 2% of EDs in the US are reported to have a fully functional EDIS [11].

The difficulty of integrating electronic systems into clinicians' work is often cited as a key factor influencing the slow uptake of ICT [13–15]. Studies which explore in-depth how clinicians use EDISs in real-life settings are valuable in understanding barriers to integration, as well as identifying unintended consequences of technology introduction [16,17], which can inform system design and integration. At a Consensus Conference of the American College of Emergency Physicians which focused specifically on ICT and its impact on emergency care, two of six key areas identified as needing research related to incorporation of ICT into ED physicians' work [9]. The trend to purchase off-the-shelf systems offering integrated information regardless of patient location provides impetus to evaluate the impact of commercial EDISs on how clinicians provide care [18].

Our aim was to describe Emergency Department (ED) physicians' and nurses' perceptions about how the introduction of an integrated Emergency Department Information System (EDIS) influenced their sequence of work and to quantitatively measure changes in the sequencing of clinician work.

2. Methods

2.1. Study design

A mixed methods design provided multiple perspectives on EDIS use [19,20]. This research was part of a larger study examining the use of ICT to support work practice innovation [21,22]. We have previously reported results relating to the impact of an integrated EDIS on the quality of care delivered in the ED [22]. In the previous paper we used qualitative data related to the interview/focus group question about whether the integrated EDIS had impacted on patient care. This paper reports on the impact of an integrated EDIS upon ED physicians and nurses work processes. We used different data from

the original large data set reported previously [22] for the qualitative aspect of this study (phase 1) and obtained further quantitative data (phase 2) to confirm the extent to which perceptions were consistent with observed behaviour. Ethics approvals were obtained from the study hospitals and the University of New South Wales, Sydney, Australia.

2.2. Study setting and population

Phase 1: The qualitative phase was undertaken in EDs in four Australian metropolitan public teaching hospitals between October 2009 and February 2011. Annual ED attendances ranged from 35,687 to 63,650 with hospital inpatient bed numbers ranging from 445 to 759. Hospitals were enrolled based on their use of the same commercial integrated EDIS (*Cerner FirstNet*). Physicians and nurses ($n=97$) were selected purposefully to reflect a broad range of junior and senior clinicians with variation in usage of the system. Sixty-nine semi-structured in-depth interviews were conducted with 42 senior physicians, 11 junior physicians and 16 senior nurses. In addition we undertook five focus groups (two with junior physicians, 14 participants in total; three with nurses, 14 participants in total) and 26 h of direct unstructured observations.

Phase 2: A key result from phase one was the perception amongst physicians that having access to an integrated EDIS changed their work flow and the order in which they accessed patients' past history information. We therefore developed a structured observation tool to measure the extent to which observed behaviours were consistent with reported perceptions. Observations recorded the order and frequency with which physicians accessed past medical history electronically prior to first seeing a patient. Phase two was undertaken in one of the four study sites EDs with 34 physicians and observations of 116 unique patient episodes.

2.3. Integrated Emergency Department Information System (EDIS)

Before implementation of the integrated EDIS the four EDs had stand-alone ED information systems which were not interfaced with other clinical systems in use at the hospitals. Between May 2007 and December 2008 all study EDs were upgraded to the new EDIS which was a module of the hospitals' enterprise-wide clinical information system (*Cerner HNA Millennium*). The integrated EDIS module (*Cerner FirstNet*) at each site allows access, via one log-in, to a common centralised database containing clinical and management information relating to patients attending all eleven hospitals in the region including the four study hospitals. *Cerner HNA Millennium* is a patient data repository which is composed of many components of an electronic medical record. It includes a Provider Order Entry function allowing orders to be placed for pathology, medical imaging, diets and transport requests. Clinical staff can view diagnostic test results, test order status, electronic discharge summaries from previous ED and inpatient admissions and other information such as ambulatory care notes across all hospitals in the region. *FirstNet* enables the creation of data relating to triage, mandatory reporting, initial patient management plans (including ED case history notes) and discharge summaries. Diagnostic

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