

A TIME MOTION STUDY EVALUATING THE IMPACT OF INFORMATION TECHNOLOGY ON EMERGENCY DEPARTMENT CONSULTANTS ACTIVITIES

Research in Progress

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Abstract

Studies on health information systems are often focused on assessing the usefulness of such systems, however they lack detailed insights on how such systems affect multitasking and the amount of time spent on patient care activities as this impacts the quality of care. This is a time motion study based on a single case study methodology where consultants in an emergency department will be observed and interviewed with the aim of evaluating the impact of information system use in an emergency department in a metropolitan hospital in Australia. The study is a 3 stage study which is building on data from two previous studies that were conducted in the same setting in 2008 and in 2012. Data analysis from the two previous studies have revealed that more time is spent on communication and clinical care activities, also the analysis showed that the role of the physician as well as the gender influences how time is spent on the different tasks. The evaluations will be based on predefined task categories to investigate how time is spent on IT supported tasks vs non-IT supported tasks, this is key to the implementation of systems that meet user expectations and are fit for purpose.

Keywords: Emergency Department, Information Technology, Multitasking, Time-motion Studies.

1 Introduction

Information technology use in healthcare is seen as strategic in creating efficiencies and improvements that are cost effective and beneficial to patients (Shekelle, Morton and Keeler, 2006). In emergency medicine, information technology is ideal in supporting the collaborative work and information needs of clinicians thus optimising the delivery of better patient care (Berg 2003; Taylor 2004; Laxmisan et al 2007) in terms of timely treatment, attendance and execution and the reduction of ED waiting time. These improvements can result from a multiplicity of factors including improvements in workflow (Lederman and Firth, 2005) and changes in work routine (Peng et al, 2012). The emergency department (ED) is different from other medical environments in that it is often chaotic as a result of a coexistence of inpatients, outpatients and critical patients where doctors are forced to multitask in order to promote patient safety and provide quality care (Fairbanks et al, 2010). This leads to complexities that often arise due to factors such as the variation in patient conditions, demand for prioritisation by care providers, shortage of resources such as beds, longer waiting times, which makes the ED workflow non-linear and challenging (Wang, 2009; Lederman et al, 2008). Therefore, information systems implementation in ED should take into consideration the criticality and complexity of ED processes, tasks and decision making demands by reflecting an understanding of the processes and ensuring that the implemented solutions supplant but do not diminish the utility of the existing system (Pennathur et al, 2007).

It has been reported in some studies that the lack of use or reluctance towards system use in emergency departments has been attributed to its disruption of the workflow, and the suggestion is the implementation of systems that are fit for purpose – meet the needs of users and fit in with the workflow (Thorn, Carter and Bailey, 2014). Also it is important to understand how information technology use affect time utilisation in the ED as this forms the basis for implementation of information technology that is acceptable by the intended users as well as provide an insight into how information technology use affects the time spent in providing care to patients (Pizziferri et al, 2005).

1.1 Context of the study

This is a three stage study which is building on previous studies that were conducted in 2008 (Kee et al, 2012; Peng et al, 2010) and 2012 in the emergency department of a large hospital in Australia (Peng et al, 2012; Lederman et al, 2015; Peng et al, 2013). The 2008 study was focused on evaluating how consultants spend time in carrying out clinical activities and non-clinical activities by quantifying the proportion of time consultants spend on pre-determined task categories with a focus on multi-tasking. When this study was conducted, paper based patient records were still in use and the EDIS (Emergency Department Information System) was used to document the patient pathway from arrival till consultation. The study was conducted over a period of 2 months with a total of over 130 hours of recorded observations of duty and resuscitation consultants. On each hourly observation, it was recorded that a total of 101 tasks were performed by the consultants. The second study was conducted for 59 days over a period of 5 months, the observations were based on the structuration theory to determine the patterns of work activities that emerge during the implementation of an information system and quantify the time spent on activities that are involved in direct care of patients and also activities involved in indirect patient activities. The analysis of the data from both studies have revealed the following:

- The biggest proportion of time is spent on communication tasks
- The different work roles have an impact on how much time is spent on different tasks – duty consultants spend more time in communication with other nursing staff and on the phone communication, resuscitation consultants spend twice as much time communicating with patients family members, thrice the amount of time on communicating events with students and four times as much time communicating with personnel.

- In clinical care, resuscitation consultants had a higher task rate than duty consultants as well as spending more time in clinical care tasks and this is due to the nature of their responsibilities in the ED; the resuscitation consultant is responsible for critical care including attending to critically ill patients as well as performing complex procedures.
- Comparison by gender revealed that there was a higher hourly task execution rate exhibited by females in comparison to their male counterparts. Female consultants spent more time on communication, computer use and documentation and less on transiting and non-clinical tasks. Computer use differed according to different roles as well as gender, duty consultants spent more time using the computer than resuscitation consultants. In the ED, duty consultants have an administrative role which involves dealing with patient flow information such as incoming patients and patient transfers, thus the longer amount of time spent on the computer.

Based on the findings from the data analysis of the two previous studies, this study aims at quantifying the amount of time spent on the different tasks and evaluating the impact of information technology on IT supported clinical activities vs non-IT clinical activities and also assessing the interplay between the role of the consultant as well as the role of gender. Consultants will be observed for a period of time based on predefined categories and will also be interviewed to gain insights into their work patterns and measure the time spent on IT supported clinical activities versus non-IT supported clinical activities. This is important in providing a detailed account of IT by looking at the duration and the activities and tasks that are performed and the findings will be useful in supporting decision making in IT acquisition and implementation in health care and specifically in an ED setting.

2 Literature Review

The use of time motion studies have been in existence since the early twenties as a result of a recognition of inefficiencies and a wastage of resources from industrial processes which led to the development of techniques aimed at reducing process times to achieve efficiency (Taylor, 1914). This technique was also adopted in the healthcare industry to assess inefficiencies and promote cost reduction (Gilbreth, 1914; Baumgart and Neuhauser, 2009). This has seen the integration of information technology in the healthcare sector which is driven by the need to improve efficiency, quality and reduce costs (Chaudhry et al, 2006; Silow-Carroll, Edwards and Rodin, 2012) and is often aimed at achieving benefits such as improved healthcare quality and safety as well as optimisation of healthcare related cost (Jones et al 2014; Callen et al, 2013). In ED, health information technology (HIT) is often implemented to support the dynamics and variations that exist in the reactive and adaptive emergency care environments (Bengtsson, and Lennartson, 2014). It has been reported that HIT capabilities lead to improvement in ED efficiency by reducing waiting times and improved turnaround times when ordering tests and medications during patient visits (Landman et al, 2010; Selck and Decker, 2016; Lederman and Dreyfus, 2014).

Despite the advantages of HIT in ED, the implementation of information systems in emergency departments is often perceived as disruptive to work routines and the workflow. This as noted by Rodriguez, Aziz, and Chatwin, (2014, p.88), is due to the fact that “emergency departments (EDs) workflows require robust coordination between resources for treatment, referral, admission and discharge purposes in order to maintain a swift and accurate patient flow through the different stages during their ED visit”. Information system studies in regards to workflow have shown that users often experience difficulty in integrating the technology in their routine clinical practices, and despite the perceived benefits of the technology, difficulties have been reported in assimilating the use of the technology in their work (Callen et al, 2013). These difficulties as stated by the authors are in relation to significant data entry demands required and the time taken and are often seen as contributing to workflow disruptions. Studying time as a resource and how it is distributed in a technologically

supported environment allows insights into the impact of such technological advances. Introduction of technology to healthcare settings often disrupts the workflow as shown in a study which aimed at quantifying the impact of IT on workflow, it was revealed that time to execute tasks is often affected and the workflow is also often fragmented (Zheng et al, 2010), it is therefore essential to conduct time motion studies to evaluate the impact of technology use on clinician workflows.

The literature also raises questions of how much technology can reinforce status, occupational identity and authority in health settings (Novek, 2002) which can be particularly pertinent to gender issues. Recent studies have in fact found significant gender differences in doctors activity rates that are not easily explained by differences in working hours but suggest more complex issues to do with gender expectations and socialisation that are worthy of further exploration (Jefferson et al, 2015).

2.1 Time motion studies in healthcare

In order to understand the actual use of information technology in ED and gain insights into how information technology impacts clinical efficiency it is imperative that the work processes and workflows are studied by measuring such impacts through the quantification of time spent on IT based activities vs non IT based activities through continuous observations (Zheng, Guo and Hanauer, 2011). As noted by the authors, “to develop such an understanding requires rigorously conducted research that can generate compatible and comparable results to inform effective technology designs and implementation approaches” (Zheng, Guo, and Hanauer, 2011, p.704). The effect of HIT on clinical activities is at times mixed, with studies showing increase in time related to computer use and others showing a slight decrease in documentation time due to the streamlining of the workflow, however these studies lack long term evaluations (Chaudhry et al, 2006).

Studies have been done to quantify the time medical professionals spend in executing their tasks to determine how much time is spent on direct patient care as this promotes better patient care and patient satisfaction (Westbrook et al, 2011). Time-motion studies have been conducted in health care settings such as emergency department, general medicine and surgical environment to assess if medical practitioners maximise the time spent on patient care by timing their activities (Hollingsworth et al, 1998). In a study to determine the impact of a computer physician order entry (CPOE) in a paediatric ward, a time motion study was conducted before and after the implementation to assess how physicians allocate their time in regards to patient care, by determining whether the time they spend using the CPOE will reduce their contact time with patients. The observations were conducted using a tablet and they were categorised as direct patient care, indirect patient care and other, each having sub categories. The findings revealed that more time was spent on the computer and this was allocated to indirect patient care activities, but time spent with patients did not decrease (Yen et al, 2009).

Another study by Perry et al (2013) conducted in a level 1 trauma centre to compare the proportion of time that emergency radiologists and emergency physicians spend in patient evaluation tasks revealed that emergency physicians spent most of their time in assessment and mitigation (59.8%) and emergency radiologists spent more time on determining physical findings and improving turnaround times of ED patients (61.8%) and the findings also highlighted the interplay between the two specialities in providing care to patients. In another study conducted by Chisholm et al (2011), where physicians from two emergency departments were shadowed to compare their work activities as an evaluation of systems as interventions in the emergency workplace, the findings showed that physicians in an academic setting spent 64 minutes of a two hour shift in indirect care of patients and 36 minutes in direct patient care, also the study showed that physicians in community settings spent more time on indirect patient care activities where 55 minutes of a two hour shift was spent on such activities while 41 minutes were spent on direct patient care. The outcomes of this study did not show

much of an increase in comparison to the time motion study conducted by Hollingsworth et al (1998) which assessed how physicians and nurses allocated their time to departmental activities, there is not much of a noticeable change in the amount of time spent by physicians in both direct and indirect patient care activities. As reported in the outcomes of the study, indirect patient care activities accounted for 47% of the clinician's time and 32% of the time was spent on direct patient care.

In the above studies, transit time decreased significantly and this can be attributed to easier access to computerised information sources and the decreased need for face to face exchange of information. Other observational studies have been conducted to enable a comprehensive description of the ED environment which is useful in evaluating future strategic interventions in the ED work place, however they lack a detailed overview of how technological innovations affect the execution of such activities and tasks. One study conducted on the impact of a computerised order entry system on paediatric physicians to assess whether an increase in the amount of time spent on the computer will affect time spent on direct care to patients revealed an increase in time spent on non-clinical activities (Yen et al, 2009).

3 Methodology

Overall this mixed method study addresses the need to better understand the impact of IT in an ED by focusing on the time spent on activities and task execution. The rationale for the evaluation is to explore the impact of technology use on clinical activities and identify patterns of use in order to generate findings that can inform the design of IT based interventions that will promote better patient care. The evaluation will use a mixed methods case study based approach where both quantitative and qualitative methods will be employed to obtain the needed information. Using mixed methods provides more evidence and an in-depth understanding of the results since the combined use of both the qualitative and quantitative methods in a single evaluation will yield results that a single approach may not yield and also because the limitations of using either method is offset by the other (Creswell and Clark 2011). A mixed methods approach also creates a synergy whereby one method enables the other to be more effective and together both methods would provide a complete understanding of the evaluation (Greene and Caracelli 1997).

A case study research approach will be used as it enables a focus on an intensive assessment of events that occur within the structure of the organisation and the selection of cases is representative of the phenomenon under study (Wynn and Williams, 2012). A case study methodology as explained by Benbasat, Goldstein and Mead (1987) allows a valuable insight into phenomenon being studied by answering the how and why questions thereby allowing the complexities of the unit to be studied intensely. The authors also advocates for the use of the case study methodology in information systems research due to the shift from technical to organisational focus of research on information systems and the ability of the methodology to allow the capturing of knowledge of practitioners as well as enabling the development of theories. Case study is suitable for this study since it's an exploratory study, the case study methodology as noted by Yen (2003), allows for results to be interpreted directly and allows transferability of solutions. As stated by Gomm et al (2000), good case studies allow for the recognition of complexity of social truths as well as the generalisability of a solution or instances of that solution.

We have received University and Hospital ethics approval for his study. Continuous observations and interviews will be conducted with the participants. Continuous observation is effective as an observation technique since an observer records the activities thus ensuring the accuracy of the results (Ampt, et al, 2007). Preliminary observations were carried out at random times for a period of 1 month, three times a week. The weekdays were chosen at random and the observations started with

shadowing one consultant for a 3 hr evening shift. This was aimed at gaining an understanding of the emergency department and familiarising the researcher with the research setting. The preliminary observations were recorded on a note pad and they allowed insights into consultants' roles and responsibilities towards clinical care and how the information system in place supports them.

In this study we will follow the methodology detailed in the previous two studies (Kee et al, 2012; Peng et al, 2010; Peng et al , 2012; Lederman, et al, 2015; Peng et al, 2013) . In sum, the medical staff will be shadowed for a period of time using a tablet that has a time stamp software to capture the activities being performed as well as to time the execution of the activities. This technique has been adopted by a few studies in Australia (Westbrook et al, 2008; Lo, Burke and Westbrook, 2010), with the aim to quantify the time medical staff spent in patient care activities. The 35- 40 minute interviews will be conducted with the staff that were shadowed, the interview questions will be semi structured since this method offers flexibility by allowing more questions to be asked based on the responses of the respondents. When conducting semi structured interviews 'open, direct, verbal questions are used to elicit detailed narratives and stories' (DiCicco-Bloom and Crabtree 2006) as cited in Whiting (2008, p. 36). Due to the nature of the phenomenon being studied, semi structured interviews are a suitable method of data collection as they allow the participants to provide more information which gave more insight and enriched the quality of the data obtained from them. The interview questions will be organised around specific themes and based on the interviewee responses, more questions will be explored in order to get an in-depth understanding of the phenomena being studied.

Following up from the previous findings on gender, additional questions will be added in this study to those asked in 2008 and 2012. We intend particularly to focus on the issues raised by Jefferson et al, cited above, who suggested that patient expectations of female behavior led to longer instances of psycho-social communication between patients and doctors. This issue will be explored in greater depth in interviews with consultants.

The shadowing will be based on the following predefined categories which reflect the activities that are carried out in the ED workplace:

- Clinical care
- Communication (incoming/outgoing)
- Computer use
- Transiting
- Documentation

4 Conclusion

In this study we continue into stage 3 of a longitudinal study which examines how the introduction of Information Systems can impact on organizational change over time with regard to the time and distribution of patient related activities. With the increase in female practitioners it is imperative that more is known about the differences between genders with regard to task execution and how these differences relate to technological and non-technological tasks. We hope to explore avenues for reaching a deeper understanding than previous studies which have tended to focus on differences in working hours and habits as opposed to broader sociological and cultural issues that affect the ways tasks are carried out. A final goal of the project is a systematic and practical way of managing the implementation of hospital IS for better achievement of intended organisational goals.

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