Paperless workflow in radiation oncology: Perceptions of the multidisciplinary team

Abstract Purpose: The introduction of a paperless workflow in a radiation oncology setting is a major undertaking and its acceptance by a multidisciplinary team (MDT) team can be vital in its success or failure. In order to assess the acceptance of an electronic medical record (EMR), its ability to enhance six aims of improved patient care was analysed at Radiation Oncology Queensland (ROQ). The six aims of improved patient care assessed were safety, effectiveness, patient centredness, timeliness, efficiency and equity. Methods: A Likert scale questionnaire was designed and completed by five MDT groups. These five MDT groups were radiation therapists, radiation oncologists, physics, nursing and administration. The data were then analysed by simply calculating the response percentage for each of the disciplines. Additionally demographic data of average age and sex was collected. Results: For each of the six aims of improved patient care all responses were in the neither agree nor disagree range to the strongly agree range. There were no responses recorded that indicated disagreeance with the potential of an EMR to enhance the six aims of improved patient care. Conclusion: The results indicate that the MDT at ROQ view that the introduction of a paperless workflow through an EMR can enhance the six aims of improved patient care. An EMR has been accepted by the MDT and its potential of improving patient care is readily acknowledged.

Keywords: electronic medical record (EMR), effectiveness, efficiency, equity, patient centredness, safety, timeliness.

Introduction
The introduction of a paperless workflow at Radiation Oncology Queensland (ROQ) was an absolute priority upon the commencement of radiation therapy services in May 2007. The department is a comprehensive radiation oncology unit, which is equipped with the Aria™ (Varian Medical Systems, Palo Alto, CA, USA) patient information system (PIS). The impact of electronic medical records (EMR)¹,² in reducing workload have been analysed in areas as diverse as primary care, paediatrics and intensive care units.³,⁴,⁵ However little published work has investigated their efficacy in the radiation oncology setting.⁶ Previous work undertaken by our institution¹ has illustrated the key advantages from a radiation therapist perspective that can increase the efficiency of specific daily tasks. The specific daily tasks that showed these advantages were EMR preparation versus traditional treatment sheet and history check and image analysis in an electronic format. A radiation oncology department, however, is made up of a truly multi-disciplinary team (MDT), consisting of radiation oncologists, radiation therapists, medical physicists, nurses and administrative staff. It has been shown previously that when introducing EMRs that the biggest workload reduction in the MDT of a radiation oncology facility is for nursing and administrative staff.² However, the purpose of this study is to gauge the perception of the efficacy of a paperless workflow across all disciplines. It has been noted that an EMR can offer extraordinary opportunities to meet the six aims of improved care.⁷,⁸ The six aims of improved care have been designated as safety, effectiveness, patient centredness, timeliness, efficiency and equity.⁹

Aim
The aim of this study was to assess whether or not the introduction of an EMR would be seen to enhance or hinder the six aims of improved patient care in the setting of a radiation oncology department as perceived by a MDT.

The definitions of these six aims are:

Safety – avoiding injuries from care that is intended to help them. In radiation oncology this could be related to the total quality assurance process.

Effectiveness – providing services based upon scientific knowledge and avoiding those not likely to benefit. Providing an effective journey through a course of radiation therapy is of course relevant to radiation oncology.

Patient centredness – care that is respectful and responsive to individual patient preferences, needs, values, and includes patient values in clinical decision. Radiation therapy is very much an individual journey for the patient and there must be mechanisms for respectful and responsive care.

Timeliness – reducing waits and sometimes harmful delays for those who receive and give care. In the radiation oncology setting time is often critical, from quick turn arounds for planning procedures to prompt daily treatment.

Efficiency – avoiding waste, in particular of equipment, supplies, ideas and energy. The importance of efficiency of the MDT in radiation oncology cannot be understated – the efficiency of both individual staff and team is critical.

Equitability – care that does not vary in quality...
due to personal characteristics (gender, ethnicity, geographic location, or socio-economic status). All processes in radiation therapy should be standardised and provide equitable care for all.¹⁰

Each of the MDT may view these factors from a different perspective and grade the impact of an EMR on them differently, but it is now established that an EMR is a vital requirement for patient care.¹,² Importantly the acceptance of a paperless workflow by the MDT is paramount to its intention of meeting the six aims of improved patient care. It must be stressed that the six aims of improved patient care as described are considered appropriate in the radiation oncology setting. All six aims are factors that all radiation oncology centres would consider in the overall experience of patients within their facility.

Electronic medical record

The electronic medical record in use at ROQ is ARIA™, manufactured by Varian. ARIA is a comprehensive radiation oncology patient information system, containing all facets of the patient’s journey through a radiation oncology facility. Included in the EMR are all patient correspondence, drug prescriptions and medications, as well as complex radiation therapy planning and treatment information. Additionally diagnostic images are stored within the patient record, inclusive of CT and MRI scans, as well as treatment related digital verification images taken during a course of treatment. The EMR in use allows a paperless workflow as all patient details are stored under the one unique patient ID. Additional to the EMR itself is the capability to data-mine the ARIA database using Sybase Infomaker 10™ (Sybase, Dublin, CA USA). This database management tool allows complex reports and forms to be utilised to further enhance the workflow achievable in a paperless environment. In effect, it is the capacity to take information from individual patients EMR and present them to team members in a way that eliminates searching for information. This not only enhances efficiency but allows careful analysis of workflow and associated statistics.

Effectively each discipline’s contribution to a patients’ care is undertaken in ARIA, with administrative, nursing, medical physics, radiation therapy and medical information all stored as one patient record in one patient database.

Materials and methods

This project was designated as a quality assurance activity/clinical audit after internal review in accordance with the Health Services Act. This was confirmed by the Toowoomba and Darling Downs Health Services District (TDDHSD) Human Research Ethics Committee (HREC) on the 17th May 2011 and the project did not require ethics approval.

Designation of multi-disciplinary team

The MDT at ROQ consists of radiation therapists, radiation oncologists, medical physicists, nurses and administrative staff.

Each of these disciplines performs different tasks and procedures within the ARIA platform. The combination of these tasks forms the patients care path through the facility. Each discipline viewed the efficacy of the six improved aims of patient care relevant to their own workflow. The tasks undertaken by the specific MDT members within the EMR are displayed in Table 1.

Staff questionnaire

For the purposes of this study a questionnaire was constructed making use of the Likert scale¹¹ and a series of demographic questions were also asked. This scale utilises a scoring system whereby responses are recorded

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**Table 1:** Designation of multidisciplinary team and roles undertaken by each discipline.

<table>
<thead>
<tr>
<th>Multidisciplinary team</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation therapist</td>
<td>Planning and delivering radiation treatment, utilising all information within the EMR. Use of care paths, task pads, scheduling information and all clinical information within ARIA</td>
</tr>
<tr>
<td>Radiation oncologist</td>
<td>Creation of patient letters, review of test results and patient correspondence, treatment reviews and close monitoring of patient through a radiation treatment regime</td>
</tr>
<tr>
<td>Nursing</td>
<td>Use of all clinical information within ARIA to monitor patients treatment journey. Review of clinical information, test results, care paths and task pads</td>
</tr>
<tr>
<td>Administration</td>
<td>Management of patient correspondence, scheduling consult appointments, billing information and care path creation</td>
</tr>
<tr>
<td>Physics</td>
<td>Scheduling of quality assurance activities, analysis of dosimetric concerns and monitoring of performance of equipment</td>
</tr>
</tbody>
</table>

**Table 2:** Questionnaire response results and demographic information.

<table>
<thead>
<tr>
<th>Multi-disciplinary team</th>
<th>Response</th>
<th>Average age</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation therapist</td>
<td>16 request, 15 response, 1 no response</td>
<td>27</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Radiation oncologist</td>
<td>6 request, 5 response, 1 no response</td>
<td>44</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Nursing</td>
<td>6 request, 6 response</td>
<td>35</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Administration</td>
<td>4 requests, 3 response, 1 no response</td>
<td>34</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Physics</td>
<td>2 request, 2 response</td>
<td>38</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
ranging from strong agreement to strong disagreement to a statement question. The questionnaire was not piloted as it was viewed as a simple tool to gauge the perceptions of the acceptance of an EMR by the MDT.

In this case the statement questions referred to whether or not a paperless system enhanced the six areas of improved patient care. The questionnaire was delivered electronically to all staff at ROQ and the staff were stratified into five groups according to their discipline, these being administration, nursing, physics, radiation therapy and medical.

Data analysis
The surveys were returned electronically and were de-identified. They were then analysed using Microsoft Excel 2007 (Microsoft, Seattle, WA, USA). The percentage response of each MDT was aligned with the assigned score on the Likert scale and graphed. Demographic data was also analysed inclusive of average age of the MDT groups and sex using descriptive statistics.

Results

Questionnaire
The response results of the questionnaire and the respondent demographics are displayed in Table 2.

In total, 34 questionnaires were distributed with 31 being completed and returned. The participating MDT is predominantly female with the oldest average age being 44 for radiation oncologists and the youngest being 27 for radiation therapists. The average age of the entire MDT is 36. The data is presented in graph format for the six aims of improved patient care.

Six aims of improved patient care

Safety
Figure 1a shows that the majority of members of the radiation oncology MDT responded that paperless workflow is effective in ensuring patient safety. This was particularly evident for nursing and administration whilst some member of the physics, radiation oncology and radiation therapy teams neither agreed nor disagreed.

Effectiveness
As displayed in Figure 1b all respondents regardless of MDT group strongly agreed or agreed that the paperless work-flow ensures an effective journey through a radiation therapy course.

Patient centeredness
It was strongly agreed by the administration and nursing teams that
a paperless approach allows more time for patient care and a holistic approach (patient centeredness). There were some responses from the radiation oncology, physics and radiation therapy teams that neither agreed nor disagreed. This is displayed in Figure 1c.

**Timeliness**

The administration, nursing and physics teams all felt that the paperless environment ensures that patient needs are met in a timely fashion as shown in Figure 1d – i.e. minimal waiting times between appointments, minimal waiting times for documentation. A small percentage of the radiation oncology (20%) and radiation therapy (5%) teams neither agreed nor disagreed.

**Efficiency**

All members of the MDT, apart from half of the physics respondents, strongly agreed or agreed that a paperless workflow allows you to meet your everyday goals in an efficient manner. This is represented in Figure 1e.

**Equity**

Figure 1f shows that 50% of the physics team, 10% of the radiation therapy and 20% of the radiation oncology team neither agreed nor disagreed with the proposition that the paperless approach standardises care and ensures equity of care for every patient. However the rest of the MDT strongly agreed or agreed.

**Discussion**

**Respondent demographics**

The average age of the MDT team being 36 potentially, indicates a potential information technology (IT) savviness that would help with the introduction of an EMR. This has been identified before in the radiation oncology setting. The higher average age of 44 for radiation oncologists is also potentially indicative of reasonable IT skills. The relevance of high-end IT skills for clinical practitioners has been identified in previous analysis of paperless environments. It has also been noted that health care is decades behind other industries with respect to IT adoption. Advanced IT skills have become a necessity for the MDT in the radiation oncology setting and are vital in order to move to a truly paperless environment. It is acknowledged however that this represents a potential cost in terms of training and resource management. Many of these skills cannot be taught in a short time period as they often involve a large shift in work processes and assumed IT knowledge. Importantly the current environment was the first time all of the responding MDT had worked with an EMR. There appeared to be no difference between the responses of females and males.

**Six aims of improved patient care**

It has been stated previously that many IT projects do not result in the effects being aimed for. This can be due to a variety of reasons including project management and leadership, lack of quick results and a lack of motivation. Fortunately for the team at ROQ the process of introducing an EMR has been considered a success. This success has been measured by the efficiencies of the department and the overall satisfaction of the team.

This is due in part to the motivation of a team to be successful in a new centre and the opportunity to be part of something innovative and bold. The six aims of improved patient care were all considered to be enhanced by the introduction of an EMR. There were no responses from the radiation oncology MDT that indicated disagreement to the proposal that an EMR could improve the six aims of patient care. Interestingly the administration and nursing teams appear to be the most welcoming of an EMR and this is supported by previous published work.

The most supported aim of improved patient care by the introduction of an EMR was that of “effectiveness”. All members of the MDT strongly agreed or agreed with the concept that a paperless workflow did and could enhance the six aims of improved patient care. It is logical to infer from that an EMR can help to ensure a streamlined journey through a radiation therapy course.

Certainly it is considered difficult to measure the effectiveness of an EMR, as there is no single criterion on which to base an evaluation. Additionally it is a relatively new concept in radiation oncology and tools to assess an EMR are in their infancy. This small study represents a simple way of assessing an MDT’s perception of an EMR and its effect on patient care. It seems a logical, simple approach to measure the perceptions of an MDT team regarding an EMR by using some aspects of patient care such as the six aims. Of course there are numerous stakeholders in the assessment of an EMR and its outcomes such as the MDT described in this study and...
as has been noted before all have different views, opinions and expectations of what an EMR should be and can do. For example some members of the MDT team may anticipate more automation of routine tasks than is currently achievable. Additionally it is still necessary to input data into an EMR – it cannot do the work for you.

Efficiency of an EMR in a radiation oncology setting has been illustrated before, and other factors such as timeliness and safety have been identified as improved in other published work. It must be noted that the roles of radiation oncologists, radiation therapists, medical physicists, nursing and administrative staff are very different. Issues of patient ‘safety’ for example may present different concerns to administrative staff than they would to radiation oncologists or radiation therapists. By the same means, non-patient contact staff such as medical physicists may view ‘patient-centeredness’ differently to nursing staff. This is acknowledged but what is important is that all professional groups felt that even within the context of their individual roles an EMR could provide real improvement to the six identified factors.

Peck, et al. suggested that making the electronic leap offers the ability to be more efficient and to enhance the sharing of data across geography and networks. Although not directly reported in our results the EMR in use has allowed sharing of data across multiple sites. Ultimately this is the purpose of the EMR, to unite an MDT in providing the best continuity of care for a patient through the relevant facility. The Institute of Medicine suggested ten rules for the redesign of 21st century healthcare inclusive of knowledge being shared and information flowing freely, transparency in patient care being necessary and cooperation amongst clinicians being a priority. Interestingly the major critical environmental force in the redesign of American healthcare was noted as information technology. Acceptance of such an environment has led to the perception of the ROQ having an MDT can embrace this change and make it work.

From the results collected in this study it would seem that the majority of the MDT do view that themselves and patients benefit from the introduction of an EMR.

Recommendations and limitations

This study recognises its limitations and serves only as a simple method of assessing a radiation oncology MDT’s perception of the effectiveness of an EMR. It is acknowledged that there is limited research on the understanding of the effectiveness of EMR systems in healthcare. However, this represents a simple approach to assessing the perception and acceptance of an EMR in the radiation oncology setting. This area of research is still in its infancy and needs further work such as broadening the scope of centres participating and developing assessment tools. Continued research will be undertaken by the MDT with particular emphasis on repeating the questionnaire and analysis at the new ROQ centre in Cairns.

It would also be a recommendation that the existing data from this study be potentially benchmarked against other centres as they begin the transition to an EMR.

Conclusion

The introduction and acceptance of an EMR is a complex undertaking. It is an enormous change to traditional radiation oncology workflow and requires much thought and team work. However the experience at ROQ has indicated that an MDT can embrace this change and make it work. Acceptance of such an environment has led to the perception of the ROQ team that “safety”, “effectiveness”, “patient centeredness”, “timeliness”, “efficiency” and “equity” can all be enhanced by an EMR.

Ever evolving technology indicates that an EMR is the way forward in radiation oncology, it can certainly improve the efficacy of a patients journey through a radiation oncology facility and hopefully enhance communication amongst the MDT. The EMR offers real opportunity for improved collaboration amongst radiation oncology team members and this can only occur when acceptance of the change in workflow is at high levels amongst the team.

Through careful analysis, thought, teamwork and commitment an EMR can be successfully implemented into a radiation oncology setting, it can be accepted by the MDT and it can improve the quality of our care.

References