Report

Radiotherapy in New South Wales
A business improvement strategy

July 2009

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1 Executive summary

Radiotherapy, the use of high energy x-rays and similar rays (such as electrons) to treat disease, is a major component of treatment for many people with cancer. It can be given either as external radiotherapy from outside the body using x-rays or from within the body as internal radiotherapy. Radiotherapy works by destroying cancer cells in the treated area. Although normal cells can also be damaged by the radiotherapy, they usually repair themselves. Radiotherapy treatment cures some cancers and can also reduce the chance of a cancer coming back after surgery. It may also be used to reduce cancer symptoms.

Under the Radiotherapy Business Improvement Strategy (RT BIS), the Cancer Institute NSW with the support of NSW Health worked with the staff of 10 public radiation oncology treatment centres (ROTC) to identify opportunities for improvements in the operational practice of radiation oncology service delivery. The principle objective of this project was to provide patients with improved access to radiation oncology treatment through better-coordinated and more cost-effective service delivery.

The project was conducted in three phases from May 2006 to October 2007 and was facilitated by an external consultant, LSI Australia Pty Ltd. Project teams and steering groups were established for each centre and were responsible for setting their own targets, prioritising their own improvement initiatives and for developing their own solutions. Typically, the chief radiation therapist on each site acted as project manager. The projects were carried out by multidisciplinary teams of centre staff with external consulting support.

Each project followed a common approach, including:

- Establishing a baseline of performance over a range of common key performance indicators.
- Mapping current patient flow processes.
- Engaging centre staff in all disciplines and at all levels in critiquing the current processes.
- Establishing small teams to address the key problem areas identified by the critiques.
- Trialling and implementing solutions.
- Installing a new Management Operating System to provide daily and weekly visibility on centre activity.

During the six-month baseline period prior to the commencement of the project, the 10 participating centres averaged 354 courses per potential linear accelerator per year, with only two centres meeting the NSW Health service planning figure of 414 courses per linear accelerator per year across all their linear accelerators. At the completion of all projects the participating centres averaged 411 courses per linear accelerator per year, an increase of 16 per cent.

Overall, the participating centres demonstrated an annualised theoretical increase in throughput of 1,467 courses per year. Where they existed, waiting lists were reduced in most centres.

The North Coast Cancer Centre at Port Macquarie and Coffs Harbour Base Hospitals, adopted the methodologies established through this program in the recent establishment of their radiation oncology treatment centres.

2 Improving access to treatment through process change

Redesign and process change serve many different needs in the modern healthcare environment. Redesign projects are being undertaken across many countries covering the whole healthcare spectrum from community to acute services and beyond. Healthcare organisations are using redesign to address variation in the quality of care and improve public satisfaction.

Healthcare redesign involves thinking through the best process to achieve speedy and effective patient care. The approach includes identification of delays, unnecessary steps and potential for error to redesign the process to improve the quality of care.[1] More and more, system and organisational change in healthcare is being driven by the need for increasing flexibility to meet increased costs and patient demands.

Redesign is not a new concept, yet it is rapidly evolving in healthcare. Redesign as a concept represents a radical challenge to healthcare providers to reconsider their whole approach to improving the quality of services rather than focusing on specific aspects.[1]

Many processes in healthcare have developed organically with little critical analysis over time as the demands on services have changed or as the technology available for patient care has improved and become available. The reactive nature of much of healthcare has not allowed time for reflective thinking regarding processes and potential for improvement.

Redesign in healthcare means not just doing more of the same, or doing it slightly differently. It thinks about the assumption that it needs to be done at all, and whether what is done at present adds any value to patients.[1] Process redesign should not be confused with changing clinical practice and challenging established clinical guidelines and the evidence supporting effective clinical outcomes. Rather redesign is about improving the processes underpinning the delivery of clinical care.[2]

There are several facets related to the delivery of radiotherapy in NSW that make it suitable for a process redesign approach. These include:

- The need to improve patient access to radiotherapy considering that approximately 52 per cent of the estimated 30 per cent increase in the number of cancer patients over the next 10 years will require radiotherapy.[3]
- The highly coordinated multidisciplinary service provision model lending itself to redesign methodology with input from each contributing group.
- A suspected underutilisation of services. If in 2006, each linear accelerator had provided the 414 courses used by NSW Health as a planning parameter, an additional 2,544 courses could hypothetically have been delivered across the state.

The scope of the program included the following objectives:

- to develop, implement and sustain smarter models of care in radiotherapy clinical practice
- to facilitate processes to implement changes in these practices
- to develop business models to improve business efficiency statewide.

The following outcomes were expected:

- improvement of access to treatment at the local level
- reduction of waiting times and the numbers of patients on waiting lists.

Importantly, the project acknowledged that improvements needed to be made beyond equipment and workforce to develop models of care that best utilise available resources.

3 The project approach (methodology)

Preparation for the project

The evidence on redesign both in healthcare and other industries suggests that if the process is to have any deep and lasting effect strong senior leadership (clinical and managerial) is needed to support front line teams, remove obstacles, and negotiate horizontal cross-boundary relationships.[1]

Involvement of the Chief Executive (CE) or senior management is essential to ensure that smaller improvements are consistent with the overall organisational goals and to confirm that the required resources are available to support and sustain change.

To prepare for the project, endorsement was sought at CE level of the participating Area Health Services (AHSs), together with the ROTC Directors. Project teams and steering groups were established for each centre and typically the chief radiation therapist on each site acted as project manager.

Clinicians may feel that their ability to exercise clinical judgement and professional autonomy are threatened by redesign. It is important to emphasis during these projects that the focus is on process change, not practice change.[2] This aspect was strongly emphasised in preparing for the RT BIS project.

The literature suggests that well run redesign projects are managed by local frontline staff with the support and oversight of senior management with facilitation by experts experienced in the process.[4] The project was built on this design, with the appointment of LSI Australia Pty Ltd by the Cancer Institute NSW to execute the project at each site. The external consultants principal responsibility was to ensure that the local projects succeeded in improving performance on-site. To achieve this, the consultants were responsible for the following tasks:

- Setting up the Performance Improvement Projects at each centre.
- Collecting and disseminating the baseline key performance data.
- Designing and implementing the daily and weekly management operating systems at each centre.
- Establishing the Centre's project steering groups, and managing the transition of these into business management forums.
- Mapping the detailed processes for each centre
- Conducting all staff critiquing of the centres processes.
- Analysing the results of the critiques, and helping prioritise where needed.
- Establishing continuous improvement processes in the centres to address the priority issues which emerged from the critiques.
- Developing detailed proposals for substantial process changes which addressed:
  - redesigning the processes around booking of patients for treatment and imaging
  - redesigning the processes around planning the patient's treatment
  - billing.

Each project followed a common methodology covering six broad phases:

1. Start up - In the start-up phase the consultant met with the key stakeholders and local staff to get a high level understanding of the business and the potential bottlenecks.
2. Baseline determination - Phase 2 involved the collection of a common set of baseline Key Performance Indicators (KPIs). These were used to monitor the process at the local level and were not intended for comparing individual units against each other.
3. Process mapping - Phase 3 represented the actual mapping of workflows and processes involving engagement of all staff in critiquing of these. Out of this phase the areas of focus for process improvement were identified.
4. Process improvement - Once workflow critiquing was completed, work began on improving process and facilitating change. This included the establishment of a Management Operating System (MOS) to monitor a subset of KPIs on a daily and weekly basis to examine the effect of process change.
5. Continuous improvement - In the Continuous Improvement Phase teams were established to look in detail at particular problem areas. These teams were responsible for proposing and implementing improvements.
6. Sustainability and ongoing support - In the final phase the implemented changes were monitored and fine tuned through the establishment of a new unit management forum to drive performance and continuous improvement.

4 **Results** and discussion

The RT BIS was conducted in three phases and by its conclusion had covered ten ROTCs. The sites and project periods are as follows:

- May to August 2006 - Royal Prince Alfred Hospital, Liverpool Hospital and Campbelltown Hospital.
- October 2006 to April 2007 – St George Hospital, Wollongong Hospital, Westmead Hospital, Nepean Hospital and Royal North Shore Hospital.
- June 2007 to October 2007 - Prince of Wales and St Vincent's Public hospitals.

Results on individual project phases

Start up phase

The first part of the project at each site involved initial discussions with key stakeholders. The responses capture the predominant themes:

- "Radiation Therapy requires a complex team effort to deliver treatment – we often communicate poorly and end up chasing people to get the message across".
- "Despite good data collections and business systems there are no clear indicators for radiotherapy performance and it is hard to monitor throughput".
- "The complexity of radiotherapy planning causes frustration. This stems from the complexities of the quality and safety requirements of radiation oncology treatment planning and often adds to delays in the finalisation of plans".
- "Process bottlenecks occur well up stream in the treatment and planning process and impact on the number of patients being treated on the linear accelerators".
- "We need more management skills training if we are to increase treatment capacity."

Baseline determination

To determine baselines for the project, data from the previous six months was collected and included:

- courses per machine (throughput)
- attendances per machine
- machine operating utilisation
- referrals
- billing.

The 10 participating centres averaged 354 courses per potential linear accelerator per year over the six months prior to the commencement of the project. Only two centres met the planning figure of 414 courses per linear accelerator across all their treatment machines.

Process mapping

A process is a systematic series of continuous actions, operations, or a series of changes taking place in a definite manner directed to some end. The mapping of processes is a powerful tool for visually demonstrating workflows and understanding them in their totality. The literature on redesign is unanimous that mapping of workflows and processes followed by the engagement of all staff in critiquing of these is an essential step early in the process improvement project.

This visual representation of the process allows those involved in sections of the process to see it in its entirety and to better understand their role in the overall pathway. The process engages staff in understanding the journey end-to-end, and in owning any problems that emerge. Individual staff may feel their own contribution to the process is straightforward, but may never have seen how it fits into the wider picture and how the whole system could be made more efficient.[1]

Process mapping focuses on how processes are organised prior to any intervention rather than identifying how a process would work in an ideal system. This method of identifying the work done includes all of the major activities undertaken; how information is transferred, connections and interactions with other specialties and departments. Once constructed, process maps are subject to a period of critiquing by staff involved in the process. In this critiquing the focus is on the structure and the process rather than the persons responsible for it. The first rule of a mapping session is that it must record what the process is, not what people think it should be.[7] Mapping the patient journey needs careful planning and facilitation to prevent blaming .

Addressing issues raised during the mapping process requires a robust debate including [7]:

- why a particular step occurs
- what can be changed
- what steps really add value and have an impact on patient outcomes
- what steps do not add value and can be eliminated.

In their knowledge of systems, clinicians have been shown to play an important role in these debates, providing invaluable input to liberate existing resources by deploying them more effectively.[2] Clinicians were actively encouraged to participate in the mapping part of the RT BIS project.

The literature on redesign outlines typical examples of issues raised as a result of process mapping. They include :

- Poor communication usually occurring at the interfaces of clinical practice.
- Decision makers not available at times when decisions are to be made.
- Poor alignment and timing of activities involving a single patient, either not consecutive or separated by long intervals between activities.
- Imperfect alignment of laboratory and imaging services with patient requirements.
- Mismatch of patient demand and staff supply.
- Lack of co-ordination of care and variable clarity on who is responsible for a particular patient.
- Poor documentation compliance.
- Decision making only happens '9 to 5' Monday to Friday.
- Suboptimal processes for accessing services delivered in the community.
- Teams not authorised to perform the tasks required.
- Delays in the process causing a damming of patient flow 'downstream' that exacerbates 'upstream' congestion.

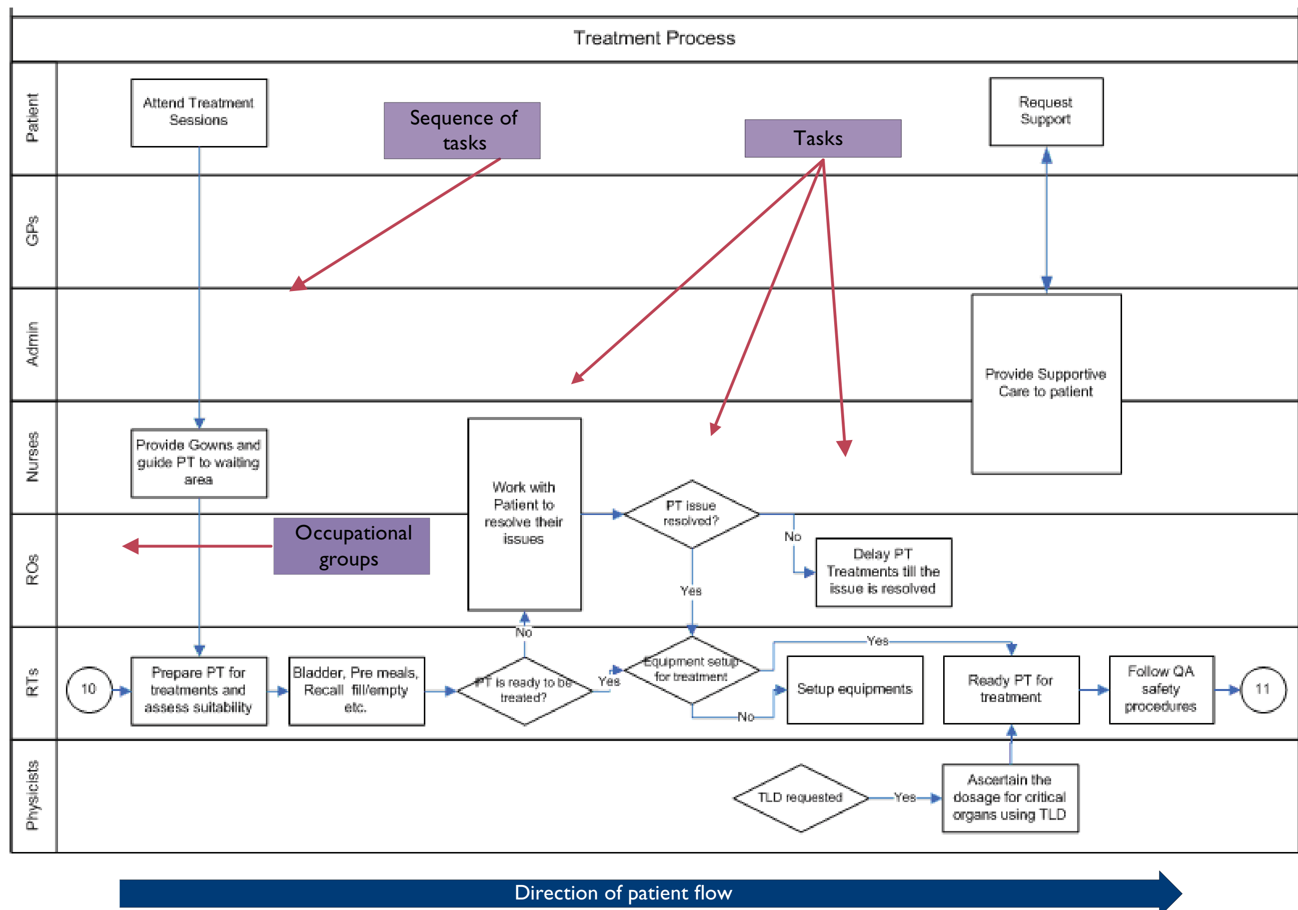
During this process mapping phase of the RT BIS, workflow processes were mapped using a Brown Paper Workflow Mapping and Critiquing Technique. As can be seen in **Figure 1** the workflows were displayed on brown paper on a long wall in a non-clinical area accessible to all staff. The entire workflow was displayed to provide staff an opportunity to observe the entirety of the workflow and their own contribution. Prior to representing the workflow visually it was possible that some staff may not have fully understood how their role added to the patient journey. This step provided staff with perspectives outside their own, regarding how the system could be made more effective.

Figure 1: The brown paper workflow mapping and critiquing technique

Once the workflow was completed the staff from the unit were invited to critique it on the proviso that nothing was excluded apart from apportioning blame. The staff were either taken through the workflow in groups or individually. Comments and critiques were added to the workflow using "post-it" notes. Once completed the critiques were assessed, analysed and where possible grouped into common themes.

A 'swim-lane' style of workflow map was used (see **Figure 2**) where individual occupational areas were listed down the left hand side of the map in individual 'lanes' stretching horizontally across the map. The workflow of the patient treatment pathway was then mapped horizontally across the diagram with tasks sequenced to each occupation group (including the patient). The completed process map clearly demonstrated the complexity of the processes and was used by those involved in the system to identify opportunities for change.

Figure 2: Sample 'swim-lane' workflow map



Themes for improvement were consistent across all participating ROTC and mainly focused on:

- Simplifying the booking process including possible automation of the booking process.
- Ensuring patient referrals were current.
- Amending the patient consent approach.
- Ensuring required or missing documentation is available at the time it is needed.
- Formalising and standardising treatment planning interactions between key occupational groupings including communication and access to medical staff.
- Rostering of staffing across all specialities to ensure continuous coverage by key decision makers at appropriate times.
- Duplication of safety and quality assurance checks at the treatment planning stage.
- Billing and the tracking of revenue streams into the service.

A small set of Key Performance Indicators (KPIs) describing workflow was also developed during this phase of the project and included:

- Attendances per linear accelerator per day.
- Treatment plans completed.
- New and re-treatment consultations.
- Number of patients started, finished and under treatment.
- Number of unbilled files.
- Linear accelerator availability.
- Waiting list status:
    - average waiting time by triage category
    - numbers of patients by triage category.

Process improvement

The next phase of the project was process improvement and focused on data collection. These small data sets were intended to provide a snapshot of the units and were used to determine the priority areas upon which to focus change. The data needed to be simple, clearly visible to all stakeholders and available in real time to allow analysis and correction of problems.

During this phase of the project, the concept of management operating systems (MOS) was introduced to the ROTCs. The MOS is the regular collection and reporting of a small standard set of key performance data describing the workflow processes of the centre, and for the purposes of this project were designed to align with the KPIs.

In most cases, the data required for the MOS was extractable from the existing radiotherapy business IT systems and was therefore available in close to real time. The MOS was useful in analysing the effects of any incremental process change and was used to set targets and confirm that the interventions achieved their goals.

This stage highlighted the importance of data collection in maintaining improvement, in particular:

- Ensuring that the management teams had the daily and weekly information needed to focus on all aspects of the centres' performance.
- Interpreting the data, and proposing actions in response.
- Helping develop solutions to the priority issues identified during process critiquing.
- Providing hands on input where needed.

The literature on redesign shows that the key to engaging senior clinicians is to supplement discussion of the theoretical model of redesign with simple examples and supporting datasets that can be applied in their own clinical practice.[1]

The literature on redesign in healthcare systems suggests that data identifying the nature and extent of problems and evidence of improvements provide the strongest tool with which to engage clinicians in the change process.[4,5]

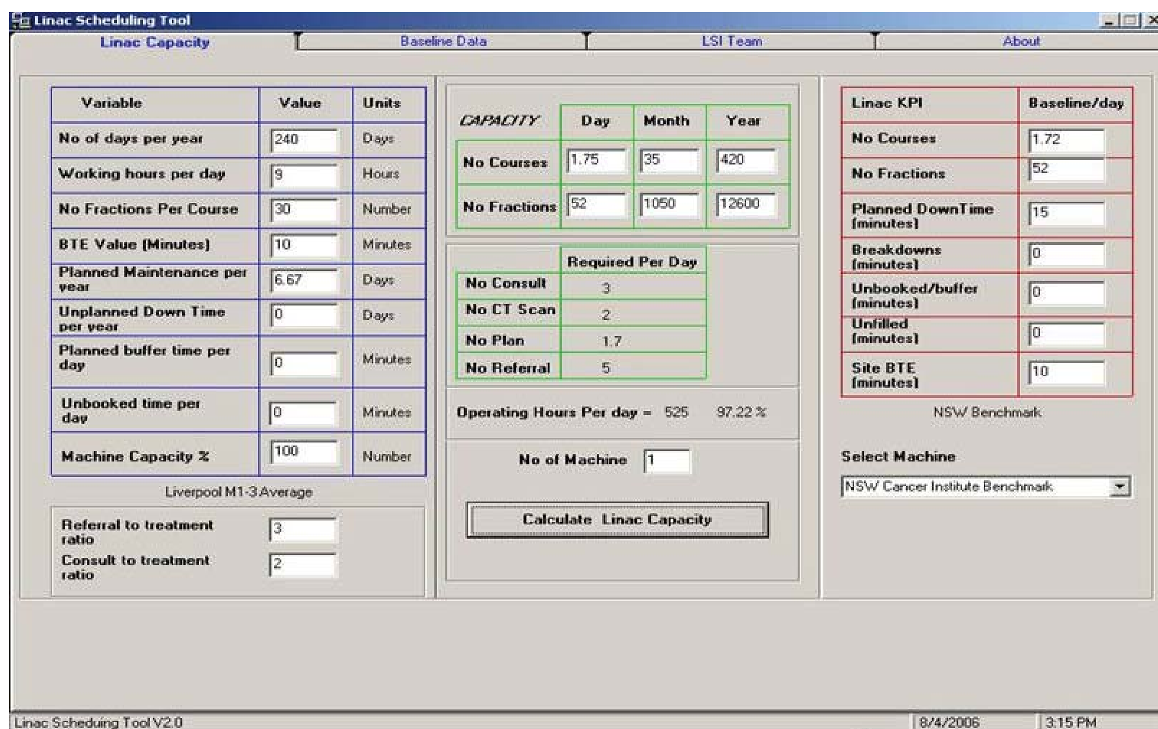
Continuous improvement

The next stage of the project was the continuous improvement phase. In this phase, LSI Australia coached the local staff on the components of the Quality Improvement Cycle (**Figure 3**) stressing the importance of regular analysis of the key performance data utilised in the MOS.

Figure 3: The quality improvement cycle

During this phase, the consultants worked with the teams to develop specific quality improvement tools. **Figure 4** shows an example of a modelling tool for linear accelerator capacity into which the process inputs can be varied and the influence upon these quantified in terms of patients treated per day. Using this tool to set a theoretical capacity, it was shown that on average a 30 per cent higher capacity for treatment was possible compared to the baseline period.

Figure 4: Sample of theoretical linear accelerator capacity modelling tool



These theoretical capacities were then used to set the patient treatment targets for each linear accelerator. Through the continuous improvement phase the centres incrementally increased the number of patients booked per day for treatment and planning in an approach termed 'practical optimisation'. The main elements of this approach were:

- To progressively increase the number of patients booked each day, usually by increasing the number of daily appointments per linear accelerator by two each week
- Monitor the impact on patient care, by a combination of Senior RT observation and feedback from treatment teams.

This 'practical optimisation' approach was useful in eliminating or reducing the buffers from the various components of the patient flow process.

In incrementally adjusting processes the project teams understood the role of mentoring. To do this, each day's performance was assessed and any issues arising noted for resolution. Using the flexible approach, potential problems were anticipated and adjustment to schedules and rosters made accordingly. These changes were then reported at the regular review meeting where the project progress was discussed with the project teams. In an ongoing application of the process, it would be useful for key decision makers to be involved in this process.

Sustainability and ongoing support

Sustainability is defined as the capacity to continue operating in an ongoing way.[4] Previous authors have identified sustainability to be the most challenging phase of clinical process redesign.[4] Embedding the changes of a quality improvement project such as the RT BIS and supporting the redesigned processes into core business is the lasting challenge of clinical redesign projects.

The primary risks to sustainability of the RT BIS have been identified by the project consultants as:

- The gap between capacity and referral patterns. For centres with insufficient referrals, there is very little incentive for unit staff to continue with the new methods.
- The absence of continuing education in the redesign process as there is a risk that new methods of work will be gradually abandoned as staff skills need refreshing and new staff need to be trained in these methods.
- Abandonment of established management operating system as department heads have competing demands on their time and other than the goodwill of the participants there is no requirement to continue with the management process.
- Underuse of tools. A series of tools was developed during the project. Their dissemination and further training on their content is an upcoming sustainability initiative of the Cancer Institute NSW.

Despite the heavy clinical load for all centres and pressures for some units undertaking decommissioning and recommissioning of treatment equipment, it was clear there was a general willingness and desire to participate in the program and to continue the benefits.

To assist in sustaining the benefits of the program, recommendations include:

- Weekly or fortnightly review of a small set of performance data. This could be facilitated by automating the extraction routines from the radiotherapy business systems where the majority of the data is already collected for other purposes.
- Assign responsibility for continuous quality improvement initiatives to an existing staff member.

- Develop mechanisms to encourage the transfer of knowledge of good practice between centres.
- Seek opportunities to introduce incentives for individuals and centres to reward performance supporting process improvement;
- Provide education and training in continuous quality improvement methodologies including the tools and methods developed for this project.
- Examine options for regular reporting to a central agency and Area Health Services on the defined Key Performance Indicators as an external reason to maintain the data collection, reporting and usage.
- Introduce a regular rolling patient experience survey and include a patient "non executive" participant in the management process to provide an external stimulus to sustain the process.
- Seek to align the continuous improvement initiatives from this program with the broader NSW Health Clinical Redesign Program and forums including ARCHI.

McGrath et al suggest several strategies for supporting sustainability of redesign projects, which align with the approach applied in the RT BIS project.[10]

Overall results

Throughput

Over the years, there has been much discussion within radiotherapy circles around the baseline for the annual number of courses per year per linear accelerator. For the purposes of the RT BIS, the NSW Health service planning figure of 414 courses per linear accelerator per year was used to establish a comparator for initial and ongoing measurement of performance in improving access.

The activity over the six month period prior to the project at each centre was chosen for the project baseline. During this six month period, the 10 participating centres averaged 354 courses per potential linear accelerator [1] per year. Only two centres met the planning figure across all linear accelerators. It should be noted that the activity figures for the remaining centres may have been below the service planning figure due to fewer referrals or more complex cases.

By the end of their respective projects, the participating centres averaged 411 courses per linear accelerator per year, an increase of 16 per cent. Incorporating this increase, the participating centres demonstrated an annualised increase in throughput of 1,467 courses per year, approximately equivalent to the treatment capacity of four linear accelerators.

Figure 5: Average courses per linear accelerator over project timeframe

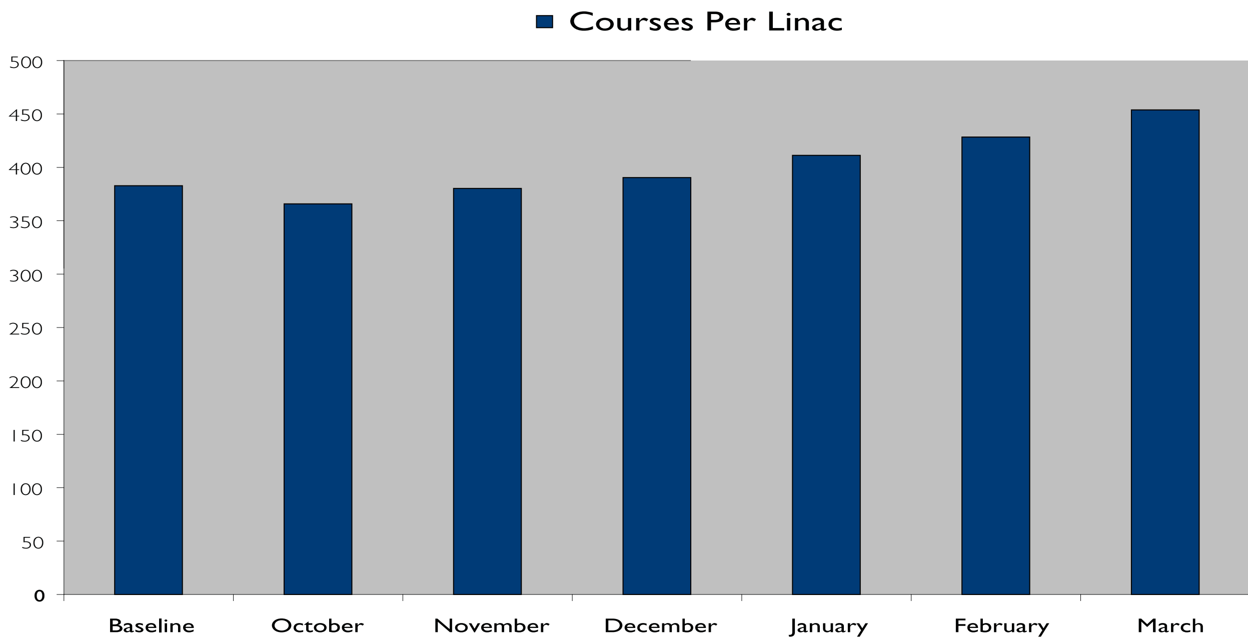
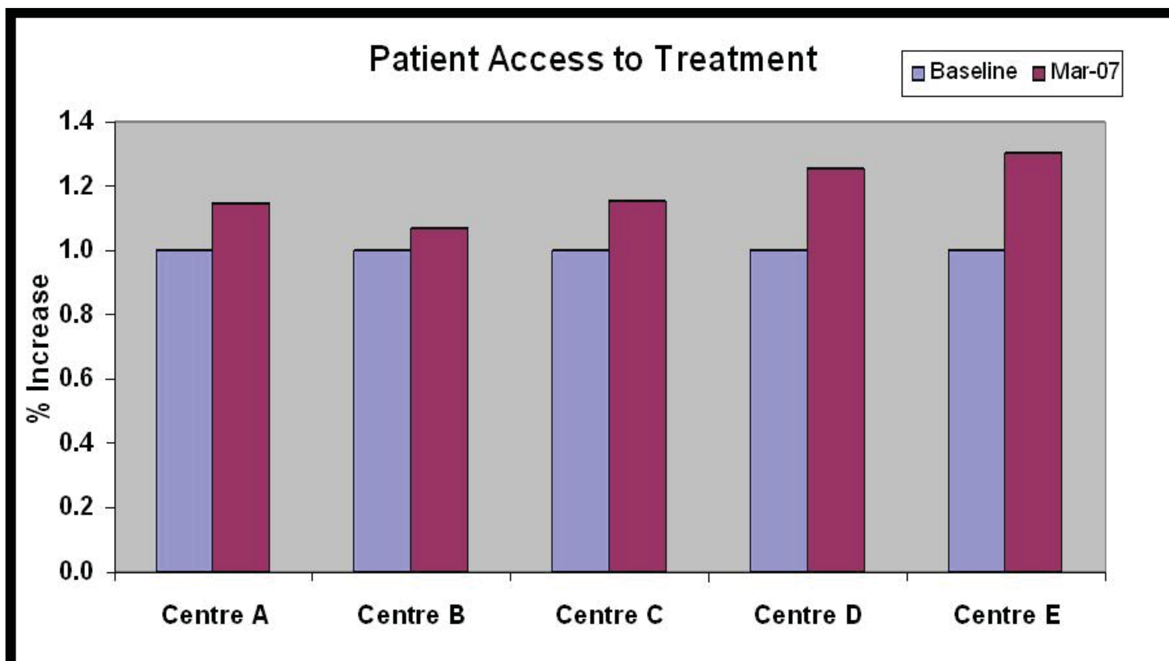


Figure 5 and **Figure 6** demonstrate the incremental improvements in throughput across the project. **Figure 5** demonstrates the changes in patient throughput across the duration of the project on average for all centres. It shows that as the project initiatives started to be implemented the benefits were gradually realised. **Figure 6** shows that the full benefit of process improvement was seen in comparing the last month of the project to the baseline data. The average increase in patients treated in the last month of the project compared to baseline, was 19 per cent with a range from 9 per cent to 27 per cent.

Figure 6: Improvements in courses per linear accelerator across five project sites



It became clear early in the project that for the purposes of throughput improvement centres fell into two general categories:

- Those centres where the volume of referrals (demand) is typically on or in excess of the centre's treatment capacity.
- Those centres where the volume of referrals is typically below the centre's treatment capacity.

Process improvements achieved during the project could be translated directly into increases in patients for five centres. Prior to the project, the baseline throughput of these centres was 385 courses per linear accelerator per year. By the end of their respective projects, these centres averaged 462 courses per linear accelerator per year, an increase of 20 per cent.

For centres in which capacity exceeded demand, process improvements secured during the projects provided limited scope for throughput increases (as there were typically fewer patients referred to the centres than their capacity to treat.) For these centres, gains in throughput were typically limited to a one off increase caused by reducing the elapsed time to prepare patient treatment plans. The baseline throughput of these centres was 306 courses per linear accelerator per year. By the end of their respective projects, these centres averaged 333 courses per linear accelerator per year, an increase of 9 per cent.

If the theoretical treatment capacities per linear accelerator calculated by centre staff in the course of the projects were achievable, additional referrals to radiotherapy would need to be sought across the state to utilise this increase in capacity. Several suggestions for increasing the numbers of referrals to radiotherapy have been put forward including;

- Increase education of referring clinicians regarding the evidence base for the use of radiotherapy as a treatment, and in particular for new treatment methods.
- Communicate to the referring clinicians current waiting times for Radiation Therapy by centre, particularly for those centres with additional capacity and little or no waiting time.
- Establishing additional metropolitan and rural clinics to increase referrals and ensure optimal utilisation rates.
- Regular review of treatment centre capacities on a short interval basis and comparing these to referrals to provide early warning of centres where demand will exceed capacity.

Processes could be introduced for handling referrals in excess of capacity. These could potentially include:

- formalisation of Unit to Unit networks
- exploration of Area level coordination.

Waiting times

Waiting lists were reduced in most centres during the course of the project. By the end, waiting lists for Ready for Care (RFC) patients tended towards the centres' current planning timeframe – typically, two weeks.

Capacity

Those centres with referrals on or in excess of the planning figure calculated on average, a potential throughput capacity of 497 courses per linear accelerator per year. Those centres with referrals below the planning figure calculated on average a potential throughput capacity of 483 courses per linear accelerator per year.

By the end of their respective projects, the participating centres averaged 411 courses per linear accelerator per year, an increase of 16 per cent. Incorporating this increase, the participating centres demonstrated an annualised increase in throughput of 1,467 courses per year, approximately equivalent to the treatment capacity of four linear accelerators.

All the participating centres calculated theoretical throughput capacities for each linear accelerator. Across all 10 participating sites these aggregated theoretical capacities reflected a potential 39 per cent increase in courses per year compared to the planning figure, resulting in a theoretical additional 3,521 patients treated per year. In total achieving the theoretical calculated treatment capacity for each linear accelerator would add nearly 3,500 courses per year to the treatment capacity for NSW, or the equivalent of more than 8 linear accelerators. Even if only 50 per cent of the gap between achieved and calculated throughput is realistic, then a further 1,000 courses per year could be provided, in addition to the 1,500 achieved during the project.

Process improvement

In addition to increasing throughput, the RT BIS enabled the ROTCs to address parts of their processes causing local difficulties. As a result, a range of process improvements were secured, including:

- The elapsed time from consultation to treatment was reduced in most centres, to an average of 10 days from an average of 20 days.
- All centre management teams have tools to focus on work processes.
- The treatment planning process at each centre has been streamlined and simplified, eliminating potential bottlenecks and facilitating further reductions in elapsed time from consultation to treatment.
- The booking process in most centres has been formalised to maximise throughput and where necessary to eliminate "single person risk", where bookings could be delayed if a key staff member was absent.

A number of tools were developed during the project with the potential for future statewide implementation, including:

- throughput management
- patient booking
- electronic booking forms
- radiation therapist rostering
- radiation oncologist rostering.
-

Best Practice Service Delivery

As the RT BIS progressed, substantial cross-site analysis of booking, treatment planning and billing practices occurred. As a result, practices identified as successful at single or a few sites have been flagged as being potentially valuable for more widespread application.

Improving patient communication

Patients understandably do not usually place much importance on administrative matters when they are diagnosed with cancer. However, providing easily-understood information is a key component of improving business processes and smoothing the patient journey. A number of centres have introduced some or all of the following approaches to improve communication:

- An initial communication pack containing:
    - concise details about how to get to the clinic
    - where to park if driving
    - information about the treatment billing
    - requests to bring any test results that they might have
    - a reminder to bring the most current referral letter.

- Placement of notices in the ROTC Reception Area, reminding the patient to ensure they have a current and valid referral letter.
- Running of weekly referral letter reports to check for referral letters that are due to expire in the coming week. Patients are then asked to get a new referral letter.
- The provision of an information booklet upon completion of the planning session about the specific area of treatment of their tumour and information about health care during the treatment.
- The use of review and follow-up sessions as additional communication opportunities.
- Regular patient surveys to monitor the performance of the ROTC and provide a patient perspective on all aspects of the treatment process.

Securing patient consent

Securing patient consent was identified by participating centres as an issue affecting process flows. To mitigate this, standardised processes were developed during the project for radiation oncologists to secure consent at the initial consultation.

Booking patient planning and treatment appointments

The projects established three areas where centres can make significant improvement in booking:

- Transferring responsibility for booking to suitably qualified administrative staff.
- Implementing a 'practical optimisation' approach to capacity increase.
- Adopting a "do it now" approach to treatment start date.

In many centres, booking was carried out by a very senior radiation therapist. Although there are advantages in this, the overall consensus was that this diverted scarce and valuable resources from more value adding tasks. In addition, there has been a 'single person risk' at some centres, leading to a growth of waiting lists in the face of key staff absences.

Measures to address these issues include:

- Transferring responsibility for booking to suitably qualified administrative staff.
- Training more than one staff member to provide absence cover.
- Automating or partially automating bookings.
- Combining the booking of simulation and treatment.

Introducing incremental increases in appointments per day

From a perspective of increasing access to treatment the fundamental booking decision facing RTOCs is how many patients should / could be booked per linear accelerator per day. When considering approaches to improve this aspect, it should be noted that booking flexibility at some centres is constrained by limited scheduling software which does not allow appointments to be scheduled at intervals less than 10 minutes. However, where scope existed to introduce more flexibility, the following approaches were developed:

- Using adjusted basic treatment equivalent (BTE) as a de facto standard treatment time.
- Booking appointments in 10 or 20 minutes sessions and making approximate adjustments for casemix.

The project teams tested the usefulness of BTE as a scheduling tool, and concluded that while it would be of great value, the timescales needed to enhance and reach agreement on BTEs across all centres would prevent their implementation during the project. As a result the teams developed a 'practical optimisation' approach, which involves:

- Agreeing a potential treatment capacity per linear accelerator per day, based on realistic constraints.
- Gradually increasing the number of appointments per day up to this standard.

- Observing the impact on patients and staff, and adjusting the standard down if needed.

Treatment start date

The project found that treatment start dates for non-emergency 'ready for care' patients are typically influenced by:

- the need to minimise the elapsed time from simulation to treatment
- the increasing complexity, and so increasing time, required to complete and perform quality checks on treatment plans
- the availability of treatment slots.

As a result, a treatment start date at several centres was being booked based on availability, and then the patient's simulation appointment 'back-scheduled' a number of days based on a (often generous) time allowance for completing the plan. For centres with little or no waiting list there is an opportunity to reverse this process by:

- Booking the simulation appointment for as soon as possible after the consultation, at which consent is given.
- Booking the treatment start for a date based on standard plan completion times, say 10 days.

This approach has the further advantage that any reductions in time taken in planning will be immediately reflected in reduced times to start treatment.

Reducing elapsed time in treatment planning processes

The standard approach to planning at most centres has been to schedule one or two extended planning sessions per week for each radiation oncologist. This has had the following disadvantages:

- It hinders iterative interactions between radiation therapists and radiation oncologists during plan preparation.
- It introduces an artificial one week cycle into the treatment planning process.

For non-complex tumour sites the elapsed time for completion of plans averaged 10 times the effort in terms of staff time required to carry out the work. There is an opportunity to simplify and streamline the planning process, through:

- obtaining patient consent before the CT/Sim Session
- introducing weekly pre-planning sessions between radiation oncologists and radiation therapists
- providing more frequent scheduled access to radiation oncologists for planning inputs and approvals
- rostering a single dedicated physicist each day for planning advice and quality assurance checks
- reducing duplicate quality assurance checks in planning
- introducing a process in which experienced and trained planning radiation therapists "cross check" their plans, so eliminating the need for upwards sign off accelerating the process of finalising plans ready for treatment.

Billing

In general the centres demonstrated effective billing processes, with little backlog of unbilled treatment files. At the beginning of the project, three centres had billing backlogs largely as a result of administrative staff shortages. At all centres a combination of process change and the redistribution of staffing resources reduced the backlog.

During the period of the project billing was mostly manual at all centres. In addition, some centres experienced difficulty in the processes for recruiting and retaining administrative staff. It was recognised that there is an opportunity to eliminate some unnecessary administrative tasks and increase the reliability of the billing process through automation. The key elements of the solution are:

- Deploying sufficient administrative staff to clear any unbilled backlog.
- Where the patient is appropriately referred, adopting a bulk billing policy.

- Building and testing an interface between the Treatment record (e.g. VARIS or LANTiS) and the Hospital Billing system.

Business models

During the project two key elements were added to the business models at most centres:

- A weekly or fortnightly management forum for reviewing performance data and project progress.
- Daily and weekly schedule controls supported by simple KPI data to monitor throughput and react to resolve problems.

The project found there are vastly more similarities than differences between the centres in their core business management and patient flow processes. As a result the approaches described below have general applicability across all centres.

Weekly/fortnightly management forum

At all centres a weekly or fortnightly steering group was established for the project. In many cases this evolved into a management forum. It was recommended that these centre management teams dedicate resources to continue these processes at the conclusion of the project to assist in sustaining the benefits achieved. The centre management forum was attended by department heads, and was generally scheduled for 30 minutes, with a two item agenda including :

- performance and issues from the prior period
- progress report on key implementation projects from the continuous improvement programme.

The core function of the meeting should be to review a small set of standard KPIs, comprising:

- throughput, measured in attendances per linear accelerator per day compared to target
- treatment plans completed last week compared to target
- new and re-treatment initial consultations carried out, compared to target
- number of patients started, finished and under treatment
- number of unbilled files, where treatment is complete
- linear accelerator availability
- waiting list status, average waiting time by patient triage category and numbers of patients by triage category.

When the data becomes available, centre financial performance could be added to the agenda at appropriate intervals.

Should the centres implement regular rolling patient experience surveys the results should be discussed as appropriate at the centre management committee. At one centre a patient representative participated as a steering group member, agreeing to attend the ongoing management forum once each month in a ‘non-executive’ capacity. Where this is adopted, the centres should schedule review of patient experiences to coincide with the meetings attended by the patient representative.

Daily / Weekly schedule control

Many of the process changes identified have the effect of eliminating or reducing inbuilt buffer times from the various components of the patient flow process.

Prevention of additional process creeping back into the workflow will require close monitoring. Over the life of the project the centres introduced a daily schedule control review to do this. This process has proved to be a vital part of increasing access to treatment. During the project, the process for establishing theoretical capacities for each linear accelerator was used to develop targets for daily schedules of attendance across the whole workflow. As a result, achieving daily targets will ensure that a focus remains on keeping processes as lean as possible while maintaining quality.

5 Summary of key findings and outcomes achieved

Key findings

- An across-the-board willingness to improve business processes in all participating centres. This willingness allowed all centres to treat significantly more patients, compared to baseline, during the project period.
- Prior to the project, only two centres were exceeding the planning benchmark of 414 courses per linear accelerator per year. By project end, five centres were exceeding the planning benchmark. Four others are constrained by shortage of referrals.
- Referrals are not well matched to treatment capacity, with the result that some centres have waiting lists while others have spare capacity.
- Improving a radiation oncology treatment centre's business processes requires the participation of all departments.
- Establishing a process in the centres for managing continuous improvement is vital.

Key outcomes

- By the end of the project the participating centres were treating at a rate which equates to an additional 1,467 patients per year in excess of baseline.
- The average increase in attendance per day, compared to baseline, was 16 per cent.
- Waiting lists were reduced in most centres. By the end of the period, in all centres waiting lists for ready for care (RFC) patients tended towards the centres' current planning timeframe – typically, two weeks.
- All centres have estimated theoretical treatment targets based on a review of their historical capacity which will meet or exceed the state benchmark.
- The elapsed time from consultation to treatment was reduced in most centres, to an average of 10 days.
- Centre management teams have the tools needed to focus on improving access to treatment.
- The Treatment Planning process at each centre has been streamlined and simplified.
- The booking process in each centre has been formalised to maximise throughput and where necessary eliminate 'single person risk'.
- Patient communication has been improved.

The most unexpected finding of the project was the extent to which referral patterns and capacity were unaligned. During the project period only 50 per cent of centres had sufficient referrals to allow them to realise throughput gains through process improvement. For the remaining 50 per cent referral rates were not sufficient to meet the annual treatment targets. In some centres, waiting lists grew even as throughput was increased, because of referral in excess of treatment capacity.

6 Conclusion

The RT BIS project confirmed there is enthusiasm for change in ROTCs in NSW. The consultants to the project reported that the level and quality of staff participation in the project was higher than for similar projects they had undertaken previously. In particular, a broad range of staff participated in the critiquing process, representing more than half of all centre staff.

Across all sites many of the initiatives implemented during the project had been considered or begun before the project started. This project enhanced the management focus devoted to improving performance, and correspondingly increased the momentum of change.

The RT BIS found that managing the process for booking patients for treatment is a major key to managing access to radiotherapy treatment in NSW. The most striking result of the project was that access to treatment could be improved significantly by gradually increasing the patients booked per day and monitoring the impact of this change. In most cases there was sufficient capacity to allow throughput increase from within existing resources. The projects provided the management processes to ensure that this could happen through a consultative approach which encouraged staff to participate.

Transferring the day to day task of treatment booking from highly skilled senior radiation therapists to suitably trained and supported administrative staff was shown to free up resources that could be used to improve treatment planning and other value adding activities. Depending on volume, the administrative resources required will be between 0.5 and 1.0 FTE.

Treatment planning is the area which centre staff consider the most intractable problem. Altering radiation oncologists' schedules in relation to the patient treatment planning process would be seen as a key signal to the centre that the management team is serious about making improvements happen.

The outcomes of the RT BIS supported the literature on clinical redesign in that six months is the minimum amount of project time required to secure sustainable process change. In the case of ROTCs, this particularly applies to the core process improvements in booking and planning that require testing and acceptance over a longer timescale. In addition, centre management teams need training and support over a longer period in examining and changing work practices.

The most difficult phase of redesign is not identifying issues or designing new solutions; it is implementing those solutions and embedding the redesigned model into core business processes. Redesign is not simply a matter of finding a new way through a series of one-off projects or crisis-driven reforms but of making that new way 'the way we do things around here'.[4]

Abbreviations and acronyms

AHS	Area Health Service
BTE	Basic Treatment Equivalent
CCORE	Collaboration for Cancer Outcomes Research and Evaluation
CSCIP	Cancer Services Collaborative Improvement Partnership
KPI	Key Performance Indicator
MOS	Management Operating System
PDSA	Plan, Do, Study, Act
RFC	Ready For Care
RJAC	Radiotherapy Joint Advisory Committee
RORIC	Radiation Oncology Reform Implementation Committee
ROTC	Radiation Oncology Treatment Centres
NHS	National Health Service

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