



What is the impact of an electronic test result acknowledgement system on Emergency Department physicians' work processes? A mixed-method pre-post observational study



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ABSTRACT

Objective: To examine the impact of an electronic Results Acknowledgement (eRA) system on emergency physicians' test result management work processes and the time taken to acknowledge microbiology and radiology test results for patients discharged from an Emergency Department (ED).

Methods: The impact of the eRA system was assessed in an Australian ED using: a) semi-structured interviews with senior emergency physicians; and b) a time and motion direct observational study of senior emergency physicians completing test acknowledgment pre and post the implementation of the eRA system.

Results: The eRA system led to changes in the way results and actions were collated, stored, documented and communicated. Although there was a non-significant increase in the average time taken to acknowledge results in the post period, most types of acknowledgements (other than simple acknowledgements) took less time to complete. The number of acknowledgements where physicians sought additional information from the Electronic Medical Record (EMR) rose from 12% pre to 20% post implementation of eRA.

Conclusions: Given that the type of results are unlikely to have changed significantly across the pre and post implementation periods, the increase in the time physicians spent accessing additional clinical information in the post period likely reflects the greater access to clinical information provided by the integrated electronic system. Easier access to clinical information may improve clinical decision making and enhance the quality of patient care. For instance, in situations where a senior clinician, not initially involved in the care process, is required to deal with the follow-up of non-normal results.

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1. Introduction

The usability of health information technology (IT) systems is a key factor affecting the ability of health IT to contribute

to the delivery of safe, high quality health care [1]. Numerous health IT applications across healthcare systems globally have been developed to support test result management processes, including systems that can track pending test results at hospital discharge [2], deliver result notifications to clinicians [3] and utilise tracking systems to document test result acknowledgement and subsequent clinical actions [3]. Nevertheless, research continues to point to challenges associated with the use of electronic test result management systems [4]. These include problems related to the potential for information overload [5], negative effects on the efficiency of

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work processes [6,7] and challenges in establishing appropriate escalation procedures to ensure test result follow-up [8].

Inefficiencies are often related to the time taken to use computers and the complexity of computer tasks [7,9]. It is therefore necessary to ensure that electronic test result management systems are developed to complement existing clinical work processes [10]. The aim of this study was to examine the impact of the introduction of an electronic results acknowledgement (eRA) system on emergency physicians' work processes and the time taken to manage microbiology and radiology test results for patients discharged directly from an ED.

2. Material and methods

2.1. Setting

The study was conducted in the ED of a 550-bed metropolitan teaching hospital in Sydney, Australia. The ED manages over 34,000 patient attendances per annum. Test result acknowledgements for all radiology and microbiology results for patients discharged from the ED are managed daily from Monday-Friday by emergency physicians who perform one administrative shift per week on a rotating roster. During this time they review and acknowledge all radiology and microbiology results received since the conclusion of the previous administrative shift. Prior to August 2013, paper copies of radiology and microbiology results were reviewed and acknowledged by the emergency physician on administrative duty using a date stamp and signature on the hard copy report, or in a patient's medical record [11]. An eRA system (Message Centre, Cerner Millennium, MO, USA) was implemented as an additional module to the existing EMR system, and replaced the manual eRA process in August 2013.

2.2. Intervention

The Cerner Millennium Message Centre is an electronic inpatient and outpatient workflow management module which comprises an Inbox containing documents and notifications requiring review, attention, or signature, including test result reports. Results of all microbiology and radiology tests ordered from the ED arrive electronically in the Inbox, and can be viewed by all authorised ED physicians through their personal account. Available results are displayed as a list of electronic reports, which may be sorted by a range of parameters including date, test type (microbiology or radiology), result status if flagged (normal, abnormal, critical) and whether the patient was admitted or discharged from the ED. Message Centre can be accessed from any computer in the hospital via the Cerner Millennium network, or remotely if clinicians have obtained secure access software for their computer or other device.

2.3. Study design

The impact of the eRA system, including effects on physician test acknowledgement work processes, and the amount of time taken to acknowledge results was assessed pre and post implementation of the eRA system using mixed methods comprising qualitative semi-structured interviews with all emergency physicians involved in the test acknowledgement process, and direct observation of emergency physicians undertaking the result acknowledgment process.

2.3.1. Semi-structured interviews

Semi-structured, in-depth interviews relating to physician test acknowledgement work processes pre and post eRA implementation were conducted with emergency physicians (n = 12) by two researchers (JC and JL) between December 2013 and April 2014.

Audio recordings were made of interviews during which physicians were asked to describe their result acknowledgement work process pre and post eRA implementation (interview guide in Appendix A). Participants were recruited following an email disseminated by the Director of the Department and were selected purposively based on their use of the eRA system and responsibility for test result acknowledgement.

2.3.2. Observation sessions

Researchers were provided with a roster and contacted each participant ahead of their scheduled administration shift to arrange a time to undertake observation. All participants provided written consent. A subset of seven emergency physicians were recruited purposively for direct observation based on their availability during the data collection periods. Five physicians participated in the pre-eRA data collection phase and six physicians were observed during the post-eRA data collection phase; four physicians were observed in both the pre and post intervention phases. Each participant took part in one pilot session, followed by two observation sessions in either the pre or post eRA phase, totalling 10 observations sessions pre- and 12 sessions post-eRA.

The Work Observation Method by Activity Timing (WOMBAT) method was utilised to conduct a direct observational time and motion study of physicians performing their test result acknowledgement process pre and post eRA. The WOMBAT tool is a validated data collection software that is adaptable to different study settings [12–14]. The WOMBAT data collection template was modified for the purposes of this study and finalised during pilot sessions in the pre-eRA data collection phase. Using a tablet computer, observers collected information about specific work tasks performed by the emergency physician (e.g., endorsing either radiology or microbiology reports), any additional information physicians required if the report warranted further investigation (e.g., an abnormal result may require review of past results in the patient's electronic health record to determine its clinical significance), actions taken and subsequent communication (e.g., contacting the patient or the patient's GP if the result was clinically significant), what documentation resulted due to the action taken (e.g., documentation in the patient notes), and who the doctor undertook this task with (if anyone) or if they used an artefact such as a telephone to undertake the task. Fig. 1 provides a screenshot of the data collection tool. Detailed definitions for tasks reported in this paper are available in Appendix B.

Each process of test acknowledgement began in the pre-eRA phase with the physician beginning to review individual reports from the paper test result reports collected from the dedicated fax/printer through which the radiology and microbiology departments transmitted result reports. Conclusion of the acknowledgement process was defined as the moment the physician placed an individually reviewed report into a designated tray for filing into the medical record. In the post eRA phase, the test acknowledgement process was defined as the period of time between the physician clicking open an electronic result report from the list in their Message Centre account, to when the same report is "clicked off" (electronically acknowledged by the click of a specific button), and the physician was taken back to the list view. Items under the Documentation section of the tool was modified in the post phase of the study to reflect the electronic locations for documenting follow up action or notes in the electronic test result endorsement system. Pre eRA sessions took place between 21 May and 17 June 2013 and post eRA sessions between 24 June and 21 August 2014, with the duration of each session determined by how long each participant took to endorse the results that they had been allocated for that shift (from 2 min to 70 min). As information was entered into the

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