Success Factors Associated With Health Information Systems Implementation: A Study of an Australian Regional Hospital

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Abstract

This paper identifies five factors from the literature that are important for the successful implementation of health information systems (HIS). The HIS factors identified include stakeholder engagement, the support of management and local champions, understanding HIS imposed change, user training and the impact of government incentives. The paper further explored the introduction of a commonly used HIS (Medical Director®) in a regional Australian hospital and used the implementation factors as a guide for reporting stakeholder perceptions of the system. The implementation of the HIS in view of the systems users was a failure with all factors except the training issues poorly addressed. The study also reports the practicalities encountered with the system's introduction and documents several new operational factors that were found to be associated with HIS implementation. Overall, the factors provided a sound criterion on which to judge the implementation performance (success or otherwise) of the HIS. The factors identified have the potential to be used as a guide by others who are engaged with information systems in the health area.

Keywords

Health information systems, regional hospitals, systems implementation

Introduction

Enormous investment has gone into computerised health information systems (HIS) worldwide, with the operation and up-keep of such systems in the clinical environment assumed to compose a notable component of a hospital's running costs. Given the importance of HIS, the perceived benefit of adopting these types of systems tends to be underreported. In one of the few published works on health care systems evaluation, a high proportion of HIS implementations are considered to have failed with questionable outcomes (Littlejohns, Wyatt and Garvican 2003). The effective use of computer systems in health care can potentially help save lives that may otherwise be lost. They are able to improve delivery of medicines; lower the cost of public health and improve business efficiency (Health Management Technology 2001).

Health expenditure by the Australian Federal government in 2004 was A$72.2 billion and corresponded to 9.5% of GDP – some A$23 billion was dedicated to hospital expenditure (Australian Institute of Health and Welfare 2004). Furthermore, this figure has doubled over the last four decades with Australia spending a similar proportion of its GDP on health as Canada and France; more than Japan, New Zealand and the United Kingdom, but less than the USA. Indeed, Hillman (1999) indicates that as many as

14,000 preventable deaths may occur each year in Australian hospitals – a figure that may be underestimated due to the voluntary reporting system in place (Noble 2003). Dearne (2003) refers to the significant number of patients that die due to medical errors each year in the US – errors that potentially can be reduced with the introduction of health information technology. Arguably, the ability to reduce these errors and mishaps from a medical management perspective is central in efforts to improve health quality, resulting in lower health care costs (Barach and Small 2000). Furthermore, it has also been established that manual administering systems have accounted for one in three adverse reactions to prescription drugs where a patient with a known allergy has been overlooked by medical staff (Bates, Cullen, Laird, Petersen, Small, Servi and al 1995).

This paper identifies important (critical success) factors that need to be considered for successful HIS implementation. Furthermore, the implementation of a HIS in a regional Australian hospital setting was investigated from this success factor perspective as a means of establishing the suitability of these factors.

Health Information Systems and Success Factors

The identification of critical success factors in organisations when first proposed allowed organisations to quickly identify those things that must go right for them to succeed and indeed, thrive to achieve competitive performance (Rockart 1979). Since Rockart's initial proposal that critical success factors were an important management tool, the concept of success factors has received significant attention as a methodology with which to examine the implementation of information systems (IS).

Moreover, the identification and application of success factors with respect of IS implementation can also be industry specific – whereby a set of governing success factors are shaped and peculiar to the organisation's operating environment. Indeed, within the realms of information systems/technology adoption there is a basic three-stage concept that tends to underpin user acceptance – an initial reaction to the use of the system; this initial reaction is followed by intention to use the system that leads to the actual use of that system (Venkatesh, Morris, Davis and Davis 2003). Given the fundamental concept associated with information systems adoption/acceptance, this study rather than examining the broad literature on general IS adoption, draws specifically from the HIS related literature to identify the pertinent health factors. Arguably, within the health care area the introduction of health information systems has tended to lag behind other high profile areas such as financial services, banking and manufacturing. Moreover, the health care sector has its own operation forces that tend to be directed by government policy, medical work practices, professional training and duties as well as regulatory controls (Davidson and Chiasson 2005) – all issues that can be viewed as influencing the selection of factors when implementing a HIS.

The general impact of introducing information systems in an organization could be viewed as a technical matter removed from organisational dynamics – simply an implementation process where there is a rollout of technology. There is however, substantial agreement that the success of information systems tends to be determined by organisational factors (Aarts, Doorewaard and Berg 2004) – which in a health care situation have been strongly associated with involving users in the implementation process as well as having management support for the project (Fish and Turner 1999). Within the health sphere it could be argued that the commensurate medical benefits – both patient-centric and from an organisational perspective – justify the potentially disruptive nature of introducing information systems. However, the desirable introduction of new technology by health care organisations can be greatly assisted by considering key implementation success factors that are particular to the health care environment.

Aspects Of HIS Implementation

The benefit of introducing a HIS assumes a smooth transition from the traditional systems requirements analysis through to implementation. However, there is substantial evidence that suggests successful

implementation of medical and health information systems is determined by various organisational factors (Aarts et al. 2004). Lorenzi (2004) indicates that when implementing information systems in general medical practice there are non-technical issues that need to be addressed – issues that include identifying the requirements necessary for HIS expansion, poor understanding and communication with both computer systems vendors and health care staff and a lack of investment in user training. The published literature on health systems implementation has also identified important success factors that include stakeholder participation (Bowditch and Buono 2001; Sittig 2001; Souther 2001; Wolf 2001; Frabotta 2002; Weiner, Savitz, Bernard and Pucci 2004); the understanding and management of change (Coiera 1999; Sittig 2001; Heckley 2004; Kotter 1995); support from management and the influence of local information systems champions (Ash 1997; Pare and Elam 1998; Weiner et al. 2004); the importance of user training (Blignaut, McDonald and Tolmie 2001; Ammenwerth, Mansmann, Iller and Eichstädter 2003; Weiner et al. 2004); and government support and/or policy influence (Benson 2002; Heckley 2004; Cochrane 2005). Thus, from the literature it is possible to identify and categorise the pertinent and relevant success factors necessary for successful health systems implementation – success factors that tend to be associated with stakeholder participation, understanding change, management support and local champions, user training and government influence.

Stakeholder participation

The need to include clinical personnel (both doctors and nurses) in the decision-making process when implementing computers is well supported by the HIS literature (Bowditch and Buono 2001; Frabotta 2002). A recent study (Weiner et al. 2004) examined the implementation of HIS across a number of hospitals and found that regardless of the size, organisational structure or management styles (top-down/bottom-up) in all projects recognised clinicians as playing a pivotal role in systems adoption. Furthermore, the study concluded that clinical personnel provided input into the design of IT systems as well as leadership in project implementation. Various other studies also allude to the involvement of the health user as an important success factor when implementing HIS. Sittig (2001) re-iterates that users must clearly see the need for any new HIS if they are to support the challenges posed by accompanying change; other authors (Souther 2001; Wolf 2001) reinforce the importance of user buy-in if a project is to succeed.

Understanding HIS induced change

General research of information systems adoption indicates that there must be an awareness of the significant changes that occur during the stages of adoption, and that change-related problems can have potentially devastating consequences (Kotter 1995). Coiera (1999) considers organisational culture as an important factor when innovations are introduced, suggesting that steady incremental change is a better approach than disruptive and radical methods. Indeed, changing a clinician's behaviour in the medical workplace is acknowledged to be a perplexing and challenging issue when it comes to IT adoption (Heckley 2004). Sittig (2001) alludes to the positive perceptions of key and organisational leadership as an important change-management factor that need to be considered in HIS implementation. Sittig (2001) also notes that studies that examined the implementation of clinical information systems generally conclude that successful systems adoption must match the organization in relation to a variety issues that are:

- Technical – does the new system work on the currently installed hardware?
- Social – does the system provide all the features and functions required to replace the current elaborately designed formal and informal communication networks?
- Organisational – does the system support the mission of the organization?

Hence, in an endeavour to facilitate the successful introduction of HIS, health care organisations need to consider and understand the importance that organisational change with need to be addressed as part of an implementation strategy.

Management support and local champions

Pare and Elam (1998) reported that senior management must be able to understand and address the challenges associated with the introduction of IT systems in a clinical health setting – a factor that appears to allow the organisation to capitalise on opportunities for quality improvement and cost reductions. Weiner et al in their study of hospitals found that:

> *"Perhaps the most striking finding….indicated that senior managers rarely provided adoption leadership in terms of either championing the system or motivating the adoption decision process by identifying IT needs through strategic planning or goal setting."*
>
> (Weiner et al. 2004 p. 58)

Weiner and colleagues further report that it was the 'enterprising clinicians' that identified the health-related IT needs and opportunities before persuading senior managers to make the adoption decisions. Within the functional areas of systems implementation, there appears to be an important role for the supporters of new innovations. These local champions must actively and enthusiastically promote the system, build support and overcome resistance amongst the composite user groups, with the aim of ensuring that the system is actually installed and used (Ash 1997).

User training

The introduction of HIS tends to also impact on the immediate and future training requirements of an organisation. Weiner et al (2004) indicate that extensive training tends to be generally required due to the low IT-based skill levels of doctors and other clinical staff. Training may encompassing simple tasks such as how to use new and basic system hardware (such as mouse actions and functions), or may require familiarisation with knowledge intensive HIS applications. A recent two year study into the adoption of information systems by nursing staff identified that an important success factor that influenced the acceptance of a newly implemented documentation system was associated with the existing self-confidence nursing staff had when using computers (Ammenwerth et al. 2003). Arguably, HIS training instils a perceived sense of confidence in clinical staff. Furthermore, it needs to be acknowledged that at least six months of user interaction and HIS operation may be required before increased staff productivity is evident – allowing for a more tangible evaluation (rather than immediate perceived successes) of the technology's introduction (Blignaut et al. 2001).

Government influence

It has been reported that general medical clinicians tend to use computers in their consulting rooms, whereas the hospital doctor is reluctant or does not have the incentive (Benson 2002). Benson further explains that large differences in computerisation between general practitioners and hospital doctors are found in countries where general practitioners play a gatekeeper role in controlling access to secondary health care. Historically, medical clinicians in general practice worked with government agencies to remove impediments to the uptake and successful use of computers. Doctors had major incentives when running their practices – practices that depict characteristics often associated with small business – to utilise computerisation to reduce business overheads. Within the larger healthcare organisation the clinicians have ostensibly been one step removed from HIS implementation. In this type of environment, computing has been generally treated as a management overhead with doctors given no realistic incentives to become involved (Benson 2002). Moreover, the issue of appropriate funding by government is certainly the key to many past and present projects (Cochrane 2005) with Benson (2002) indicating that government leadership and economic incentive are crucial to future HIS implementation – this in an environment where it is believed that clinicians tend to respond to financial incentives (Heckley 2004). Indeed, there needs to be a general recognition that Government has a leadership role to provide appropriate incentives and funding to adopt new HIS.

Five success factors were thus identified from the HIS implementation literature. Each factor has an affiliated set of practices that health care organisations would do well to address to improve the likelihood of successful systems operation and acceptance. These factors and the identified practices are summarised in Table 1. Of these success factors, organisations such as hospitals can have a clear influence on four of the success factors. The only factor they have little control over (other than lobbying) is g*overnment influence*.

Table 1: Identified HIS implementation factors and practices

Implementation Success Factor	**Organisational HIS Implementation Practices**
Stakeholder participation	Inclusion and recognition of clinical personnel in the HIS decision-making process. Recognise the important role of clinical personnel in project leadership and their contribution to HIS design. Identification of user-related systems requirements associated with new HIS.
Understanding Change	Have an overt understanding that significant impacts can occur with HIS implementation and that steady incremental change is a better approach than disruptive and radical approaches. Recognise that the clinician's working behaviour as a perplexing issue (possibly unique personal/occupational attributes compared to other professionals) Canvas the views of key and organisational leadership on the HIS project. Identify and match organisational technical, social and organisation domains to the proposed HIS.
Management support and local champions	Recognising the adoption leadership role of senior management in: • motivating the decision-making process • identifying HIS needs through strategic planning or goal setting Identify and encourage enterprising clinicians (HIS champions) that understand IT needs to persuade senior managers to adopt HIS. Identify and recognise the enthusiastic role that supporters of new innovations (the local champions) have as alleviators of potential resistance to HIS adoption.
User training	Identify and plan for the immediate and future organisational training requirements. Understand that clinical staff training requirements can be wide ranging, starting from a low skill base through to extensive HIS instruction. Recognise the value of existing computing skills that allow staff to be self-confidence when using computers. Allow an appropriate time period before user success and HIS productivity improvements are evaluated.
Government Influence	Recognition that Government has a role to provide appropriate incentives and funding to adopt new HIS. Address and alleviate the perception that HIS is a management (non-clinical) overhead in larger health care organisations by involving clinicians in HIS.

Research Design and Methodology

This study emerged from discussions between the authors (researchers at Victoria University) and a Division of General Practice (which have been set up throughout Australia to support local GPs and their staff to continuously improve the quality of general practice and the health of the local community) in the State of Victoria. An indication was given by the Division that suggested that there was a need to automate the recording of clinical information in the Accident and Emergency (A&E) department of a small rural hospital that was in the boundaries of the Division. Thus, the university and Division jointly funded the introduction of the HIS (described later in the paper) as a scoping study for the introduction of such systems on a wider scale. After assisting with the funding of the initial system, the university did not participate in its implementation, or its usage, at all. The university subsequently funded a research assistant to conduct the interviews described below.

Although the research project could be loosely described as action research (as the initial joint funding of the project did obviously influence the outcomes of then project), the non-participation of the university in anything to do with implementation means that it is probably more accurate to describe the research approach as that of a case study (Williamson 2002).

The HIS – Medical Director®

The HIS in this study was Medical Director® (MD). MD is a clinical software package used by some 85% of general medical clinicians in Australia. As such, the application assists some 16,000 doctors to record and dispense some 90 million prescriptions to patients (Health Communication Network 2004). In general terms, MD functionality provides the clinician with a powerful application that records data, manages patient appointments, handles third party pathology/radiology reports, facilitates billing and allows professional letter writing. Indeed, the broad and successful adoption of MD in general medical practice has been associated with a set of well-understood computer requirements that have been identified as providing significant clinical support for the Australian doctor (Tomlins R and Power P 1998; RACGP Health Informatics Task Group 1999; Richards, Bolton, Veale and Quinlan 1999; Benson 2002). MD was designed for use via the general practitioner desktop, however, in the few studies that examined the adoption of MD in a hospital environment the software evaluation has been undertaken to address clinical outcomes rather than from a systems implementation perspective. For example, a study that examined the adoption of MD by a regional hospital used computerised prescribing as a basis for developing the fundamental evaluation factors in gauging the success of the software (Newby, Fryer and Henry 2003). Arguably, the small hospital setting should be amenable to the implementation of MD allowing for the commensurate set of benefits that are enjoyed by the broader group of general medical practitioners (GMP).

The HIS focus – Accident and Emergency (A&E) Department

The study examined the introduction of a common and well-known clinical patient management system, Medical Director (MD), into the hospital setting. The doctors that were associated with the A&E department were (as a general rule) visiting medical officers to the hospital. They also had external medical practices and thus a relatively high familiarity with using the MD software.

The A&E department was identified as potentially gaining significant benefits from the introduction of this HIS where it was envisioned that the system would alleviate the errors associated with clinical note taking and patient data collection. It was also felt that the system would improve access to patient information from various locations within the hospital area as well reducing some of the onerous paper work that was currently prevalent in the department.

The introduction of the system was intended to function within the existing operational protocol common to the A&E area in an endeavour to minimise patient impact and procedural change. The procedural aspects of the A&E area involved:

- Patients first presenting at A&E and being attended to by nursing staff for admission (first data collection point).
- Whilst the patient waits to be attended by a doctor, various medical tests and clinical observations are recorded (a second series of data collection episodes).
- Finally, the treating medical practitioner sees the patient, dealing with clinical issues and management (third data collection point).

The study

A concerted effort was made to gain the user's perspective with respect to the introduction of MD in the A&E area. The primary data collection for the study was drawn from interviews undertaken with those involved in the implementation and use of the new software system. Individual and group interviews, as well as relevant implementation documents were utilised as part of the data collection process. Interviews can be a significant primary tool to gauge an in depth understanding of aspects of the system being studied and typically form a major part of the data collection for case studies (Williamson 2002). In terms of interview structure and guidance, the identified set of success factors were used to form and shape responses from interviewees. All interviews were recorded and then transcribed. Transcriptions were then manually analysed for common and/or emergent themes that related to the HIS success factors. One research assistant was used to conduct interviews and examine data resources in an endeavour to minimise data collection and interpretation anomalies. The research was of an exploratory nature and called for careful sifting and examination of data – a process that does not easily allow data to be automated and computerised – hence, manual data analysis was used in preference to using qualitative data analysis software. Typically, as data was gathered from various sources the researcher was able to identify similarities and differences from the information obtained. Data was collected from three types of users affiliated with the introduction of the system. The characteristic of data sources used in the study are summarised in Table 2.

Table 2: Data Sources – 3 types of users

Data Sources (Interviewees)	Description
General Medical Practitioners (GMPs)	The doctors (n=8) that agreed to participate in the study had all a relatively short, but informative interview to gauge their perceptions of the HIS.
Nursing Staff	Nurses that participated in the study were organised in two small groups (n=8) that allowed their collective perceptions of the new system to be recorded.
Implementation support officer	The local division of general medical practice supported the project by training nurses and GPs in systems use, documentation, specialised information system support to develop the project. The implementation officer was also one of the authors of the paper and was able provide relevant perceptions associated with the adoption of the HIS.

For the purpose of this study MD is the HIS that was implemented in a small hospital setting. Indeed, the terms HIS and MD tend to be utilised interchangeably throughout this article when discussing the study. Furthermore, the study uses the identified HIS success factors and important organisational implementation practices to direct the researchers in their data collection activities. Hence, the general research question that guided the study involved capturing the various stakeholder perceptions with respect to the introduction of the HIS. Results are reported as selective summaries of HIS users' perceptions under the different success factor categories. Summaries have also been structured and inter-dispersed with participant quotations to reflect typical user views.

Results and Discussion

User perceptions associated with the introduction of MD were gathered and reported across the areas identified as being important for successful HIS implementation – stakeholder participation, management support and local champions, understanding HIS imposed change, user training and the impact of government incentives. In the A&E setting the important users of the system were the GMPs and nursing staff – an aspect of the study that is reflected by the significant contribution these two groups make in reporting outcomes associated with the MD implementation process.

Stakeholder participation

It is important to engage prospective stakeholders in the preliminary HIS decision-making process to identify systems requirements. Furthermore, in the early stage of systems development it is common practice to recognise the clinical and administrative role users have and allow them to make a contribution to the design of the system. The GMPs, nursing staff and the implementation officer were identified as the important stakeholders that provided insight associated with this factor.

General Medical Practitioners

There was a perceptions amongst all but one GMP that they were never included in the decision making process associated with the implementation of the MD software. Indeed, one comment encapsulates the non-inclusion of GMPs appropriately:

> *"....it was presented to the doctors that it was going to be a pilot scheme for the study of computers in an A&E environment...."*

One of the GMPs interviewed did consider that they had been included in the decision-making process – this GMP, a 'champion' for the introduction of the system initially, was identified as having a particular enthusiasm for the use of computers in medical practice and healthcare in general. This doctor had made a concerted effort in engaging the requirement aspects of the initial consultation process associated with MD's introduction.

In terms of recognising the clinical role of GMPs when it came to influencing the design of MD, the general consensus was that no appropriate degree of consultation occurred. A pertinent comment from one GMP that tends to collectively summarise the perceptions of many was that:

> *"Medical Director is used by many GPs in the network. However, there was no recognition of our administrative role."*

User requirements, when introducing an information system are one of the most important aspects associated with successful implementation. There was general agreement amongst the GMPs that they were not part of the identification process when it came to the introduction of MD. Generally, the responses appear to confirm the practice of exclusion rather than inclusion of GMP in the user requirements process. Consider some of short but terse responses from GMPs:

> *"No, we were not included in anything."*

> *"Were we just told that it was coming and that it will be MD – nobody asked us about it."*

Some clinical or administrative user roles were reflected in the design of data entry templates that aimed to enhance and streamline data capture – however, according to one GMP this led to a limited use of the medical director program. One GMP suggested that if they had been approached before the system was implemented that some design and operational issues that directly reflected clinical administration facets of the system could have improved system use and indeed, acceptance. For example, it was pointed out that there was a clinical impractically associated with running MD from where it was positioned because records were physically distant from the patient. Another clinician suggested that the system should have been laptop-based allowing portability from one clinical treatment area to another.

Nursing Staff

Two groups of nursing staff (N=4) were interviewed over a period of time after the introduction of MD. With respect to being involved in the initial decision-making process all generally felt that there had been little or no inclusion of their group in the adoption of the new system. Indeed, nursing staff reported similar sentiments with GMPs in that they felt excluded from the early formative decision-making process with various summary comments reflecting nursing staff perceptions on the issue:

"...we were told this is what we are doing and this is what it is."

"the program (MD) was up and running when we were introduced to it..."

All nurses perceived data-entry as one of the potential hindrances in using the system. Hence, a series of patient data capture templates with appropriate selection options were pre-configured to minimise typing. Nursing staff were also identified as the primary users of the system who would enter initial and on-going patient data. Some clinical/administrative features associated with nursing roles were addressed in the initial systems design stage and primarily involved the customisation of data input screens, user access and templates. From this perspective, nurses played an important role in the design of data capture templates through their active engagement in the design process. Nurses generally indicate:

"Our clinical role was recognised, yes we were asked what we wanted on the screen."

Although, nursing staff were involved in data capture design, they did not appear to have been a source for other design aspects of the system that had a clinical or administrative focus. Post implementation interviews with nursing staff also identified design and operational issues that the desktop installation of MD in the A&E area was inappropriate in that it forced staff to have their backs to the patient when operating the system.

The early engagement of nurses identified that for each staff member to have their own system logon would be unworkable and time consuming. It was also recognised that in an A&E work environment that patient contact and treatment was a team based effort by a collective group of GMPs and nurses. Consequently, initial MD design alterations accommodated a common logon for staff to access the system.

Implementation support officer

The information management support officer of the Division had a major role in user training, software optimisation, template creation and user-manual documentation. In effect the support officer was ostensibly viewed as an implementation resource after the decision to adopt MD was made. In what appears a peculiar system implementation strategy, the support officer reported that he appeared to be *out of the loop* when it came to systems associated meetings – something that led him to question his own role in the entire project. Furthermore, the support officer indicates by not being included in meetings where MD-related decisions occurred impacted on his support role:

"..I experienced confrontation particularly with GMPs and nurses who resisted being imposed upon...when it came to the initial and on-going operation of the system."

The support officer was the human interface between the instigators of the system – who saw value in its introduction – and the users who were told that it was going to be introduced. He felt that a simple process of relevant consultation (with all stakeholders) was missing and would have made his job a lot easier.

Summary of Stakeholder engagement

The important stakeholders (GMP and nursing staff) were not included in the decision-making process to adopt the new MD application. The support officer – a significant member of the system team was left out of the loop when it came to making decisions about the on-going activities of MD. With respect

to recognising the role of GMP and nursing staff contributing to aspects of the proposed system, only nursing staff reported that they were adequately consulted in the development of the system. The manner that stakeholders were engaged in this project is contrary to the reported literature that suggests that there is an important link between stakeholder inclusion and participation in health systems adoption and eventual success.

Furthermore, an important operational and practical design issue that was not initially considered was overlooked – that a desktop-based application was not appropriate in an A&E setting that had high patient throughput as well as a one-patient to many-staff interaction ratio. As identified by staff a mobile laptop device would have enhanced the practical usefulness of the MD software.

Understanding Change

An initial briefing process associated with the introduction of MD clearly articulated the systems aims and also explained the intended workflow changes in moving from a manual data collection environment to a computerised one. All stakeholders were asked their views on the introduction of MD and how the system had affected their workflow. The perceived work changes after the systems' implementation were generally negative amongst the GMP and nursing staff. One GMP identified that duplication commonly occurred because patient data was manually recorded and then at a later stage entered into the MD system. Another GMP summaries the practicalities of using the new system:

> *"…it was more difficult because we doubled up with some paperwork – firstly when with the patient, and then entering the information into the computer at the station…."*

Also reported were certain inflexibilities in the system associated with the customisation of MD for the hospital scenario:

> *".. using the system was worse because we could not access a particular patient's history in the way a general practitioner normally does…"*

The important issue associated with altering data template design was to streamline data capture – pre-configured formats were to reduce and minimise typing. However, the customisation of the basic MD system for the hospital environment appears to have led to an inadvertent loss of familiarity that GMPs may have had with the application. The premise associated with introducing MD was that it was perceived as an appropriate system to use in the A&E environment because of the previous experience GMPs had in using the application – they used commercial application of MD in their surgery every day when not at the hospital. Paradoxically, the alterations to MD through data-entry customisation had the unexpected consequence of reducing various aspects of application's functionality for this important group of users.

The introduction of MD affected nursing staff workflow. It was expected that a variation in recording patient information from a manual process to electronic one would impact on the nursing work environment, however all nurses identified that the practicalities of the workplace physical environment were an important workflow constraint. Nurse's indicated that:

> *"….you have sometimes in access of five people waiting to be seen…whilst the computer can only be used by one person at a time."*

> *"…the location of the computer was not an issue for me… it was just that you couldn't enter patient information in real time."*

> *"…the system was much harder (labour intensive) and took longer to enter patient information."*

Arguably this series of comments reflects the practicality of working in a high turn-over health care section of the hospital where nurses tend to numerous patients and record multiple sets of clinical information. Such a scenario ideally requires multiple sets of computer workstations allowing maximum opportunities for, and flexibility in, patient data entry. Indeed, the introduction of the new system

appears to have identified an ergonomic type factor that is associated with understanding the impact of health systems related workplace changes.

In terms of traditional information systems cutover from the existing manual system to MD no extra resources were provided in the form of general clerical staff to assist nursing and medical staff in the transition phase. All nurses suggest that from their experiences a designated person or group of administration staff should have been made available to enter patient data and records.

Summary of understanding change issues

An import factor associated with successful HIS implementation is the acknowledgement that any new system will have an impact on personnel through actual or perceived work-place changes. All clinical stakeholders reported a poor understanding of the aims of introducing the new systems and the subsequent impact on their own working practices. Indeed, the documented pre-implementation briefings to staff explaining the goals of introducing the system appeared to have been forgotten or poorly conveyed to staff. MD appears to have impacted on nurses and doctors forcing them to not only record patient data manual, but then line up to use the computer to re-record electronically patient information. Furthermore, increasing resources in the form of clerical staff to assist with electronic data capture were critically overlooked in the initial transition phase to MD – an issue that impacted understanding the change management issues in this project.

Management Support and Local Champions

The likelihood of an HIS project succeeding is greatly enhanced if there is management support through active and visible actions. Moreover, all projects tend to have individuals that champion the cause of adopting a new system taking either formal or informal leadership roles at various functional levels of implementation.

The general perceptions of GMPs and nursing staff with respect to management support involvement were negative. Staff reported that there was very little form of leadership or support demonstrated by management either before or during the introduction of MD. Representative comments include:

> *"…there was no leadership and there was never a leader on the ground."*
>
> *"…It was a miss-mash and the collective wisdom was very small."*
>
> *"…I was certainly motivated to give it a go, but again there was not enough provision of support and leadership to make it work."*

The individuals that were important in championing the virtues and acceptance of the MD system were identified in this study but did not appear to impact on the project's success. One champion was the implementation support officer that also undertook the training of staff using the system. However, no matter how much the support officer espoused the benefits of MD, he was viewed as an external third party provider and as such, an outsider to the A&E working environment. Another local champion was one of the GMPs that had a high proficiency and experience in using computers in the medical workplace. The role this GMP had was one of:

> *"…promoting that MD had been implemented and was now available… I tried to generally motivate and encourage the use of the system amongst staff…"*

From a nursing perspective the A&D the senior and deputy nurses championed the value of the system and provided tacit support through attendance of training sessions and the encouragement of nursing staff to also use the system. However, in terms of designated nursing personnel as either leaders or the go-to person, no nurses filled this role appropriately due to the restrictions associated with the rotating shift and part-time nature of nursing work conditions.

Summary of management support and local champions

Management was non-existent in the implementation of the new MD software. Indeed, the only notable involvement in the project was the approval of the initial pilot study to be run within the A&E section of the hospital. There appeared to be a perception by medical staff that because they had previous practical experience with the system that no management support was needed – just implement MD and the application would function in a similar manner that the doctors were familiar with. Arguably, the few but important local HIS champions appeared to be transient in the way they interacted with the system and the other hospital staff. For example, the implementation support officer who was the person involved in staff training staff had strong MD champion features, however, was viewed as external to the A&E working environment and not part of the collaborative medical team. The one champion GMP in providing motivation and encouragement in using the system was highly valuable, but restricted to the times that this person visited patients within the A&E workspace – significant championing gaps tended to result when the GMP was not present. Nursing staff all worked rotational shifts, identifying a practical limitation to having nurses as formal champions of the project. Indeed, it may be valid to suggest that information systems champions within this medical workplace needed to be overly present and representative of the work cohort in order to champion the practical and effective value of the system.

User Training

Training issues associated with the introduction of MD were examined and the general perceptions of staff were that they had been given instruction before the introduction of the system and also during the system's use. Indeed, this appears to be one of the factors that was well recognised as having the potential to result in the failure of the project if not addressed appropriately.

Training tended to be mainly focussed on nursing staff and was undertaken by the implementation support officer who identified that many nurses were working from a low skill base. However, there appears to have been an informal approach to staff attending training with some nurses identifying operational issues that hindered training effectiveness and which were associated with the practical work environment. Some of the views of nursing staff on this issue were:

> *"… we had time before we started using it when were able to "play"…but its not until you start using something that you really run into all the problem issues…"*
>
> *"… all part-time and full time nurses were given training to play. Initially we had set times and also ad-hoc occasions when there was spare time…"*
>
> *"… if it was quiet you could go and practice, however it was hard to find the time…"*

The reference to being able to play with the system captured in aspects of staff comments relating to training arguably reflects an informal approach to consolidating staff MD training. Moreover, there was a perception amongst nursing staff that by playing with the new system was a non-threatening approach to enhance nursing computer skills – an approach that appears to support the informal approach to finding time to engage in system training.

There was no indication from staff that training was mandatory and that sufficient resources were provided to alleviate workload stresses so as to allow them to consolidate their understanding of the system through these play episodes. Moreover, it was noted that not all nurse staff were at the same computer skill level and that numerous nursing staff could not be reached for training due to their odd hours of work – again suggesting that training was based on an informal approach with limited or no resources provided to overcome these practical issues.

The GMPs, having previous exposure to using MD were assumed to have a solid body of understanding and practical experience in being able to use the system. Furthermore, it was recognised from early feedback sessions that "most of the doctors at the hospital were computer literate and did not view the system as a threat…". As such, the GMPs were given a demonstration of the newer customised aspects

of MD with the expectation that they would easily be able to operate hospital's variant to the one they commonly used in their private practices.

Summary of user training

The nurses received most of the training, however it was clear that there were operational variables that appeared to stifle the effectiveness of training – operational issues such as lack of time to play with the system, variable working hours that hindered training attendance and no allocation of extra resources to support the nurse's training sessions. GMPs, who had a history of being familiar and experienced with the general concept of using MD, were expected to use a customised version of the application with minimal training.

Instruction and training associated with MD adoption was recognised by the project's facilitators as an important issue. However, even though initially acknowledged as a significant factor there appears to have been an informal and limited approach to staff training. Much of the informal and ad-hoc approach to user training appears to be related to pre-existing operational issues which in the case of nursing staff primarily related to shift-work that precluded effective training attendance. With respect to the GMPs, a fundamental assumption of pre-existing knowledge in using MD reduced the training focus on these users and may have been an incorrect assumption.

Government influence

There was no direct Government involvement, participation in, or facilitation of the implementation of MD. The implementation of MD stemmed from initiatives to introduce an electronic system to enhance access to patient information within the hospital and as such, Government involvement and influence was an absent factor. Governments can enhance systems adoption by providing appropriate incentives and funding to adopt health information systems in general. Furthermore, the involvement of Government can alleviate the perception that information systems are a management domain (non-clinical) and directly engage the support of the diverse number of medical personnel in the respective area that the system is to be implemented. As was mentioned earlier, this was the one factor that could effectively not be influenced (in the short term at least) in relation to the introduction of MD.

Given that government participation in the project was absent, the study sought the views from nurses and GMPs on the role that government may have had in the implementation of such a project. The general consensus amongst the staff was that the role of Government was to provide the fundamental resources that would allow the implementation of health information systems so as to significantly enhance access to timely and complete patient information. Arguably, such electronic information flows and data improvements would allow general enhancements in clinical care, perceptions that were reflected in a high proportion of staff responses:

> *"... the government has a great opportunity to purchase a single system for hospitals however there must be interoperability between all stakeholders to make viable..... it seems to me that it is an opportunity being wasted."*
>
> *"...they could have a unique national system for hospitals that would be a benchmark to which all GP practice software could communicate/integrate into so we could all share information."*
>
> *"...the whole system would benefit greatly if hospitals had electronic records because at the moment most of the records are entered manually by nurses with varying degree of success."*

In retrospect, the implementation of the hospital's MD system invariably required formal support from Government in providing tacit guidance and direction as well as extra resources to alleviate some of the operational issues encountered with staff training.

Conclusions

The paper identified five health information systems implementation factors from the relevant healthcare literature that medical-based organisations need to consider in order to increase the likelihood of succeeding when introducing an information system. The five success factors included, stakeholder participation, the understanding of system imposed change on the organisational personnel, the importance of management support and local champions, user training and the impact of government support in providing incentives to use new health systems. Arguably, the identification of these factors provides a pertinent implementation framework by which to judge the success of a health information systems project. The paper further explored the introduction of the commonly used Medical Director® application in the A&E department of a regional hospital using the factors as a guide for capturing stakeholder perceptions. The implementation of MD was a failure with all factors except the training issues ignored. Indeed, even the implementation practices associated with user training were approached in an informal and limited manner.

In general, the study identified several additional implementation factors that could be said to affect the successful introduction of a HIS. These factors appear to be associated with common aspects of a hospital workplace and reflected operational aspects of the A&E department. One of the additional factors identified was associated with nursing shift-work and the presence of part-time staff that made it difficult to formalise effective training sessions. The irregular hours of work issue also dilute the impact of the local information systems motivators leading to championing gaps when these individuals were away from the area were the system was being used. Indeed, from the previous literature, the HIS champions tend to be assumed to be an ever-present constant accompanying the introduction of a HIS – something that appears to be an exceptions in the health environment encountered in this study. Arguably, in the healthcare sphere there is an increased likelihood that identified information system champions may have transient or reduced value if not overly present to encourage and motivate others to use the system.

Another operational factor identified in the study relates to the physical practicalities of the patient-clinician interaction that does not appear to have been considered in MD's usability design – as opposed to software design. The historical widespread use of Medical Director® in the doctor's surgery is as a stand-alone desktop application operated in a doctor-to-computer (1-to-1) manner. Hence, the common use of the application is in a face-to-face situation across the doctor's desk and in a relatively ordered time frame – a scenario that is significantly different to that encountered in the A&E environment that commonly has many different staff tending to a number of different patients in different locations. Thus, the variability in working locations impeded the system from being used in the traditional standalone fashion, resulting in staff at times having their backs to a patient when using the system and/or a time delay in an endeavour to wait to use the system. Furthermore, the disparate location of patients encountered in the A&E led to a high degree of staff movement and was an impediment to efficient MD use – where various staff alluded to the system's utility being more suited to a wireless-mobile platform. Arguably, mobile devices such as a laptop or PDA may have been appropriate to accommodate the high degree of staff movement that occurred in the A&E area.

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