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Technical Note

Implementing Radiation Oncology Care Plans as a foundation for process improvement

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Abstract

Background: At The Radiation Medicine Program described, the entire radiation therapy (RT) workflow was previously conducted through the use of two electronic programs. It duplicated workflow and created a situation where it was difficult to measure the RT process. Recent enhancements to the electronic medical record facilitated the consolidation of RT planning and treatment workflows into one electronic system.

Purpose: This report will describe the clinical implementation of electronic Radiation Oncology (RO) Care Plans at a Regional Cancer Centre, and how they can be applied as a foundation for RT process improvements.

Impact and outcome: A total of 51 Care Plans and 95 IQ Scripts were successfully implemented. The benefits of RO Care Plans include a more streamlined process, removed ambiguity, improved communication, standardised workflow and automation of tasks. In addition, multiple performance indicators can be obtained from the RO Care Plans, such as caseload reports, workflow reports and a 'white board'.

Conclusion: The implementation of RO Care Plans serves as a foundation for data-driven process improvement at a local Regional Cancer Centre.

Keywords: professional practice; quality assurance; radiation therapy workflow; safety; standardisation

BACKGROUND

Radiation therapy (RT) treatment is becoming more complex with the integration of multiple advanced technologies. It is imperative to enhance the safety and quality of radiation treatment delivery with regards to the performance of hardware, software and operator interactions.[1] The Radiation Medicine Program described utilised two electronic programs for the entire RT workflow. MosaiQ (IMPAC Medical Systems, Sunnyvale, CA, USA) functioned as the electronic medical record, record and verify program, as well as a communication tool between clinicians. A secondary electronic system was used to facilitate appointment bookings and contour prompting. The dual systems duplicated workload and created difficulties in measuring the RT process within the department.

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Recent MosaiQ enhancements include IQ Scripts and Radiation Oncology (RO) Care Plans. These features are able to facilitate process improvement by measuring different quality indicators within MosaiQ. The Care Plan is the plan of care for the particular patient that maps out any procedures, tests or activities that are required for the radiation treatment. Once a Care Plan is applied, the system triggers a cascade of events that drive the process forward. This is facilitated through the use of IQ Scripts. IQ Scripts are highly flexible and customisable tools to execute specific logic, for all clinical activities, as defined by the users.[2] They can improve daily workflow and empower data collection for continuous improvement.[2] For instance, IQ Scripts are able to automatically generate Quality Checklist (QCL) items and assessments for quality assurance (QA) procedures. The activities generated from IQ Scripts are the building blocks for the successful development of RO Care Plans. The completion of one activity triggers one or more other activities that are linked together in the process.[2] This report will describe our Regional Cancer Centre's clinical experience with the implementation of electronic RO Care Plans, and how they can be applied to improve RT processes.

RO CARE PLANS WORKFLOW

Previously, two electronic programs were used in the daily RT workflow. Once patient consent was obtained, the radiation oncologist would create a computed tomography (CT) requisition in the booking system with specific CT simulation instructions. A radiation prescription would be entered and approved in MosaiQ. During the CT simulation and planning stages, both the booking system and hospital emails were used for communication between oncologists and planners. QCLs were utilised for completing required tasks throughout treatment. These QCL items were user initiated and would be appended both at the time of CT simulation, as well as at the time of treatment. This workflow was created based on the process maps designed before clinical operation of our department in 2010.

RO Care Plans facilitated the consolidation of RT planning and treatment workflows. This streamlined the process and set the foundation for process improvements. As the entire end-to-end RT process would be consolidated, it would be possible to generate reports to analyse and identify opportunities for improvements. For example, the times associated with the generation and completion of a QCL could be analysed to determine whether the process was performing as expected or prompting further investigation if there was variation. With the new workflow, the radiation oncologist would apply the appropriate RO Care Plan based on the disease site and specific treatment technique (Figure 1). The entire process from consent to treatment completion could then be linked via IQ Scripts (Figures 2 and 3). In order to adapt this new workflow, it was essential to understand and verify the end-to-end process for RT.

ACTION PLAN FOR IMPLEMENTATION

Process maps were reviewed and modified to accurately capture the clinical practice and

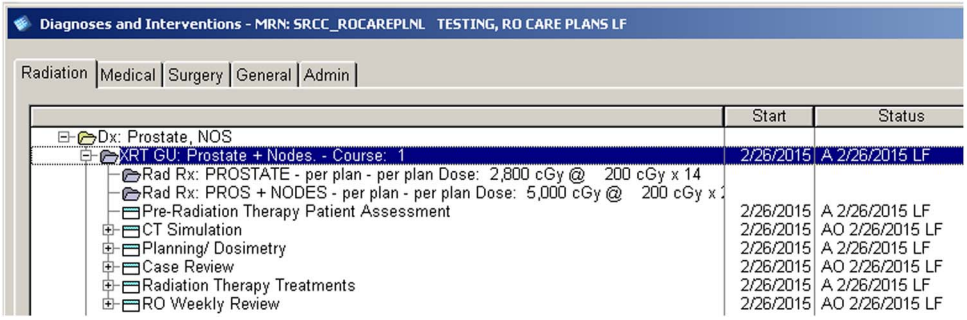

Figure 1. A Radiation Oncology Care Plan for a radical prostate and pelvis lymph nodes case displayed in diagnoses and interventions within MosaiQ. All orders within the Care Plan are listed here.

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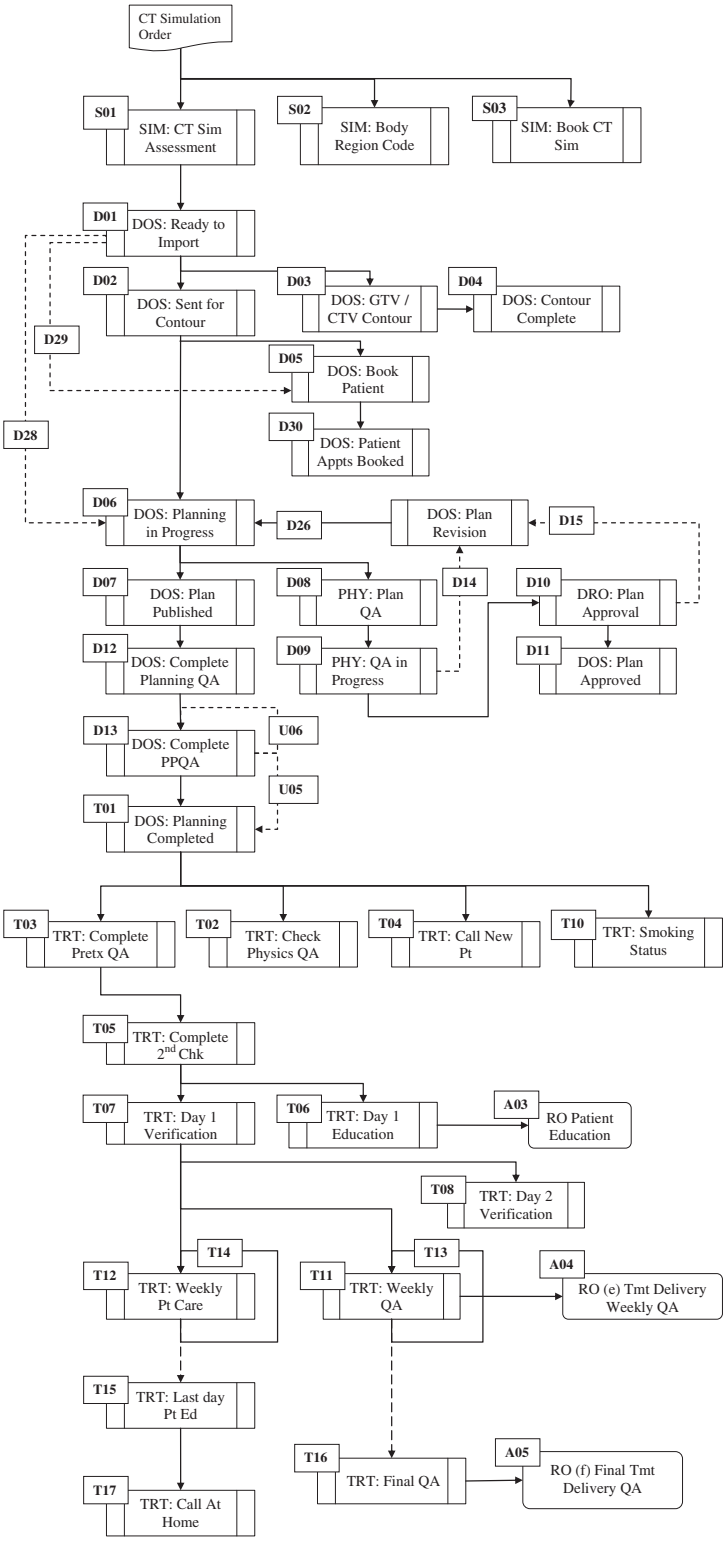

Figure 2. Flowchart of the end-to-end radiation therapy workflow using the IQ Scripts function. At each step, a Quality Checklist (QCL) or assessment is generated. S01–S02 indicate the simulation process. D01–D30 indicate the dosimetry process. T01–T17 indicate the treatment process. A01–A05 indicate the automatic generation of assessment tabs. U01–U06 indicate an alert for an emergency case workflow.

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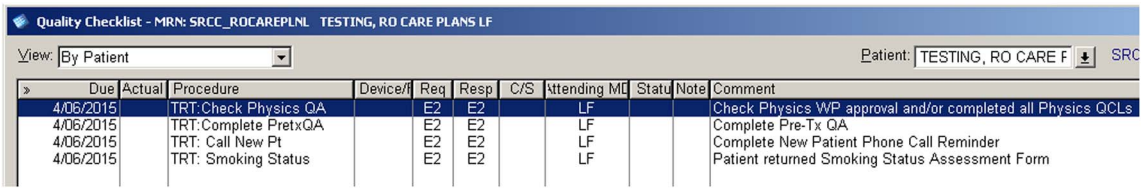

Figure 3. A simplified Quality Checklist under the new process. Only items that are due immediately are shown.

accommodate the new processes with RO Care Plans. All stakeholders were consulted and given the opportunity to provide input to the new workflow. A detailed action plan was developed to ensure a smooth transition from previous practice to the new process of using RO Care Plans.

Radiation oncologists were consulted for all disease-specific and treatment technique care plans. The building of each care plan was based on the site-specific standards of care procedures for radiation treatment, such as intravenous contrast orders for CT simulation, as well as additional activities needed during treatment, such as dietitian referrals. An example of a radiation treatment care plan for a prostate and pelvic lymph nodes case is shown in Figure 1. A total of 51 Care Plans and 95 IQ Scripts were developed. All aspects of the RO Care Plans and IQ Scripts were tested, before implementation, to verify that they would perform as planned. One-on-one education sessions were conducted with each radiation oncologist, as the implementation of RO Care Plans would be a significant change to their daily workflow. These sessions ensured familiarity with the use of care plans before clinical implementation and refined any orders or activities within each care plan. In addition, training sessions were held with the different professional disciplines (Nurses, Radiation Therapists, Medical Physicists and Unit Clerks) to cultivate understanding of the RO Care Plans and the changes to the daily operations and activities. A 'Go Live' date was set for 30 March 2015, from which all new patients consented for treatment would be processed using the new RO Care Plans workflow. This avoided any confusion in running two processes simultaneously. During the transition period, the implementation team provided technical support and coaching to clinicians working in new patient clinics, CT simulation, planning and on the treatment units. This facilitated a smooth changeover of the workflow and minimised interruption to the clinical operations of the department.

IMPLEMENTATION OBJECTIVES

The RO Care Plans workflow is designed to incorporate key concepts of process engineering and human factors engineering.[3,4] Multi-disciplinary involvement, repeated hands off and interdependent tasks are inherent in the entire radiotherapy process. Thus, the new daily workflow needs to maximise the available resources and, at the same time, ensure that the safety and quality of treatment is maintained throughout the entire workflow.

Process engineering methodologies have been widely adopted to improve quality and safety in high-risk industries, such as the aviation industry. The key concepts include improving efficiency by streamlining processes, removing ambiguity, improving communication and standardising workflow.[3] These are applicable to the adoption of RO Care Plans at our Centre. The Care Plans streamlined the RT processes by eliminating the duplication of tasks in the secondary booking system, which can be considered as 'waste' within the process. This elimination also declutters the physician's workload, which consequently improves efficiency within their clinics as well as increases their available time for interacting with patients or performing other critical tasks. The idea of streamlining is integral to the lean approaches to process improvement, where waste is identified and eliminated to maximise the value of the activities being performed.[3,4]

The utilisation of IQ Scripts allows different tasks to be automatically prompted by QCLs, at the appropriate time, to the responsible professionals. Once the Care Plan is applied, the system

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will trigger a cascade of events to move the process forward within the department. This process is different from our previous state that relied on the end users to consistently look upstream to monitor whether the previous task had been completed. Through RO Care Plans, the end users would automatically be prompted once the upstream activities have been completed. The resulting process is now system driven as opposed to user driven. This creates a system that removes any ambiguity of responsibilities and improves communication among team members.

Consolidation of the entire workflow within one platform provides transparency of care for all patients and equal access to information for all clinicians. By increasing transparency and enabling the sharing of information among health-care providers (e.g., medical oncologists), this information infrastructure can facilitate improved coordination of care within the Cancer Centre. As each task is interdependent, it also creates an accountability framework and performance management structure to ensure the safety of all patients undergoing treatment. For example, nurses can identify the step within the process of treatment planning for a patient. Finally, RO Care Plans standardise workflow to maintain the same standard of care for all patients as determined by their specific disease presentation and treatment technique. An example of this is that all concurrent chemo-radiotherapy patients are referred for a dietitian consultation through an order within the concurrent care plans.

Care plans are also designed according to the principles of human factors engineering. These principles act to support human work and can lead to a successful process that includes automation, simplification, standardisation and forced functions.[4] The use of IQ Scripts not only removes ambiguity and improves communication, but they also automate the notification of responsible parties that specific tasks are ready for completion. This enables the completion of all steps in the workflow and safeguarding from steps being missed or skipped. It also enables standardisation in ensuring the same tasks have been completed upstream and downstream in the process. Furthermore, forced functions are utilised in the new workflow so that team members are forced to complete certain QA Checklists at a particular time within the process. Thus, the new workflow is designed to be more suitable to the operators such that the system can maximise the human performance in order to achieve improved patient outcome.[5]

Besides designing a workflow based on process and human factors engineering, the RO Care Plans enable the department to collect multiple performance indicators to facilitate data-driven continuous improvement of the health-care service. For example, target contouring time can be collected based on the time stamps of the QCL and the time variation can be analysed. Control charts could then be plotted to evaluate the wait time based on different disease sites and technique. Whereas specification limits would be generated based on the provincial or departmental guidelines, control limits would be generated based on process characteristics. Variations within the process could then be identified as random or non-random events. Variations due to random events would be 'in-control', and not need adjustment, whereas non-random events would be considered 'out-of-control' and prompt further investigation and process improvement. The data can therefore guide the allocation of resources and ensure workflow efficiency. Thus, the new innovative RO Care Plans process provides the framework to continuously improve health-care services for patients.[6]

CHALLENGES AND LIMITATIONS

Alongside the many benefits of utilising RO Care Plans, there were a few challenges and limitations that needed to be overcome during the implementation stage of the process. First of all, this new workflow introduced major changes to the RT end-to-end process. As change to workers' routine is the major source of risk, it can create unwarranted errors and challenge some long-lasting approaches to quality.[4] Thus, an extensive training schedule was established to support each member of the team. This ensured all professionals would be able to perform their tasks correctly and confidently in the new setting. The training and guidance was particularly important for our radiation oncologists. With the

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new workflow, applying and approving the RO Care Plans correctly by the radiation oncologists is of the utmost importance as it triggers the flow of patient care. The RT process will not flow downstream if this is done incorrectly. In comparison, missing steps or information, such as a missing booking system account, were not as easily identifiable with the previous workflow.

In addition, contouring prompts have changed from an email with the previous process to now a QCL notification. This requires radiation oncologists to be diligent in checking their personal QCL lists to ensure tasks are performed in a timely manner.

Lastly, a lot of effort was invested in the design and implementation process. Changes in workflow require time to implement and results are not noticed until after the implementation and transition periods.[7] This can create frustration and confusion among staff and they may not be able to appreciate the potential benefits in the beginning. Therefore, tremendous amounts of education and communication were required to help facilitate the adoption of the process change.

FUTURE DIRECTIONS

With the implementation of RO Care Plans, the RT process is easily managed within MosaiQ. The current Care Plans will be closely monitored to ensure that they are reflecting current practice and identify where modifications are needed. As our Centre introduces new clinical practices, additional Care Plans will be developed for any new treatment sites and techniques. It is our hope that Post-Radiation Treatment Follow-Up Care Plans will also be established in the near future.

A number of initiatives are underway to ensure the long-term sustainability of the program. First, data can be extracted from MosaiQ with the implementation of RO Care Plans. As each patient with the consolidated workflow will have at least one Care Plan associated with them, the monthly departmental caseload can be reported and analysed based on the application of Care Plans. Within a 6-month period following implementation (1 April to 30 September 2015), we were able to identify that 40% of our cases were of a palliative intent, 30% were breast cancer cases and 10% were radical lung cases. During this time, there was a steady monthly intake in our department with an average of 110 new care plans applied each month (Figure 4). As the entire RT process is mapped within each Care Plan, measuring the number of care plans applied facilitates measurement of all the work that occurs within the RT department.

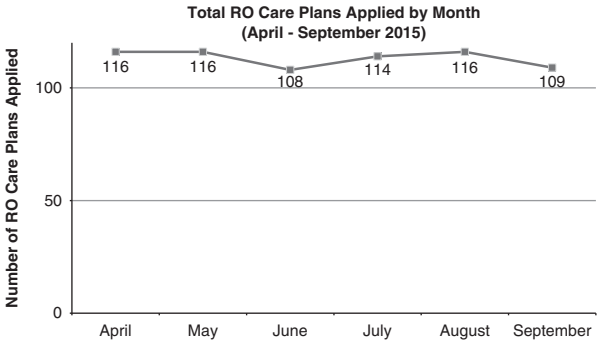

Figure 4. The number of care plans applied in each month from April to September 2015.
Abbreviation: RO, Radiation Oncology.

Moreover, workflow reports can be generated to recognise any bottleneck situations within the department. In this case, resources can be shifted to those tasks and areas so that such tasks are completed in a safe and efficient manner. As each step of the RT workflow is marked using a QCL item, the time stamps of creation and completion of each QCL can be extracted. These performance indicators can allow us to identify the efficiency of the process as well as to investigate the reasons for any delay within the end-to-end process. For example, the time difference between the creation and completion time of the contouring QCL will give us a performance indicator for contouring timelines for each disease sites. Currently, the internal guideline is to have targets contoured within 48 hours. The workflow report can identify the time required for each case and a baseline can be established for each treatment site. The preliminary data is shown in Figure 5. With this information, we can identify outliers, to direct further investigation and corrective actions.

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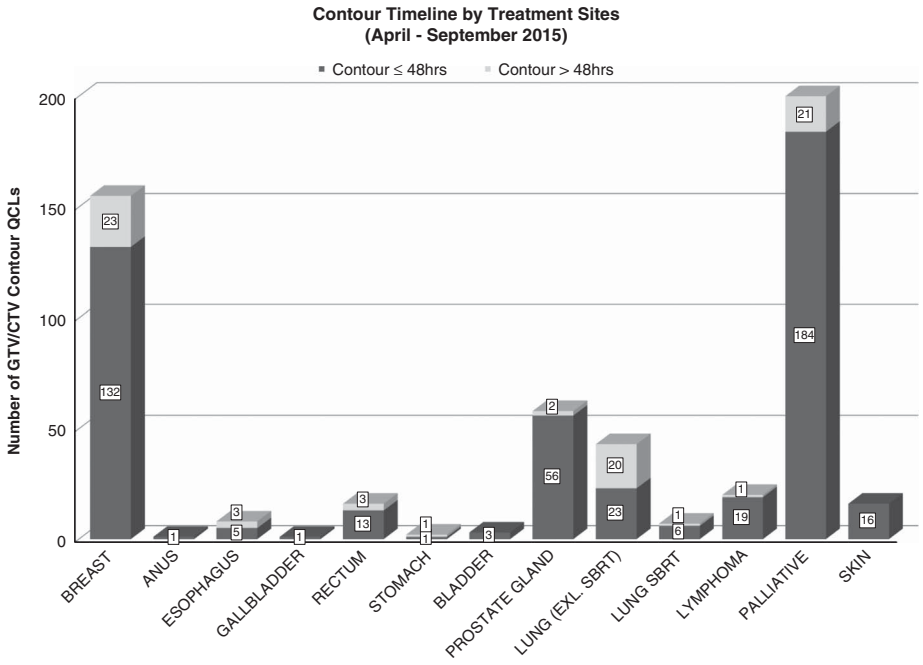

Figure 5. Target contouring timeline by disease site, from April to September 2015, to identify the frequency of targets contoured within and outside of 48 hours.
Abbreviation: QCL, Quality Checklist; CTV, Clinical Target Volume; GTV, Gross Tumor Volume.

A future direction is to implement a patient list in the department, which can be easily identified and displayed. The creation of a 'white board' based on the QCL items within the workflow is currently under development. The vision is that the management team can monitor the activity and allocate resources for a smooth daily operation. For example, the 'white board' would identify the number of patients arriving for CT simulation in the coming week, the number of cases undergoing planning and so on.

As all major steps in the radiotherapy process can be tracked, the information can serve as a building block for future initiatives, such as a patient portal, enabling patient-centred care that allows for a better patient experience during RT treatment. This web-based application can allow patients to understand their own treatment process and create transparency for our patients. For example, patients would be able to follow the progress of their treatment plan as it moves through the system, number of remaining treatments and so on. This communication tool will drive patient-centred care as well as increase patient satisfaction and experience with our service.

CONCLUSION

The implementation of electronic RO Care Plans serves as a foundation for process improvement at a local Regional Cancer Centre. RO Care Plans can enhance daily workflow and maximise the performance of clinicians in radiation medicine. The benefits of RO Care Plans are based on process and human factors engineering. They can streamline process, remove ambiguity, improve communication, standardise workflow, automate tasks and create forced functions. Multiple future directions, such as caseload reports, workflow reports and a 'white board', are under development. The multiple performance indicators obtained from the RO Care Plans can ensure data-driven continuous improvement and guide the future development of cancer centre services.

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Conflicts of Interest

There are no conflicts of interest for all authors.

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