Different usage of the same oncology information system in two hospitals in Sydney—Lessons go beyond the initial introduction

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ABSTRACT

Background and purpose: The experience of clinicians at two public hospitals in Sydney, Australia, with the introduction and use of an oncology information system (OIS) was examined to extract lessons to guide the introduction of clinical information systems in public hospitals.

Methods and materials: Semi-structured interviews were conducted with 12 of 15 radiation oncologists employed at the two hospitals. The personnel involved in the decision making process for the introduction of the system were contacted and their decision making process revisited. The transcribed data were analyzed using NVIVO software. Themes emerged included implementation strategies and practices, the radiation oncologists’ current use and satisfaction with the OIS, project management and the impact of the OIS on clinical practice.

Results: The hospitals had contrasting experiences in their introduction and use of the OIS. Hospital A used the OIS in all aspects of clinical documentation. Its implementation was associated with strong advocacy by the Head of Department, input by a designated project manager, and use and development of the system by all staff, with timely training and support.

With no vision of developing a paperless information system, Hospital B used the OIS only for booking and patient tracking. A departmental policy that data entry for the OIS was centrally undertaken by administrative staff distanced clinicians from the system. All the clinicians considered that the OIS should continuously evolve to meet changing clinical needs and departmental quality improvement initiatives.

Conclusions: This case study indicates that critical factors for the successful introduction of clinical information systems into hospital environment were an initial clear vision to be paperless, strong clinical leadership and management at the departmental level, committed project management, and involvement of all staff, with appropriate training. Clinician engagement is essential for post-adoption evolution of clinical information systems.

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1. Introduction

Introducing clinical information systems into hospitals is complicated by technical, social and managerial impediments [1]. A series of actions lead to a chain of responses, which eventually determine success or failure [1]. While oncology information systems (OIS) in the Department of Radiation Oncology have a specialised function to run radiation therapy machines, they also can function as an electronic medical record. Few detailed, systematic studies of OIS introduction have been undertaken in Radiation Oncology.

A previous paper described how a New Zealand Oncology Department implemented an OIS, successfully replacing paper-based procedures with an electronic system [2]. The difficulties encountered included clinical process redesign, change management, paper removal, implementation costs, hospital-wide integration and quality assurance. Resistance to change by clinicians was also identified as a key challenge.

To fill the knowledge gap about what works and how it works in integrating IT into hospital clinical practice, this study aimed to: compare the simultaneous introduction of the same OIS in two Radiation Oncology Departments in two public hospitals in Sydney; identify differences in the extent to which the OIS was used in the two hospitals by radiation oncologists; uncover factors contributing to any differences in usage; and compare our findings with those from other studies aimed to: compare the simultaneous introduction of the OIS in two Radiation Oncology Departments in two public hospitals in Sydney; identify differences in the extent to which the OIS was used in the two hospitals by radiation oncologists; uncover factors contributing to any differences in usage; and compare our findings with those from other studies.

Both departments implemented the same OIS (LANTIS®, Siemens Oncology Care Systems, Concord CA), as the New Zealand Oncology Department. While the OIS was also used for radiation treatment verification at both sites, this study only interested in the introduction and use of the electronic medical record function of the OIS for radiation oncologists; therefore, the functions for administrative staff, radiation therapist and radiation physicist were excluded from the study.

2. Research methods

Semi-structured interviews with radiation oncologists at both hospitals were conducted to obtain descriptive, qualitative data. The decision makers for the introduction of the OIS at both hospitals were contacted and their decision making process for system introduction was revisited.

An interview guide was developed based on the previous literature and three rounds of brainstorming by the research team, followed by consultation with three radiation oncologists in a third hospital in Australia. Topics covered in the interviews included the radiation oncologists’ computer experience, the implementation strategies and practices, the clinician’s use and satisfaction with the OIS, and its impact on clinical practice. The face validity of the interview guide was assessed by a pilot interview with two radiation oncologists in the third hospital in Australia.

The clinicians provided informed consent to participate in the study before interviews started. The interviews were conducted over a 3-week period by the second author in August 2007. Each interview lasted approximately 40 min, and was digitally recorded. Twelve of the 15 oncologists, six from each hospital, completed an interview. Three oncologists could not participate in the interview due to time constraints.

Recordings were transcribed into text and imported into the NVIVO7 software (QSR International) for coding of concepts and issues. To ensure that the coding was accurate and comprehensive, two researchers independently conducted thematic categorization concurrently. Differences were reconciled by discussion. The codes were further assessed by the first author.

3. Results

3.1. Reasons for the introduction of the OIS

Hospital A had a paper filing system, which clinicians were not happy with. The clinical leaders clearly stated their desire to become paperless, believing that ICT applications would increase their efficiency by enhancing communication and improving the availability and timeliness of information. Hospital B had an in-house developed information system that handled patient booking, but could not incorporate radiation treatment data; therefore the perceived need was to solve this problem through replacing the old system by a new commercial OIS to handle patient booking. There was no vision to go paperless.

3.2. The usage of the OIS in each hospital

In Hospital A, the “electronic medical record” (EMR) function of the OIS was first used in 2003. In 2005, all radiation prescriptions and bookings were electronic. After this the modules for clinical appointments, prescribing chemotherapy and clinical notes were used.

The project management committee decided that clinician usage of the OIS in Hospital A be compulsory. Oncologists’ letters were still dictated, but day-to-day notes were directly entered by each clinician. The EMR was the sole documentation system for radiation oncologists, therapists, physicists and nurses, and was used extensively in medical oncology, hematology and palliative care.

In Hospital B, the clinical module of the OIS was implemented in 2004. The functions implemented were administrative functions, such as patient booking and tracking. The only clinical data entered was diagnosis. Following clinician refusal to enter diagnostic data, the project management committee decided that data entry should be undertaken by the specifically trained data entry staff. Clinicians could look up data using individual user name and password. Table 1 lists the different usage levels of the system in the two hospitals.

3.3. Was the implementation completed?

In hospital A, the OIS implementation was regarded by all clinicians as an ongoing, evolving process without completion point. One clinician said:

“As a product we started small and progressively added on features to it or new ways of using it. This process is still continuing. So I don’t think I’ll ever say it is complete”.

Another clinician added, “There are always upgrades and there is always further scope to do things. So I think the general and basic implementation is complete but obviously its advanced use is not.”

In Hospital B, the OIS implementation was also considered incomplete. Clinicians believed that they should be given the right to enter data and make changes.

“There is a lot more we can do in LANTIS, like what treatment the patient had, what dose, various therapy related information.”

3.4. Why was the same OIS used differently in these two hospitals?

The OIS usage differences were explained by the clinicians’ perceptions about the causes that led to the differences and the information gathered from the decision makers for the introduction of the OIS. These are grouped in three categories: people, process and technology.

3.4.1. People

3.4.1.1. Radiation oncologists’ demographic profile. The age profile of the interviewees was similar. Most of them were 30 years old, three were 40 years old and one in each hospital was in 50s. All clinicians had experience using email, Web browsers and Microsoft Word. Some had previously used the OIS in other hospitals. Therefore, their computer skills were comparable in both hospitals.

3.4.1.2. Leadership. As mentioned in the section explaining the reasons for the introduction of the OIS, the heads of departments, both were radiation oncologists, provided a clear direction for the initial introduction of the OIS. However, after the initial introduction, there was no Head of Department in hospital B to drive and control the change for almost 2 years.

3.4.1.3. The project manager’s contribution. A radiation therapist in Hospital A undertook the role of Project Manager. She provided training and support for every clinician, most of them appraised “The project manager was the key to it all”.

Because every modification was driven by the project manager, with input from clinicians:

“She became very proficient with the OIS and with writing reports. She has developed everything extremely well.”

In Hospital B the original project manager was technically highly competent, completed his job of transferring data from the old database to the new system, and left the position after several months on the job. A part-time appointment followed to manage system access rights and the other functions of the system. In Hospital B there was role confusion amongst the clinicians regarding who had been managing the OIS because there was a lack of director as mentioned above.

Which attributes should a project manager have? In Hospital A, it was not believed that the project manager needed to be a senior staff member, or required an IT background, although some IT knowledge was considered advantageous.

“It is more about people skills. The information system is all about interfacing people with the machinery, the machinery is the lesser part of it all. The people are probably the most important thing.”

“What she needed was a very good understanding of people … and a very good understanding of the work flow in the department.”

“I think you got to see somebody has a natural talent and a natural interest … The talent in terms of not only understanding IT but very particular about detail and following things through it.”

3.4.1.4. Clinicians’ attitudes towards the OIS. In Hospital A, all of the clinicians were very positive about the processes used to introduce the OIS. One clinician expressed his satisfaction with the implementation of the system:

“Success, strong success! Outstanding success! Why? Because it has achieved its aims. That is, we have centralized information that is accessible to all the people who need it. It is timely, and I think it enhances patient care. We have a much better way of communicating information about patients now. It is not the actual system; it is the actual benefits through the organization that has sur-
passed my initial expectations. The actual success of the way it has been used in the department has been very satisfying."

Another clinician said:

“I think it is a success because first of all you can access it. So you are not tied to a paper file. I think that functionality is vastly superior than the paper files.”

In Hospital B, the implementation was generally viewed as a guarded success. It could be a lot better. It is a borderline pass because it enables us to do things much quicker and easier than what we have been able to do previously.”

In Hospital A the clinicians were enthusiastic about the further development of their OIS. One stated:

“We can continue to develop it and improve our work flow and data quality.”

In Hospital B, the common opinion was that the system was underutilized; as commented by a clinician:

“Perhaps underutilized, as I said we can’t input any information and we can’t change anything. So (it is) purely for us to view and check things out. Do I think it is a success? Compared to previous paper-based system I think it is much better. Because now we look up in advance clinic appointments, how old they (patients) are, we can look up previous letters, we can anticipate how many people coming from multi-disciplinary clinic. You can anticipate how long it will take things”.

It was acknowledged that although now happy with the OIS, some clinicians in both hospitals were initially uncomfortable in adapting to the use of the OIS because of unfamiliarity with electronic documentation practice.

3.4.2. Process

3.4.2.1. Different vision for the introduction of the OIS. The clinical leaders in Hospital A were keen to go paperless. Financial assistance from the Department of Health enabled them to realize their vision. In Hospital B the in-house developed patient registration system was cumbersome because of its inability to incorporate the data generated from radiation machines; therefore, the clinicians were also enthusiastic to introduce the OIS. However, the explicit goal in Hospital B was only to transfer the old data to the new OIS, rather than going paperless.

3.4.2.2. Project funding. The clinical leaders in both hospitals stated that the initial project funding in both hospitals was provided by NSW Health. Hospital A successfully secured ongoing funding for the positions of designated project manager and IT support person. In Hospital B, a clinician recalled that after the conclusion of the initial introduction, there was a temporary shortage of resources needed to maintain the system.

“The hospital originally refused to fund a position to supervise the software side … It took a while convincing them to fund it. This slowed down the implementation.”

By the time of the interview, there was a part-time project manager attending to the daily administration of the OIS and other functions such as controlling machines for radiation therapy.

3.4.2.3. The strategy of implementation. In both hospitals the project committee developed a strategy of gradual roll out. The project was promoted for several months before actual implementation. Training was provided for a specific group – the “super users” in Hospital A; but undertaken solely by the project manager in Hospital B. The hospital’s IS Department was responsible for solving technical challenges. There were no staff responsible for both clinical implementation and software maintenance, but all were represented on the project committee. In Hospital B, the old clinical record system was retired after importation of 50,000+ instances of patient demographic data in 2004.

3.4.2.4. Project governance. The implementation and change management was overseen by project committees and coordinated by a project manager in each hospital. The project committee in each hospital was still in operation at the time of the interview. In both hospitals the committee was chaired by a radiation oncologist. In Hospital A, the person was the head of the department. The committee included a radiation therapist, two physicists and an IT person in Hospital A. In Hospital B, the project management committee included radiation therapists and physicists. All of the above positions were internally appointed; no external person was brought into the project.

The heavy reliance on the project manager for the proper function of the OIS was seen by the clinical leaders in Hospital A as a potential risk for the sustainability of the system. Therefore, a replacement for the role was established whenever the project manager went on leave. The replacement arrangement in Hospital B was not clear.

Both implementations were strongly supported by the hospital-level management and IT department and achieved their aims at the initial introduction stage. However, after the initial goal of system introduction was achieved – transferring patients demographic data from the old OIS to the new one, the project was seen as succeeded and did not progress any further in Hospital B. The visibility of the project was low. Not all of the clinicians knew whether the committee still functioned at the time of the investigation, despite the committee still meeting once per month to solve problems for health professionals other than radiation oncologists, who used other functions within the OIS. A clinician in Hospital B commented:

“The strong impression I have is that the main difficulty we have faced since the last year and half or two years since I have been here is the lack of expertise pushing it and lack of management director (refer to the Head of Department) type control, pushing it as well.”

Some clinicians in Hospital B knew that the OIS was capable much more and for them, lack of effective leadership after the initial introduction of the OIS was perceived as the reason for the OIS system to be stagnated. A clinician talked about the condition for realizing the full potential of the OIS:
“To develop LANTIS to its full potential you need many things: you need someone with computer knowledge who is developing it and working it all out; and you also need someone with clinical knowledge, who may be the same person or different person who should be guiding what is done; and until recently we did not have that. And as I said the person in charge of, initially involved in LANTIS stopped doing it, so for a year or two there was virtually nothing being done, and then it just stopped. So we had a certain amount of capability and that was where it was left… It was frustrating because I had used it in another department where I have seen its greater abilities, so I can see what it can do.”

3.4.2.5. Workflow change management. In Hospital A the workflow redesign was undertaken as

“a gradual sort of agreement to changing process and discussion of how things would work before they were implemented. The OIS support officer would meet with the OIS group and would discuss what they were going to do next and how would that impact things. Then often it would go back to the group to see if they were happy with that and then move forward; so quite consultative but not one person redesigned our workflow.”

In Hospital A, a quality assurance system was responsible for data quality assurance. It checked who entered which data and whether the compulsory data were entered by the due date; but the individual clinician decided when and where to enter data. Some clinicians entered data when they saw their patients, others later; thus there was flexibility in the processes for clinicians. In Hospital B the new work flow was restricted by the centralized data entry. Although a project committee was responsible for improvements, little progress was made. None of the interviewed clinicians attended the OIS project meeting at the time of the interview.

Differences in the work environment were noticed while conducting interviews. In Hospital A the patients were seen in a clinic room containing a computer, allowing clinicians to enter data directly while seeing a patient. In Hospital B the clinic rooms had no computers. The doctors entered another room to access a computer with a paper aide memoir and dictate; therefore it is not possible to conduct real time, bedside documentation.

3.4.2.6. End user training and support. Although the vendor did provide clinicians with some limited training, in Hospital A, the knowledge of using the system for clinical purposes was developed by the “super user” group including the project manager. Other staff members were trained by this group. After implementation, revisions and updates necessitated a weekly, ongoing audit meeting that demonstrated major changes and new functionality to the staff members; therefore, the project manager supported staff members with education sessions, electronic presentations, demonstrations, handouts and electronic self-learning material. If required, one-on-one training was provided. In Hospital B an initial 1–2 h training session was provided by the project manager and attendance at this tutorial was a prerequisite for being allocated a system user name and password. It was perceived to be informal. Ongoing training sessions provided for individuals and groups typically lasted half an hour.

In both hospitals technical support only covered office hours; therefore, problems occurring after hours had to wait until the next working day to be resolved. This was considered reasonable by the clinicians.

3.4.3. Opinions about technology

The clinicians in Hospital A thought the graphical user interface could be more customized and that image files needed to be available at one click. Importing laboratory results was problematic and this was the sole reason for the continuing existence of paper files to store the data that could not be put into the electronic system. Tools for document sorting and manipulating were regarded poorly. System stability was assessed as ‘improved’ over the years. As clinicians in Hospital B only used a few functions of the OIS, little complaint about the system was heard.

4. Discussion

Adding to the limited literature on the effectiveness and outcomes of health sector IT investment [3], our case study detailed what had caused the incremental evolution of one clinical information system in one public hospital but failed to achieve this in another, despite similar management structure in the same city. With the same state health department and a similar level of hospital management to drive the change, we identified different actions that led to different levels of usage and outcomes of the same clinical information system.

The objective description of system use (see Table 1) and our qualitative investigation demonstrate that the OIS usage in Hospital A was more advanced and widespread in supporting clinical practice than that in Hospital B. What caused this difference?

The Department of Health’s involvement in the OIS introduction consisted of funding for both software purchases and directing that the software be used for the collection of certain data. Hospital managers at both sites were enthusiastic about the system introduction. Clinicians’ age and level of IT proficiency were also similar at both sites. These similarities across both sites suggest that while being necessary, these factors are not sufficient to explain the differences in outcomes of the same OIS adaptation.

As the system in both hospitals was identical, its lack of functionality was not the reason for the differences either.

As suggested by Lorenzi and Riley [9], the sociocultural challenges to implementing the OIS were as daunting as the technical and logistical ones. There are three factors contributing to the differences in outcomes of implementing the OIS in the two hospitals.

The first factor leading to the differences is the differences in perceived needs and that only the expressed needs were addressed; i.e. going paperless in Hospital A and having booking, diagnostic and treatment data all in OIS in Hospital B. A lack of vision of the software’s capability at the initial planning for the introduction of the system in Hospital B led to the limited implementation of functions. According to the original
goal of transferring data from the old system to the new one, the OIS implementation in Hospital B was succeeded and no further action needed to be taken. As the initial goal in Hospital A was going paperless, the implementation continued 4 years after its initial introduction.

The second factor causing the differences was the usage policy of clinical data entry by the clerical staff, which distanced the clinicians from the system in Hospital B. In contrast, from the start, clinical data entry by clinicians was compulsory in Hospital A. Although it was challenged by the high demand for effective training and support, it effectively engaged the clinicians to interact with the system on daily clinical practice. This secured clinician buy-in of the system. According to the previous research, clinician buy-in is a critical success factor for ICT introduction into health care [7,13]. The more clinicians interacted with the system and experienced its benefits, the more inspirations they had in terms of what next function should be used to help their clinical practice. Therefore, although nobody had clear vision what the exact consequences of adapting the OIS would be at the initial introduction stage, the benefits had clinicians pulling for more functions, which resulted in a highly functional clinical information system in Hospital A.

In contrast, the OIS implementation strategy in Hospital B appears to hinder the increased utilization of the system. First, the usage policy, namely centralizing data entry to designated administrative staff, had avoided the complexity of training; but it also removed the opportunity for the clinicians to actively interact with the OIS; second, as there was no computer in the consultation room, the existing information could not be readily accessed; third, the clinical functionalities like patient history, examination results and radiation prescription were not implemented. If such functions were available, they would perhaps have triggered clinicians to request more functionality. In reality, without much experience with the system, the clinicians would not know what other clinical benefits the system could offer them.

The third factor that accounts for the different outcomes in the two hospitals is the leadership for the post-adoption evolution of the clinical information system. The Head of Department in Hospital A was enthusiastic and strongly supported the post-adoption evolution of the OIS to support clinical practice. The effective project governance structure ensured the timely, accurate responses to clinicians’ emerging needs for new functions. It kept the momentum going 4 years after the initial introduction of the clinical information system.

Although in Hospital B the initial system implementation was limited, most clinicians interviewed were not satisfied with their status quo and would like to change the way they interact with the system. There was plenty of reason and time to change the original arrangement. However, there was no Head of Department 1 year after the system was introduced in Hospital B. This made it impossible for Hospital B to detect or act on evolving preferences of the radiation oncologists. Lack of leadership to drive and control the change of status quo eventually made no progress in system usage 3 years down the track.

The following paragraphs discuss the successful lessons learned from the implementation practice in Hospital A. There was a common vision between the department management and clinicians to continuously develop the information system to support clinical practice. A reliable communication channel was established to ensure that any new initiative with the system was consulted with clinicians timely. This strategy was also suggested by Lium et al. [4] as a success factor for clinical IT introduction.

According to the previous literature, the provision of continuously available help that was easy to obtain [6], ongoing education and training [7] and an on-site support/resource person [8] would facilitate adaption and use of a clinical IT solution, which were the case in Hospital A. The departmental head oversaw a concerted effort to train clinicians and to change routine documentation practices. The project manager helped develop and implement training and support. The “super users” encouraged and helped their peers to use the system [5]. As sustained, continuous commitment from different levels of management existed in Hospital A, these facilitated the introduction of the system according to the previous findings of Lorenzi and Riley [9] and Wyatt [7].

Pare found that the key contributors to clinician buy-in included the change agent’s (project manager) personal attributes, the team members’ expertise and management support, and the users’ attitudes, expectations, skills and knowledge [10]. The project manager in hospital A had the attributes of a successful project manager described by Øvretveit et al. [11]; therefore, the result of our investigation in Hospital A supports Pare’s observation about change agents [10].

The project manager in Hospital B, despite excellent IT skills, was only required to oversee the data transfer and to provide support to the data entry staff, and succeeded in these tasks. As clinicians did not use the system, they did not require further support or further development of the software to enhance clinical documentation. A previous study showed an increased failure rate without an IT project manager [12]; likewise this project stagnated in Hospital B while the position was vacant.

A successful strategy for managing change in health care is to only fully implement the change after trialing its fit with clinical tasks [14]. This was the strategy used in Hospital A. The clinicians who benefited were actively engaged in developing new functionality to support their own clinical practice. Their proposals were approved and substantiated by the Management Committee under the coordination of the project manager. Therefore, adoption and evolution of the OIS occurred by both bottom up and top down approaches through a process of “convergence of tool and practice”. The system was customized to accommodate the clinicians’ activities; and clinicians altered their practices to accommodate the system, which agrees with Berg’s [15] observation. Peer pressure (or subjective norms) [16,17] and ‘carrot and stick’ drove this change process.

As lessons learned previously [11,16], effective departmental IT governance structure, with preparation and plan to produce a successful roll out, guaranteed the clinician initiated new functions to be developed and implemented in Hospital A.

While lack of basic computer skills can be a significant impediment for clinical IT acceptance [17], this factor had lit-
tle effect in this study because all of the clinicians interviewed had adequate computer experience.

4.1. Limitations of the study

To ensure that the perceptions were comparable, only radiation oncologists in the two hospitals were included in the study; therefore, the reported perspectives are limited to those of the clinicians; without views from other categories of hospital staff. We could not control for recall bias either. However, as 80% of the radiation oncologists were interviewed, the results are representative of the views of these clinicians in the two hospitals. The initial implementation strategy in Hospital B was difficult to perceive precisely due to high staff turnover. It could not be determined whether the previous experience using the OIS had affected clinicians’ responses to the interview questions.

5. Conclusion

To our knowledge, few clinical IT evaluation studies have followed the continuous evolution of a system for more than 3 years. This retrospective, qualitative evaluation of the introduction and use of the same OIS at two public hospitals in Sydney in the same time period has identified different levels of usage of the system between the two hospitals. It highlights the importance of clinical decision maker’s vision of how the system would support clinical practice and system usage policy that engages clinicians; management and leadership, particularly at departmental level; project governance and the project manager’s contribution. As the OIS in Hospital B had not been used to its full potential, its capacity to improve effectiveness and efficiency was not capitalized. The different usage of the OIS appears to have no relationship with the clinicians’ IT expertise.

Despite the above differences, clinicians from both hospitals were satisfied that the OIS had benefited them, making their clinical consultations easier and safer than paper-based system.

This study provides empirical lessons that can be learned by public hospitals embarking on the journey of introducing IT innovations into clinical practice. It suggests that clinical information systems are dynamic systems that need continuous management to support their ongoing evolution to meet the changing clinical needs.

Ethical approval

All procedures used in this study were approved by the Human Research Ethics Committee, University of Wollongong, Australia, and complied with the NHMRC (National Health and Medical Research Council) National Statement on Ethical Conduct in Research Involving Humans 1999.

Authors’ contributions

PY led the design of the survey, the analysis of data and final manuscript preparation. SG contributed to the design of the study, led the research activities of applying for ethics approval, field investigation, data analysis and thesis preparation. AM participated in the conception and design of the research protocol, and liaised with hospital managers and clinicians. All of the authors contributed to the manuscript preparation and editing.

Conflicts of interest statement

The authors have no actual or potential conflicts of interest with the publication of this paper.

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