A case study evaluation of a Critical Care Information System adoption using the socio-technical and fit approach

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ABSTRACT

Background: Clinical information systems have long been used in intensive care units but reports on their adoption and benefits are limited. This study evaluated a Critical Care Information System implementation.

Methods: A case study summative evaluation was conducted, employing observation, interview, and document analysis in operating theatres and 16-bed adult intensive care units in a 400-bed Malaysian tertiary referral centre from the perspectives of users (nurses and physicians), management, and information technology staff. System implementation, factors influencing adoption, fit between these factors, and the impact of the Critical Care Information System were evaluated after eight months of operation.

Results: Positive influences on system adoption were associated with technical factors, including system ease of use, usefulness, and information relevancy; human factors, particularly user attitude; and organisational factors, namely clinical process-technology alignment and champions. Organisational factors such as planning, project management, training, technology support, turnover rate, clinical workload, and communication were barriers to system implementation and use. Recommendations to improve the current system problems were discussed. Most nursing staff positively perceived the system's reduction of documentation and data access time, giving them more time with patients. System acceptance varied among doctors. System use also had positive impacts on timesaving, data quality, and clinical workflow.

Conclusions: Critical Care Information Systems is crucial and has great potentials in enhancing and delivering critical care. However, the case study findings showed that the system faced complex challenges and was underutilised despite its potential. The role of socio-technical factors and their fit in realizing the potential of Critical Care Information Systems requires continuous, in-depth evaluation and stakeholder understanding and acknowledgement. The comprehensive and specific evaluation measures of the Human–Organisation–Technology Fit framework can flexibly evaluate Critical Care Information Systems.

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1. Introduction

1.1. Scientific background

Although Health Information Systems (HIS) have seen rapid development and broad adoption, HIS stakeholders experience familiar levels of disappointment associated with more general system development. Failures are highly evident, prevalent, and costly [1,2]. The importance of HIS is generally acknowledged in healthcare but its accomplishments are not yet 'fit for purpose' [2]. HIS are unable to support clinical workflow efficacy [3] and generate unintentional consequences that can harm patients significantly [4,5]. System disappointments are typically caused by the inability of HIS to match healthcare work patterns and settings, creating use barriers. Health informatics studies included the concept of alignment or 'fit' to describe the essential interdependency of all human, organisation, and technology factors [6–10]; additional steps to evaluate fit across all three factors were taken in this study.

Despite a notable increase in health informatics adoption research from a socio-technical perspective, study objectives remain focused on technological system accomplishments [11]. A social science orientation is neither strongly present in socio-technical analyses nor well understood within health informatics, especially its underlying theories, concepts, and principles [11]. It has not garnered sufficient research attention [12]. Therefore, more HIS adoption evaluation studies from socio-technical perspectives and a social science orientation would improve HIS and assist the healthcare process through experience. We can use these influencing factors to guide future investment in and development of HIS.

1.2. Rationale for the study

A Critical Care Information System (CCIS) adoption was evaluated to identify the influencing factors and their fit between human, organisation, and technology in clinical practice using the proposed Human–Organisation–Technology Fit (HOT-fit) model [13,14]. The CCIS at a tertiary care centre (TCC) was evaluated to identify adoption issues and problems in the technical and non-technical aspects of the system. Input to the strategic information systems plan (SISP) of the case study setting will aid in future improvement and development of the system and other HIS in use.

1.3. Objectives of the study

The purposes of the study are to (1) assess CCIS adoption level and issues in achieving its desired outcomes which subsequently affect healthcare delivery; (2) examine current CCIS implementation status; and (3) identify lessons from influential adoption factors to inform decision making. The study considered multiple stakeholder viewpoints, including those of users, IT staff, and management. Formal permission was obtained from the TCC ethics committee before conducting this study.

2. Study context

2.1. Organisational setting

The CCIS was evaluated at two 16-bed adult intensive care units (ICUs) and two operating theatres (OTs) in a 400-bed private, non-profit TCC in Malaysia.

2.2. System details and system in use

The CCIS is used for managing critical care in the ICUs and OTs of the TCC. It was purchased and customised for the TCC organisational setting to automate anaesthesia documentation and optimise patient care, throughput, and reimbursement. The system was initiated in October 2008 but was fully implemented by May 2010, two years before the present case study was conducted; no similar system existed before it. The aim of the CCIS was to provide a paperless environment and improve patient care and safety in intensive care provision. It had a centralised patient repository that performed numerous functions, such as management of automatic charting (including vital signs), bedside device data, laboratory data, pathology reports, medication orders, planned interventions, and other related data for nursing care and monitoring, anaesthesia care, surgical care, and allied health. The CCIS was linked to bedside devices, and medical devices (e.g. connectors and integrators).

The system users used the system for data management, analysis, and reporting only. System use was compulsory for nurses but voluntary for doctors. Nurses used the system for charting and generating nursing progress notes and reports on a daily basis. Doctors used the system for patient care planning and census generation from patients, while allied health professionals, particularly physiotherapists, used it to monitor patient progress.

A usage statistics record was not available. The clinicians' team requested that the vendor provide login counts by user and department to test the hypothesis that those who complained were not those who used the system. This was shown in the login counts, including that surgeons did not log in as frequently as anaesthesiologists did. The CCIS was under-utilised, despite its potential. Nurses had a better perception of the system than did doctors. The system was used as envisaged by the users in the OT, but not in the ICU.

3. Methods

3.1. Study design

A subjectivist case study strategy employing qualitative methods was used in this summative evaluation study. A subjectivist approach enabled comprehensive understanding of the healthcare context surrounding the CCIS by generating detailed, insightful explanations [15]. Further, qualitative methods generated a fuller description of the healthcare setting and its cultural issues to help understand why the system functioned well or poorly. Interviews, participant observation, and document/artefact analysis were employed