Measuring the impact of online evidence retrieval systems using critical incidents & journey mapping

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Abstract

Online evidence retrieval systems are one potential tool in supporting evidence-based practice. We have undertaken a program of research to investigate how hospital-based clinicians (doctors, nurses and allied health professionals) use these systems, factors influencing use and their impact on decision-making and health care delivery. A central component of this work has been the development and testing of a broad range of evaluation techniques. This paper provides an overview of the results obtained from three stages of this evaluation and details the results derived from the final stage which sought to test two methods for assessing the integration of an online evidence system and its impact on decision making and patient care. The critical incident and journey mapping techniques were applied. Semi-structured interviews were conducted with 29 clinicians who were experienced users of the online evidence system. Clinicians were asked to described recent instances in which the information obtained using the online evidence system was especially helpful with their work. A grounded approach to data analysis was taken producing three categories of impact. The journey mapping technique was adapted as a method to describe and quantify clinicians’ integration of CIAP into their practice and the impact of this on patient care. The analogy of a journey is used to capture the many stages in this integration process, from introduction to the system to full integration into everyday clinical practice with measurable outcomes. Transcribed interview accounts of system use were mapped against the journey stages and scored. Clinicians generated 85 critical incidents and one quarter of these provided specific examples of system use leading to improvements in patient care. The journey mapping technique proved to be a useful method for providing a quantification of the ways and extent to which clinicians had integrated system use into practice, and insights into how information systems can influence organisational culture. Further work is required on this technique to assess its value as an evaluation method. The study demonstrates the strength of a triangulated evidence approach to assessing the use and impact of online clinical evidence systems.

Keywords: Information retrieval; Evaluation; Medical informatics; Journey mapping, Evidence-based medicine

1. Introduction

Provision of online evidence systems to support clinical work at the point-of-care has been adopted as a strategy to support evidence-based practice in the UK, USA and Australia.[1-3] Few evaluations of their effectiveness have been reported. Most studies have focused on assessing frequency of use.[4] Measuring the impact of an information system on clinical practice is problematic. There are many potentially confounding variables for which it is often not possible to control. Thus establishing the relationship between online evidence use and changes in clinical practice and patient outcomes is difficult. There are few studies that have attempted
The state of New South Wales, Australia implemented the Clinical Information Access Program (www.ciap.health.nsw.gov.au) a website providing around 55,000 clinicians’ (doctors, nurses and allied health professionals) with 24 hour access to evidence at the point-of-care in public health care facilities. A two year evaluation was undertaken to assess the extent to which the system was used, supports clinical decision-making and results in improvements to patient care. A triangulated research program consisted of four stages of data collection. Results from the first three stages have been reported elsewhere and are summarised below.

**Stage one - Web log analysis:** An analysis of 7 months of CIAP web-logs of the 55,000 clinicians who have access allowed a quantification of the rates of use by geographical Area Health Services, hospitals and professional groups. Considerable variation in the rates of use for individual hospitals and professional groups was found.[5] Medical staff used CIAP at double the rate of nursing staff. Results showed that use of CIAP was related to patient care decisions. For example, searching activity was highly positively correlated with patient admissions at individual hospitals. The wide variation in use required further investigation to understand factors related to high and low use organizations. Stage two sought to address these issues.

**Stage two - Case Studies:** In-depth case studies investigated the influence of professional and organisational factors on health professionals’ use of CIAP. Results from focus groups, interviews and surveys from clinical groups within three case study sites identified a range of cultural, organisational and team factors which were important in explaining variations in CIAP use within and between professional groups and hospitals.[6] Positive promotion of CIAP, and support and encouragement to use it were major factors influencing use. Nurses and allied health staff reported needing most support in the effective retrieval of information. CIAP was used by all three professional groups. Doctors were the highest users and most likely to use CIAP for patient care. Nurses’ awareness of CIAP was the lowest of the three groups.

Technical issues were also highlighted but were found not to be the central factor influencing CIAP use. Investigation of the association between clinical team functioning and use of CIAP to improve patient care produced interesting results, demonstrating that well-functioning teams were more likely to report effective use of CIAP. However clinical team functioning was not associated with greater awareness of CIAP.[7]

**Stage three - State-wide survey:** A statewide survey of 5,511 clinicians (doctors, nurses and allied health professionals) from a random selection of 65 hospitals was undertaken to determine awareness and use of CIAP, how and why clinicians use, or do not use, online evidence, technical issues related to use of CIAP, and clinicians’ perceptions of its impact on clinical care.

The survey showed that 63% of clinicians had heard of CIAP and of those who had, 75% had used it. Colleagues were the primary channel via which clinicians heard about CIAP. The survey results reinforced the key findings of the log analysis and in-depth cases study findings. For example, clinicians’ actual and reported use of CIAP was consistent in terms of types of resources used. Clinicians’ views about the importance of organisational factors in supporting an evidence-based approach to care and the integrated use of CIAP, reported during the focus groups in stage two, were reflected in the survey responses from the respondents. The survey identified high levels of satisfaction with the technical features of CIAP, such as ease of use and search speed. Analysis of the log data indicated that use was related to direct patient care decisions and the survey results reinforced this with, for example, 55% of doctors reporting that they had had direct experience of CIAP use resulting in improved patient care. There were significant differences between professional groups[8] and also between senior and junior clinicians[9] within the same profession. For example, senior and specialist nurses had more positive attitudes to use, perceived more support and legitimation for its use, and reported more frequent use than
did junior nurses. [10]

The results from stages 1-3 provided the context and direction for the last stage of the evaluation which sought to pilot two techniques, critical incident[11] and journey mapping[12], to assess integration of the use of CIAP and impact on clinical decision-making and patient care. These methods create a narrative of change from the perspective of system users allowing an examination of professional and organisational cultural changes and how users experience these changes. Few studies have attempted to assess the impact of online evidence systems on clinicians’ practice and outcomes of care. The largest was conducted by Lindberg et al[13], who applied the critical incident technique to survey 552 US physicians about their use of MEDLINE. Physicians reported using MEDLINE for a range of clinical tasks, from choosing diagnostic tests to developing treatment plans. In 2% of instances of MEDLINE use physicians reported finding essential information that led to saving patients’ lives or sparing limbs and organs.

Two US studies used surveys to examine clinician satisfaction with hospital library services and the reported impact of the information provided on patient care.[14, 15] King [15] surveyed a random sample of physicians, nurses and other health providers in eight hospitals. Doctors reported using the library more than nurses and other health professionals. All groups reported that over 90% of the information obtained was of clinical value and influenced their clinical decisions, contributing to increased quality of care. The second study surveyed physicians in one hospital, who reported a positive response to the hospital library service.[14] In 80% of reported cases, information obtained from the library changed or influenced clinical decisions. However, both studies had low response rates, limiting interpretation of the results.

The introduction of MEDLINE into clinical settings in a US hospital was evaluated through interviews with a random sample of physicians who participated in MEDLINE training. Physicians reported that 47% of searches influenced their clinical decisions, most frequently through confirmation of a decision[16]. Another study found that length of stay was shorter for patients for whom a MEDLINE search had been conducted earlier in their hospitalisation. A causal relationship could not be established and a number of confounding factors such as the severity of patients’ conditions limited interpretation of the findings.[17] There have been no reported studies of the clinical impact of access to an electronic resource such as CIAP, where multiple databases are accessible at the point of care.

2. Methods

Sixteen Clinical Nurse Specialists (CNS) and 13 hospital-based specialist physicians were selected who were experienced and regular CIAP users. A three-part semi-structured interview schedule was used. The first two parts were designed to obtain information about critical incidents. First, clinicians were asked to recall examples of when CIAP had been helpful in their clinical work. For each, a series of questions was asked about the type of information sought, databases used, impact of having the information and outcome of the clinical situation. Second, clinicians were asked to recall any searches that had been unsatisfactory.
A grounded approach was taken to coding the interviews.[18, 19] Initially, two researchers coded each critical incident independently. Subsequently in several meetings, coding was clarified and refined until agreement was reached on each category. In this way, categories of the types of impacts were developed. The third part of the interview elicited information about clinician’s CIAP journey. Transcribed interview accounts were then mapped against the journey stages and levels and scored (Figure 1). The technique was adapted[12] as a method to quantify clinicians’ integration of CIAP into practice and patient care. The analogy used to capture the many stages in this process. A journey must commence with an introduction to CIAP (stage 1) and each stage in the journey represents a level of integration of CIAP into practice ending at stage 5 (changes in clinical practice and patient outcomes). Scores are assigned to different levels and stages in the journey. The higher the journey score the further a clinician has integrated the use of CIAP into his/her clinical practice.

3. Results

In total, 85 incidents were described by 29 clinicians interviewed. The average was 3 per clinician (range 1-5). Three categories of impact were derived: micro clinical impacts (a positive clinical impact, but no specific outcomes could be identified; eg 31% of incidents involved a policy change); macro impacts (a positive impact with some objective measurement of the outcomes reported; and impacts on the clinicians (Box 1); eg 45% of clinicians reported that use of CIAP improved confidence in their decisions. One quarter of all incidents relating to CIAP use, resulted in measurable improvements in patient outcomes. These included improvements in medication use, improved management of

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**Box 1 Example of CIAP use changing clinician behaviour**

CNs (peri-operative care): “[CIAP] has helped us make it more evidence based and make it more grounded in good information and not just the ritual”

**Box 2 Example of CIAP use for a differential diagnosis**

Specialist (anaesthetics): “a patient had had an unusual metabolic acidosis after major surgery in the recovery room. In the recovery room here we have access to CIAP and we looked through Harrison’s for a differential diagnosis for metabolic acidosis and that helped us solve the problem.”

**Box 3 Example of CIAP use improving patient health**

Specialist (renal): “a patient who had peritonitis which he’d got from a bug he’d picked up in Central Australia….I found the epidemiology, which antibiotics to use, the formula for treatment...We were able to treat the patient successfully”
complications, differential diagnosis, and identification of effective treatment for drug
interactions (Box 2 & 3 for examples of reported incidents).

The journey mapping technique was found to be a useful measure for quantifying changes
in clinicians’ actions, behaviours, and clinical practice, which occurred in association with CIAP
use. The results demonstrated that among this sample of active users all had reached stage 5.

Total scores for the CNSs and doctors did not differ significantly. Thus among active
CIAP users CNCs and doctors appear equally likely to achieve optimal benefits. Individuals did
however report very different CIAP journeys. For example, one CNS had contributed to the
promotion of CIAP across her organisation, but described no macro clinical impacts. The
emergency department CNS described major changes to her information-seeking behaviour and
had overcome some barriers to using CIAP. The ICU physician specialist reported that his
information-seeking behaviour had changed through the availability of CIAP, but he had not been
active in promoting CIAP locally or in any broader context. In contrast, the anaesthetist described
instances where information gained via CIAP contributed to improvements in clinical practice,
but CIAP availability had not changed his information-seeking behaviour to the same degree as
his colleagues.

4. Discussion

The data from the critical incidents provided an enhanced understanding of how the online
evidence system was being used in clinical practice and reinforced the information gained from
other stages of the evaluation. These narratives of system use are an important ingredient in
beginning to understand how real-world culture change occurs. Clinicians were able to relate
clear narratives of how CIAP use had impacted on patient care. The journey mapping technique
proved to be a useful method for quantifying changes in clinicians’ actions, behaviours and
clinical practice which occurred in association with CIAP use and demonstrated how integration
of such technologies is rarely a linear process. Clinicians had individual stories about how use
had influenced their practice and the care of their patients. The sample was highly selective and
it is likely that a random sample would reveal clinicians who were content with integrating CIAP
at lower levels and who may never proceed to stage 5. For an organisation journey mapping may
provide a useful measure for assessing the level of integration beyond rates or frequency of use.
However further testing using larger, more heterogeneous samples would be beneficial.

More broadly, studies of these type realise accounts of situated practice which may be
part of a longitudinal trend of new cultures of information use. Ultimately, new information
systems must positively influence clinical practice and organisational culture, otherwise claims of
their benefits are unlikely to be sustained.

5. Acknowledgements

We would like to acknowledge Dr Sophie Gosling’s contribution to the original study design and
data collection while at the Centre for Health Informatics.
6. References