

**Providing a
Quality Radiation
Oncology Service**

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Introduction

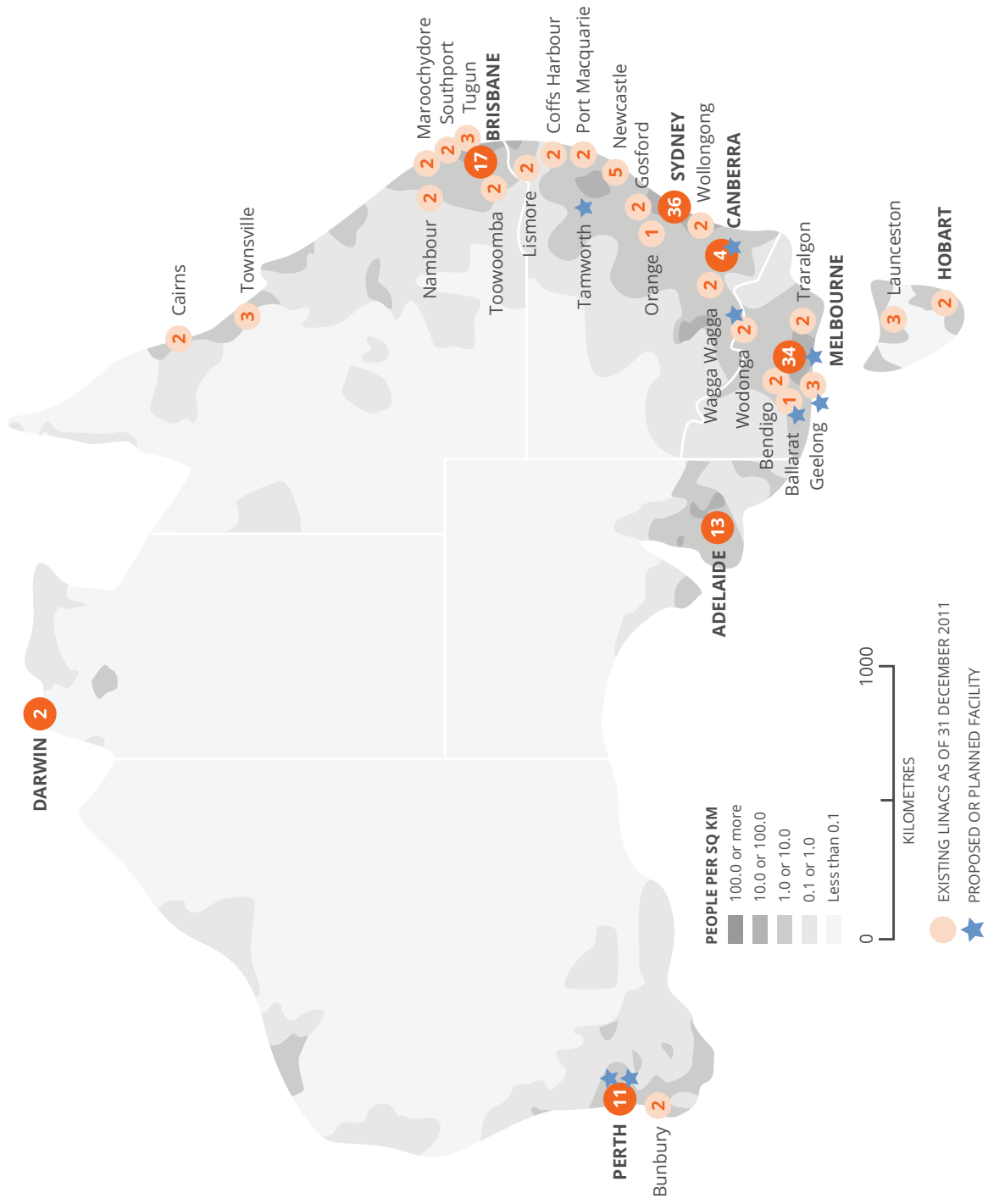
The Tripartite National Strategic Plan approaches radiation oncology from a 'needs of the nation' perspective. The questions posed in developing this plan are:

1. What is required to improve existing radiotherapy services?
2. What is required to ensure Australian patients who would benefit from radiotherapy are able to receive it?
3. What is required to ensure a world class Australian radiation oncology sector that will be able to meet the increasing cancer incidence?

The aim of the resulting strategy, at its most fundamental, is to provide for all patients who could benefit from radiotherapy so that they can have timely access to optimum treatment for their disease. To facilitate this, professions and decision-makers need information and foresight to plan nationally, systematically, transparently and collaboratively. A part of planning is the issue of ensuring that the Australian radiation oncology services maintain the appropriate quality. Quality radiation oncology requires a high degree of quality control and quality assurance to ensure that services are safe, effective and are supported by appropriate infrastructure.

In the context of quality, medical quality is defined as the degree to which health care systems, services and supplies for individuals and populations increase the likelihood of positive health outcomes and are consistent with current professional knowledge¹. The quality of medical services provided to the community is continually improving with the implementation of new technology, techniques and systems. Clinical quality improvement is an interdisciplinary process designed to raise the standards of delivery of preventative, diagnostic, therapeutic, and rehabilitative measures in order to maintain, restore or improve health outcomes of individuals and populations¹. The standards of practice in radiation oncology reflect this approach².

Locations of Radiation Oncology Centres in Australia





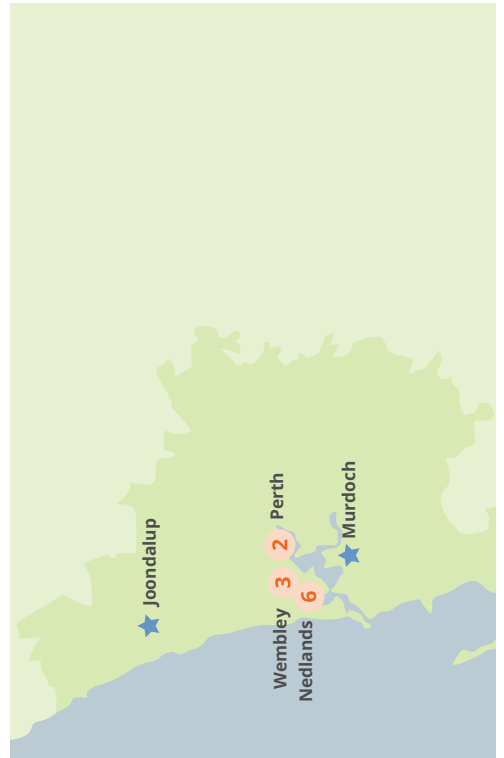
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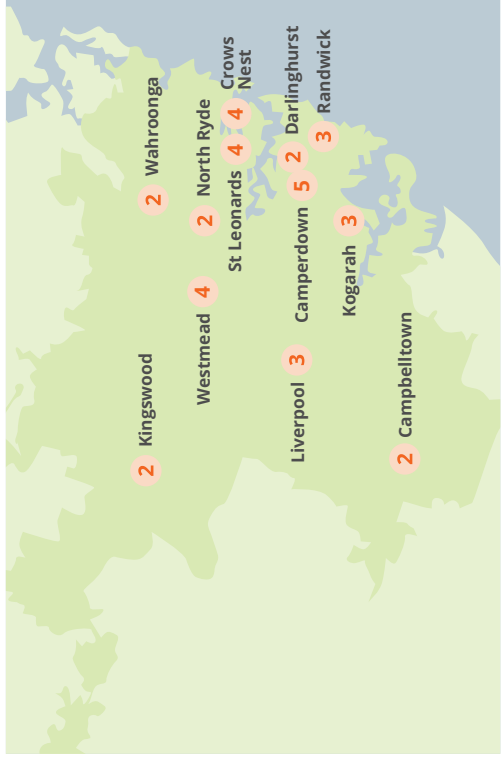
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PERTH METROPOLITAN AREA



SYDNEY METROPOLITAN AREA

Key Issues

To ensure the provision of quality radiation oncology services the 'needs of the nation' are to be incorporated into the planning process in order to ensure that access is provided to all patients in Australia who require radiotherapy. The current situation is characterised by:

- Fragmented planning of specialist oncological services, radiation oncology infrastructure and workforce;
- Variability in access to timely radiotherapy treatments across both geographic locations and cancer types;
- Lack of implemented and permanent national initiatives focused on quality and safety, including:
 - Radiation Oncology Practice Standards for facilities are not mandatory;
 - There is no nationally implemented minimum radiation oncology dataset to guide planning;
 - There is no incident monitoring system across Australia that is appropriate for radiotherapy;
 - Australian Clinical Dosimetry Service is funded only as a pilot.
- Problems persisting with the timely and safe introduction, evaluation, uptake and patient reimbursement for modern techniques and technologies in radiation oncology.

Objective

The current and future standard is a world class radiation oncology service with robust quality systems and standards in place.

Defining Success

A nationally planned approach to the radiation oncology sector, which takes into account the needs of all cancer patients, their families and carers, which is characterised by:

- **A forward-looking strategy to deliver improved radiation oncology services** through the development of a National Cancer Action Plan which effectively and efficiently incorporates quality radiation oncology services and which includes planning for the implementation and evaluation of future technology and techniques; plans to address any jurisdictional regulatory differences which influence the adoption of radiation technology and which defines and refines the National Minimum Data Set.
- **The availability of radiotherapy to all patients for whom it is clinically appropriate which can be accessed in a timely manner** with evidence of this being reduced waiting times; the access of patients to treatment consistent with evidence-based radiotherapy utilisation rates for their disease; and that the financial impact on the patient, carers and families is affordable to all Australians.
- **A patient-centred, evidence-based and multidisciplinary approach to care** evidenced by the adoption of multidisciplinary teams for the management of each patient's cancer that is supported by peer review and the provision of consistent quality information to patients, carers, family and healthcare professionals all of which are consistent with the Radiation Oncology Practice Standards².
- **Ongoing evaluation with a strong emphasis on quality assurance, patient quality of life and survivorship** evidenced by the operation of a national dosimetry audit service, patient quality outcomes being reported by facilities, the survivorship of patients being measurably enhanced and reporting of issues affecting quality being effectively managed.
- **Continuous quality improvement** evidenced by on-going evolution of the Radiation Oncology Practice Standards and demonstration of compliance with these standards at a facility level, regular review of the Radiation Oncology Strategic Plan and implementation of a national radiation oncology incident reporting framework that provides sufficient detail to assure the safety of and improve the quality of the services offered.
- **Engendering leadership and fostering a culture of quality** through the incentivisation and development of a quality culture which cultivates leadership and by the inclusion of continuity planning as part of the implementation of the Radiation Oncology Strategic Plan.

A Forward-Looking Strategy to Deliver Improved Radiation Oncology Services

Importance of planning

A quality radiation oncology service is a multifaceted process involving several distinct groups of health experts, supporting staff, and is reliant upon custom-built facilities and an array of sophisticated equipment. In terms of time horizons, the training of the radiation oncology workforce and the implementation of the relevant infrastructure is a matter of years rather than months. Australia's cancer registries provide reliable data on cancer incidence and projections are regularly updated. As such, the demand for radiation oncology is a known variable – it has been methodically researched and set at 52.3% of all new cancer patients¹². The known demand combined with the complex and interdependent manner of radiation oncology service provision make prospective planning logical and essential.

Compared to other specialties, radiation oncology is delivered in a relatively small number of facilities – 61 centres across Australia in 2011. Despite the small scale of the sector, planning occurs at both national and jurisdictional levels. Fragmentation in planning persists, despite being a key focus of the 2002 Baume Inquiry, particularly the variability in the state and territory cancer plans combined with an absence of a national cancer action plan. Endeavours to facilitate national coordination of radiation oncology service planning have been initiated through the Radiation Oncology Reform Implementation Committee (RORIC) which reports to the Australia Health Ministers' Advisory Committee. Some successes have been achieved but silos in decision-making and planning remain. Achieving a truly national approach to radiation oncology service planning, let alone cancer control planning, is challenging given the nature of constitutional relationships between jurisdictions. Submissions to the Tripartite Plan from the radiation oncology professionals highlight the need to further strengthen national planning coordination to reduce fragmentation of decision-making in radiation oncology.

Submissions to the Tripartite Plan suggested that the likely consequence of the status quo will include:

- Perpetuation of the 'winners' and 'losers' situation in terms of access to radiation oncology
- Extended waiting times for radiation oncology
- Patients continuing missing out on a potentially life-saving treatment
- Patients missing out on an effective palliative treatment to reduce their pain and suffering

The radiation oncology sector lacks elasticity because there is a maximum capacity limit set on each radiotherapy machine. Although efficiency gains are possible and should be pursued by service providers, these can only extend the capacity by a certain margin. Patient access to radiation oncology is a limitation in itself which restricts the impact of efficiency gains at a facility level. This is well-understood by the radiation oncology professionals and concerns were expressed in submissions to the Tripartite Plan, which can be summarised as follows:

- Lack of coordination and planning for the expansion of existing services to meet rising cancer incidence results in highly variable levels of patient access to radiation oncology services across geographic region;
- Poor coordination and planning between workforce and facilities in radiation oncology results in inefficiencies, such as fluctuations in workforce numbers;
- The potential of regional cancer centres being compromised because of inadequate workforce planning and of insufficient patient support schemes to access these facilities;
- Private sector infrastructure is not consistently taken into account in service planning;
- Lack of planning to ensure access to specific radiotherapy techniques.

There is a broad consensus in the radiation oncology sector that long-term planning, particularly coordinated at national level, holds the key to addressing current shortfalls and inefficiencies. In this context, the National Health Reform Agenda holds both promises and risks for radiation oncology. National planning is highly desirable to allow efficiencies in resource allocation across Australia and to accommodate the complexity of service planning and capital infrastructure in radiation oncology. The possible devolution of responsibility for facilities planning to the local health authorities would fragment an already weak system and put infrastructure further out of step with workforce planning. Providing a nationally agreed approach for radiation oncology services, and indeed for cancer services, would enable the local health authorities to confidently participate in planning the services provided to cancer patients.

Radiation oncology services should be planned with reference to other cancer treatments like surgery and chemotherapy. Ideally, radiation oncology treatment centres should be built within a cancer centre precinct³ to facilitate easy patient access to a comprehensive multi-modality treatment. This approach has been strongly supported by the Commonwealth in the past several years by funding the establishment of comprehensive cancer centres around Australia.

A nationally coordinated and prospective planning for radiation oncology services is needed, based on cancer incidence projections and the target radiotherapy utilisation rates. The essential components should include:

- A collaborative process between decision-makers, professions and patients
- A partnership approach between the Commonwealth and the jurisdictions
- Sufficient facilities that are optimally located and have adequate treatment capacity to meet the needs of patients requiring radiation oncology services into the future
- Service provision models focus on enabling patient access to quality services while taking into account existing public and private infrastructure
- Radiation oncology workforce planning is aligned to facilities planning
- Services are planned to enable patient access to the full range of radiotherapy techniques

Overall, Australia requires a National Cancer Action Plan which effectively and efficiently incorporates quality radiation oncology services.

Keeping Pace with Radiotherapy Techniques and Technologies

Radiotherapy aims to destroy cancer cells but avoid damage to the structure and function of nearby healthy tissue. Improvements in the quality and effectiveness of radiotherapy invariably stem from advances in the technology. The underlying principle of radiotherapy is to completely ablate cancer tissue while sparing adjacent normal tissue. The same principle underpins modern radiotherapy techniques.

As in many other branches of medicine, in radiation oncology there are various vendors that produce and distribute treatment equipment. While this equipment often has different configurations and various price points, the radiotherapy techniques delivered by these machines are fundamentally the same. A radiation oncology 'treatment technique' is defined as a method for accomplishing a desired radiation therapy dose distribution. The term 'technology' is used to describe the delivery device for a particular radiotherapy technique⁴.

Patient access to clinically appropriate and affordable radiotherapy treatment techniques is of paramount importance. Some examples of radiotherapy techniques include:

- Three-Dimensional Conformal Radiation Therapy (3DCRT)
- Intensity Modulated Radiation Therapy (IMRT)
- Image Guided Radiation Therapy (IGRT)
- Stereotactic Radiotherapy (SRT) and Radiosurgery (SRS)
- Brachytherapy (BT)

Patient access to clinically appropriate radiotherapy techniques should form the measurable quality benchmark for the health system. Report cards on the availability of key radiotherapy techniques in Australia are included under the section on Essential Imaging and Radiotherapy Techniques (on page 82).

The issues of new and evolving technologies are not new in Radiation Oncology and have been highlighted in the Baume Inquiry. Problems persist with the safe and timely introduction, reimbursement and dissemination of promising innovations in radiation oncology. The Commonwealth Department of Health and Ageing (DOHA) is a key agency which supports patient access to treatments through the Medicare Benefits Schedule and infrastructure improvement through the Radiation Oncology Health Program Grants (ROHPG). In the absence of DOHA support, the treatment is either not made available in Australia or is introduced on an ad hoc basis. In the latter case, the cost is passed to the patient or to the State/Territory Health Services. In radiation oncology, the effect of unavailability, delayed introduction or ad hoc introduction typically means that the service cannot be delivered to all those patients who require it for optimal cancer care. Existing delays in the introduction of modern radiotherapy techniques are around 10 years in comparison to North America. This gap is likely to continue to grow unless measures are taken.

Keeping pace with modern radiotherapy techniques makes sense because of the promise they hold for better survival, reduced side-effects and greater efficiencies. Naturally, radiation oncology techniques and technologies need to be prioritised and assessed. Technology assessment processes (including the Medical Services Advisory Committee (MSAC)) in Australia struggle to manage radiation oncology technologies for several reasons, which include⁵:

- Medical devices require different criteria for assessment than pharmaceuticals because they tend to progress with incremental innovations in performance and safety. For example, in radiation oncology substantial improvements in care can be based on the next version of computer software
- Lack of capital and infrastructure to support randomised clinical trials (RCT)
- Strict adherence to the requirements for RCT-derived evidence of superior efficacy can be problematic if applied to radiation oncology. The limitations of the RCT methodology when applied to radiation oncology are discussed in the Research and Academia section of this report (on page 118).

There is a growing concern among decision-makers about the rising costs of healthcare, including cancer care. Similarly, there is a desire to promote innovations that achieve value for cancer patient and the health system. Radiation oncology sector presents an opportunity for such innovations and improvement, but under certain conditions. The Lancet Oncology Commissions in 2011 summarised those as follows:

- Policies developed to provide value-based assessment of radiation oncology treatments must create an infrastructure for evidence generation and management.
- This infrastructure must have the ability to gather evidence in an ongoing manner throughout the life cycle of the technology and to adapt to inevitable incremental changes.
- Finally, the infrastructure must prove a path to payment coverage that ensures emerging technologies provide value and contribute to the advancement of the discipline.

Registries⁶, as a mechanism of data capture and post-market surveillance of technologies, are a powerful tool to inform clinicians and planners. The use of meaningful endpoints and nimble research methods are essential to harness the potential advances in radiation oncology treatments.

Data collection and information standards have a key role in continually informing the directions of clinical care, health services research and support advancements in techniques and new technologies. Existing research⁷ supports the value of collecting clinical and economic data on radiotherapy treatments.

Ongoing delays in the adoption of new techniques and technologies in Australia make it a key priority that Australia moves to value-based radiotherapy and the creation of infrastructure to support data collection on the impact of new treatments.

Harmonisation of Legislation

The impact of regulatory differences between jurisdictions may influence the availability of some clinical radiation oncology services or may alter practices such that some workforce initiatives viable in one jurisdiction cannot be easily translated to another jurisdiction. For example, the current implementation of the nationally adopted codes of practice and standards for radiation protection varies considerably between jurisdictions.

The differences in application and interpretation of radiation protection measures may require a greater or lesser investment in radiation shielding to comply with local regulatory requirements. There may also be lack of requirements specific to a particular practice which is exhaustively regulated in other Australian jurisdictions. These local differences mean that the clinical availability of some techniques may be relatively hindered in some jurisdictions or have associated greater compliance costs.

Another example is in industrial relations where some workforce initiatives developed in one jurisdiction may not be easily adopted in other jurisdictions. The harmonisation of these and other regulatory requirements affecting the provision of radiation oncology services should be initiated to improve consistency in access to, and the delivery of, radiation oncology services.

Minimum Radiation Oncology Data Set

A vital component of a quality radiation oncology sector is access to data to inform planning and policy. Multiple stakeholders commented in their submissions that inadequate data collection is still a barrier to effective planning within the cancer sector. The work of Cancer Australia on a National Minimum Data Set (NMDS) and national support for this initiative is therefore critical. An NMDS is contingent upon a national agreement to collect uniform data and to supply it as part of the national collection. Over time, the availability of these data will provide more accurate information on national trends, diagnoses, health service utilisation and, ultimately, improved health outcomes⁸.

There needs to be a specific sub-set of this data relevant to radiation oncology, which is available for strategic planning. This subset needs to be readily accessible by those involved in radiation oncology planning and the users must be able to contribute to the data set and able to validate and correct the data as required. The radiation oncology sub-set of the NMDS may include the following data: case mix, cancer outcomes, toxicity outcomes, patterns of care, techniques used and intent of treatment (radical or palliative). To provide a common framework for the sharing of data and to maintain visibility of radiation oncology in cancer planning, the radiation oncology sub-set of the NMDS should not be a separate data set and should be administered by Cancer Australia.

The Availability of Radiotherapy to All Patients for whom it is Clinically Appropriate that can be Accessed in a Timely Manner

Importance of ensuring access

Radiation oncology's contribution to the fight against cancer is significant. The impact of radiotherapy in cancer survival has been estimated at 40%, compared to 49% of patients being cured by surgery and 11% of patients for systemic treatments⁹. Cancer is a leading cause of death in Australia¹⁰. The 2012 report on cancer incidence projections by the Australian Institute of Health and Welfare (AIHW)¹¹ highlights just how significant the age related increase in cancer incidence across Australia will become. The AIHW report projects that the number of cases of cancer diagnosed in Australia will rise over the next decade for both males and females and is expected to reach about 150,000 in 2020—an increase of almost 40% from 2007. Increases in the number of cases diagnosed are due primarily to the ageing and increasing population and are expected to be most evident in older populations. In this context, enabling patient access to a quality radiotherapy service across Australia that is integrated with the other cancer services becomes paramount to cancer management.

The current average radiotherapy utilisation rate for Australian cancer patients is estimated at 38.1%, while the agreed target level is 52.3%¹². This means that:

- On average, 14.2% of Australian cancer patients miss out on a clinically appropriate radiotherapy treatment (which is understood to be a conservative estimation);
- This equates to at least around 18,000 cancer patients not receiving potentially beneficial radiotherapy treatment in 2012;
- In 2022, if the current under-utilisation rate is maintained, this would equate to around 24,000 cancer patients will miss out on radiotherapy¹³.

The matter of access to services is dependent on multiple interrelated factors. These include patterns of referrals, level of implementation of MDTs and other factors. Nonetheless, research in the area of access to radiotherapy¹⁴ as well as anecdotal evidence from across Australia strongly suggests that the single most important barrier to access is the proximity of patients to radiation oncology services¹⁵. This observation supports the case that patient access to radiation oncology severely limits the impact of other facility level initiatives aimed at increasing productivity to improve access.

Timely access

Waiting time for radiotherapy is an important quality indicator for oncology services¹⁶. Several different lines of evidence support the conclusion that a delay in initiating radiotherapy has an adverse effect on outcomes¹⁷. The risk of local cancer recurrence increases with increasing waiting times for radiotherapy. The increase in local recurrence rate translates into decreased survival in some clinical situations. Waiting times for radiotherapy treatments should be as short as reasonably achievable¹⁸.

Category	Definition	Maximum Acceptable Waiting Time
Emergency Care	Medical emergency	24 hours
High Priority Care	Patients for whom delay in starting will have a significant adverse effect on outcome	14 calendar days
Planned Care	All others	28 calendar days

Data from 2008 in New South Wales shows that the percentage of patients who were treated within target times improved overall: with 57% of priority one patients, 72% of priority two patients and 82% of priority three patients treated within the maximum acceptable times recommended by the Royal Australian and New Zealand College of Radiologists¹⁹. These same data can be interpreted to say that 43% of priority one patients and 28% of priority two patients were not treated within the maximum acceptable times within New South Wales in 2008.

The National Health and Hospital Reform Commission concluded in 2009 that national access targets are needed in Australia to continuously measure and report on whether people are accessing the health services they need in a timely manner. Targets for access to radiotherapy were included on the priority list and the preliminary targets were aligned with those set by the RANZCR²⁰.

Financial impact on patients, families and carers

The financial impact of accessing cancer treatments on the patients, their families and carers can mean that the optimal treatment option is unaffordable. For remote and rural patients who may need to travel to a metropolitan centre to receive treatment and be away from home for many weeks, the financial impact can be significant and prohibitive. Their ability to access childcare, replace lost income or continue their business, access the emotional and physical support provided by family and carers, as well as fund travel and accommodation costs, can determine whether the optimal treatment option is chosen. This issue is discussed in greater detail in the Supporting Regional and Rural Access to Radiation Oncology Services section (on page 96), however the quality of service provided to a patient is strongly influenced by this issue.

In the 2002 Baume Inquiry report, a recommendation was made that the Commonwealth legislation should be revised to allow out-patient radiation oncology to qualify for private health insurance. Ten years on and patients receiving radiotherapy still do not qualify for private health insurance. Financial issues that inhibit patient access to radiation oncology services have a significant impact on the quality of care offered to patients.

A Patient-Centred, Evidence-Based and Multidisciplinary Approach to Care

Empowered Consumers

A cancer diagnosis often brings about fear, anxiety and sometimes depression for patients, carers and their families. Cancer itself is a threatening experience and the acquisition of more information by those affected is associated with higher levels of satisfaction, compliance and psychological adjustment^{21,22}. Patients undergoing radiotherapy have multiple fears, anxieties, stress and expectations^{23,24}. This anxiety and depression adds costs to other Government services such as psychiatry and psychology services, other support services and in General Practice. Accessing these services is a particular problem in the rural setting where many are not readily available.

Radiation oncologists and other staff (such as radiation therapists, medical physicists and nurses) are actively involved in providing information to patients, particularly in the early stages of the treatment process²⁵. There are no standard guidelines for the timing of information provision, and individual departments vary in terms of the level of information that they provide and the setting in which the information is provided. Increasingly, cancer patients and the broader community seek to be active participants in health-care decision-making²⁶. The development and availability of evidence based information for consumers and the community supports informed decision-making and enables individuals to act to improve their health outcomes.

Consumer representatives on the Tripartite Committee have recommended that the following principles should be in place with regards to informing consumers:

- All patients and their families should have up-to-date, evidence-based and relevant information regarding radiotherapy;
- The information needs to be accessible to all. Information should be available, via interpreter services to patients and their families where their primary language is not English;
- The option of radiotherapy should be offered when it is clinically appropriate;
- The advantages and disadvantages of radiotherapy and treatment alternatives should always be discussed, including the information on the potential short and long term side effects;
- Costs (including gap payments) associated with radiotherapy in private radiotherapy centres should be made clear because the financial strain can add to the pre-existing stress and anxiety. This information should include whether the fees are to be paid up front or whether only the gap between the Medicare rebate and the actual fees is to be paid.

Currently, specific patient information about radiation oncology is not consistent or comprehensive and in many cases seen as too technical. In Australia there is lack of centrally-located, clinically-appropriate, credible and easily accessible information for patients, carers and families on procedures and treatments in the area of radiation oncology. The benefits of an easily accessible radiation oncology patient information resource could include:

- A national source of reliable and credible information about radiation oncology
- Easier access to this information by cancer patients and practitioners living in rural or remote locations, where access to reliable information is limited, thereby providing equitable access nationally to all Australians wherever they live
- Increased transparency of clinical decisions improving the likelihood of the improved evidence based treatment techniques, technology and systems being used consistently across the nation
- Contributing to informed patient consent and practice risk management
- Providing access to this information to professionals involved in providing radiation oncology increasing the likelihood of consistent and appropriate advice being provided to patients, carers and their families
- Reducing consumer anxiety about radiation oncology treatments caused largely by lack of understanding or fear of the unknown or inappropriate information
- Decreasing patient uncertainty thereby possibly reducing costs to other Government services and support services such as psychology, counselling and psychiatric services
- Reducing costs to jurisdictions by eliminating the need for each jurisdiction to produce these resources on their own

Radiation oncology practice standards

The 2002 Baume Inquiry identified a number of national safety and quality issues relating to radiation oncology. Recommendation 26 was that 'a facility accreditation program should be developed as a matter of priority ... with input from 3 professions, it should be tested in 2004 with full accreditation starting in 2005 and made a condition of continued funding in 2006'. Recommendation 27 was that 'the accreditation program should initially cover national guidelines for minimum Quality Assurance (QA) processes and dosimetry program. New requirements should be introduced as they become practical'.

Radiation Oncology Practice Standards, a Tripartite Initiative, outline the components of a quality radiotherapy service at facility level. Facility management is considered to be of vital importance in the delivery of safe, quality care to radiation oncology patients. The standards encompass three domains:

- Facility Management
- Treatment Planning and Delivery
- Safety and Quality Management

It is the Tripartite's view that the Standards should be made mandatory and that this should be achieved through legislation. The legislation should mandate compliance and will refer to the Radiation Oncology Practice Standards but should not enumerate them, so as to allow regular reviews of the Standards in line with contemporary practice. If legislated, compliance with the Standards would become a function of normal business operations for each facility. The following two steps are important:

- Incentivising facilities to reach the required Standards and providing resources
- Ongoing facility participation should be mandated and incentivised through the Medicare Benefits Schedule

Evidence based multi-disciplinary oncology practice

Cancer patients can receive treatment from a number of medical professionals. This can create challenges in the delivery of consistent care and in the coordination of care between expert clinicians. Multidisciplinary management is designed to overcome this fragmentation and ensure that best practice is delivered enabling optimal patient outcomes to be achieved, contributing to improved survivorship outcomes¹⁴. There are additional benefits to multidisciplinary practice, including opportunities for patients to be identified as suitable for clinical trials and as forums for professional development, and quality improvement activities for the team²⁷.

Cancer Australia is promoting the medical multidisciplinary team (MDT) approach nationally²⁸ with state-based initiatives to monitor and encourage MDT practice already in existence. The work of the NSW Cancer Institute is one such example. MDT practice is a critical component of quality care and should be embedded and strongly encouraged in service planning and delivery.

The MDT would consist of radiation oncologists, surgeons, medical oncologists, and haematologists. It is acknowledged that a range of other clinical health professionals make important contributions to the treatment decision-making process, these professionals may include nurses, pharmacists, radiation therapists, medical physicists, nuclear medicine physicians and radiologists amongst others. This collaborative approach allows the MDT to make decisions about the most appropriate treatment and supportive care for a patient, while taking into account the individual patient's preferences and circumstances including their care and family arrangements²⁹.

Once the decision to utilise radiotherapy for treatment has been agreed, a radiotherapy specific MDT consisting of radiation oncologists, radiation therapists, and medical physicists, as well as other professionals as required from time to time, should discuss and review the technical details of the treatment planning and delivery.

Clinical peer-review audit

It is argued that 'high-quality' means minimising process variation and moving the average closer to the optimum value. In radiation oncology this should mean a consistent and up-to-date set of specifications for treatments and procedures³⁰.

Peer review is a quality tool that is used to enable practice-based improvements in clinical practice and patient care. 'Review by Peers'³¹, a document prepared by the Australian Commission on Safety and Quality in Healthcare (ACSQHC), states that "review of professional practice by a peer is a valuable and important part of the maintenance and enhancement of a health practitioner's clinical and professional skills". The importance of participation in peer review activities by health practitioners has been identified by the Medical Board of Australia in the Continuing

Professional Development Registration Standard³², highlighting that CPD (now mandatory as a condition of registration) must include practice-based reflective activities such as peer review.

The Faculty of Radiation Oncology, RANZCR, strongly supports the participation of radiation oncologists in peer review activities and has developed a Peer Review Audit Instrument³³ to help ensure an effective peer review process. The use of this tool by radiation oncologists is strongly encouraged before radiotherapy treatment has commenced and ideally after all planning has been completed to ensure its results are the most beneficial for radiation oncology practice. This way, patient care and treatment are optimised. The Peer Review Audit Instrument is also used for radiation oncologists returning to practice from an extended break in clinical practice³⁴. The importance of peer review has been embraced in radiation oncology and mandatory participation in practice-based reflective activities such as peer review audit, clinical audit and attendance at multidisciplinary team meetings has been introduced³⁵.

Ongoing Evaluation with a Strong Emphasis on Quality Assurance, Patient Quality of Life and Survivorship

Evaluation

Evaluation refers to a periodic process of gathering data and analysing these in such a way that the resulting information is used to determine whether planned activities are being carried out effectively. An evaluation can also illustrate the extent to which the stated objectives and anticipated results are being achieved.

Evaluation in radiation oncology applies to all components of the service and can include:

- Assessment of treatments in terms of dose distribution
- Prospective and retrospective data collection, particularly for treatment outcome assessment
- Consideration of cost-effectiveness of treatments
- Review of workforce performance
- Assessment of service and facility performance
- Quality Assurance activities

Importance of quality assurance to safety and quality care

Radiation oncology is considered safe, largely because of the decades-long recognition of its risks and the evolution of quality assurance (QA) regimes to mitigate these risks. Medical physicists, radiation engineers, and other technical and quantitative-minded individuals, integral to radiotherapy practice, bring an objective and systematic approach to QA³⁶. The term QA is defined by the International Standard Organization (ISO) as 'all those planned or systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality'³⁷. QA activities are of vital importance in the delivery of safe, quality patient care in radiation oncology. A national approach to QA should be planned and facilitated to make radiotherapy more consistent and ensure safety for patients.

The process of delivering radiotherapy treatments is complex and involves understanding of the principles of medical physics, radiobiology, radiation safety, dosimetry, radiation treatment planning, simulation and interaction of radiation with other treatment modalities. Each step in the integrated process of radiation oncology needs quality control and quality assurance to prevent errors and to give high confidence that patients will receive the prescribed treatment correctly³⁸. The World Health Organization (WHO) states that proper QA measures are imperative to reduce the likelihood of accidents and errors and increase the probability that the errors will be recognized and rectified if they do occur³⁹. The incorporation of quality processes into radiation oncology practice allows institutions and individuals to systematically review their processes and adapt them going forward.

Providing safe, quality care is broader than just QA of the techniques and technologies used as part of radiotherapy. QA is part of the broader topic. As part the strategic plan the Radiation Oncology Practice Standards should be promoted and used to help shape the future so that they are an integral part of service planning and implementation. In this regard, the Standards should be used as a foundation and a framework

for service planning which would support safe and quality care. Enabling access to a quality service has to be the primary goal of planning any health service. There has been wide stakeholder input into the development of the Radiation Oncology Practice Standards which supports it being used as the foundation for service planning.

The WHO further recommends a number of general preventative measures aimed at reducing radiotherapy errors⁴⁰:

- A thorough quality assurance program to reduce the risks of systematic equipment and procedural-related errors;
- A peer review audit program to improve decision making throughout the treatment process;
- Extensive use of procedural checklists;
- Independent verification through all stages of the process;
- Specific competency certification for all personnel;
- Routine use of in-vivo dosimetry.

The goal of a radiation oncology QA program is to deliver the best and safest radiotherapy treatment to each patient to achieve cure or palliation³⁸. Radiation Oncology Practice Standards, a Tripartite Initiative, outline the components of a quality radiotherapy service at facility level and include a key section on safety and quality management. A number of guidelines on QA have also been developed in Australia, with the Radiation Oncology Practice Standards able to provide the overall framework for these activities.

In a recent study 75% of facilities reported that they were participating in a formal QA system. However, there were considerable variations in the policies followed and QA procedures performed⁴¹. In the absence of national accreditation in line with the Radiation Oncology Practice Standards, the variation in quality programs between facilities presents an ever-increasing risk. This risk increases in line with the following challenges in radiation oncology QA³⁶:

- Increased time demands and workflow;
- Higher doses of radiation are delivered more precisely and accurately, meaning that with the increase in beam-on time there are higher risks associated with each error;
- Reliance on accurate imaging technology where various imaging factors which previous had low impact on accuracy now have a higher impact on accuracy, for example stereo-tactic radiosurgery;
- Reduced utility of some 'end of the line' QA tools as processes evolves to a point where the traditional 'end of the line' QA tools are insufficient and so either replaced or discarded;
- Shorter treatment schedules leading to reduced time to assess and manage any error;
- Tighter margins mean that the consequences of geographical misses or dosimetric inaccuracies become larger.

A national and consistent approach to radiation oncology quality assurance is needed in Australia, strengthened through an accreditation program based in the Radiation Oncology Practice Standards. This should include a national reporting framework to identify issues associated with quality, similar to the anonymous reporting mechanism used in the aviation industry, which should be beneficial to identify quality issues early and address these issues to reduce the number of patients affected. This incident reporting strategy is discussed in detail under Continuous Quality Improvement (on page 56).

Dosimetry

Dosimetry is used to check that the dose of radiation delivered to the patient is accurate and appropriate. It ensures the risks of accidental over- or under-doses are minimised, leading to the best possible results from treatment. The Baume Inquiry recommended that there be a national dosimetry program. This recommendation was amplified by two significant dosimetry incidents in Australia and the pilot of the Australian Clinical Dosimetry Service (ACDS) was established in 2011. This program is well supported by the radiation oncology community in Australia with almost all centres agreeing to participate in the pilot study⁴².

Establishing an independent national dosimetry service places Australia at the forefront of risk mitigation and patient care, even among the most technically advanced countries in the world⁴³. Only the UK, the US and some of the Scandinavian countries have developed programs which provide a level of clinical support similar to that which will be provided by the ACDS. The service will also help to maintain the quality of radiotherapy in Australia, and provide a national approach to radiation measurements, making radiotherapy more consistent across the country and safer for patients⁴³.

The ACDS provide an integrated national approach and extension of this dosimetry service beyond its three year pilot is an important step to enhancing the quality and safety of the Australian radiation oncology sector.

Quality of life and survivorship

The selection of technique and technology for the treatment of patients with radiotherapy strongly influences quality of life (QOL) and survivorship for patients. The increasingly positive survival statistics for individuals diagnosed with cancer indicating increasing lengths of survival mean that QOL many years after diagnosis is becoming increasingly important. QOL and survivorship are strongly dependent on other treatments provided in the multidisciplinary environment and are essentially whole of cancer issues – they cannot be relegated to the silos of radiation oncology, medical oncology, surgery or haematology. These issues need to be examined over time in the context of the multidisciplinary team. The radiation oncology team must have awareness of and sufficient resources to contribute to this process.

Survivorship is a term that represents how a person's life fares following a diagnosis. It is a concept which can be used in cancer to describe the physical, social, psychological, and spiritual/existential impact of cancer on patient's life and help understand these factors. Cancer survivorship can be viewed as a continual evolving process starting from the moment of cancer diagnosis which occurs over the course of the remainder of life and can be defined as the experience of "living with, through, or beyond cancer"⁴⁴.

With the implementation of newer radiotherapy techniques and improved delivery technologies, the inference or claimed improvement in QOL or survivorship needs to be assessed. As part of this process, data on the late side effects of radiotherapy need to be systematically collected and evaluated. All of this information can be used to inform health professionals in radiation oncology so that they are aware of changes in QOL and survivorship to better understand and support patients during radiotherapy⁴⁵.

The information gathered from assessing QOL and other survivorship measures is also important as part of the total quality management for cancer care by providing information that can be used to inform appropriate selection of treatment technique in the future.

The contribution of radiation oncology to quality of life and survivorship outcomes needs to be an essential component of the National Cancer Action Plan and is part of the total quality management of radiation oncology for the benefit of the Australian cancer patient.

Continuous Quality Improvement

A quality management system for radiation oncology

A part of implementing a quality system, such as ISO 9001 or the ACHS Quality Standards, is implementing a mechanism by which the users of the quality system can learn from experience and developed the system over time into one which provides services of an even higher quality. This is termed quality improvement. Examples of improved quality by following this process can be reducing errors in service delivery, implementing techniques and technologies that have higher precision and accuracy, increasing efficiency and access, amongst others.

Quality improvement capacity needs to be aligned with professional receptiveness, leadership, technical expertise and survey data. It is important to remember that the patient is the greatest beneficiary of an optimal quality program⁴⁶.

Without an explicit feedback mechanism in place, the evaluation of the outcomes of an existing system is not necessarily provided as feedback to the users. Part of any quality system is the ongoing review and audit cycle in which all the quality system documents and processes are regularly reviewed. In this regard the following should be undertaken:

- A regular review of the Radiation Oncology Strategic Plan which includes an evaluation of the implementation of previous strategic plans;
- A regular review of the Radiation Oncology Practice Standards which use information gained from implementing the standards to inform the review;
- The development of a system by which workers on the floor are able to identify issues affecting service quality and to bring these rapidly to the attention of management with issues being escalated quickly and remedied promptly.

It should be recognised that, from a strategic point of view, the radiation oncology strategy and standards are part of the quality system and should be part of the evaluation and review process. The Radiation Oncology Practice Standards and the Tripartite Strategic Plan need to be included as part of the review and audit cycle and are incorporated in the strategic plan itself. This self-referential process is common to the quality manuals and similar established under existing quality standards, such as ISO 9001, and a similar quality system should be adopted.

Incident monitoring

Stakeholder submissions to the Tripartite Plan raised the quality imperative of a national radiation oncology incident monitoring system. Currently, generic incident monitoring and reporting systems exist in all healthcare facilities. Unfortunately, these systems were not designed for recording radiotherapy incidents and near misses.

Understanding why errors in radiation oncology occur and enhancing systems for error detection and harm minimisation play a central role in the delivery of quality services. Factors that can contribute to errors in radiation oncology include: lack of training, competence or experience; fatigue and stress; poor design and documentation of procedures; hierarchical departmental structure; staffing and skills levels; changes in process and others⁴⁷. While local reporting, investigation and learning following an incident are important, it is likely that other centres are experiencing similar issues. The transfer of knowledge between radiation oncology facilities is important to make radiation oncology sector safer across Australia. The absence of a national incident monitoring system in Australia constrains analysis of systemic process issues. This means that such issues can remain unidentified and therefore unaddressed, putting patients at risk.

The potential of incident reporting systems to detect, monitor, and reduce the occurrence of incidents should be recognised. For example, the Radiation Oncology Safety Information System (ROSIS) has been widely used in Europe. ROSIS aims to reduce the occurrence of incidents in radiation oncology by:

- Enabling the clinics to share reports on incidents with other clinics as well as with other stakeholders such as scientific and professional bodies
- Collecting and analysing information on the occurrence, detection, severity and correction of radiotherapy related incidents
- Disseminating these results and generally promoting awareness of incidents and a safety culture in radiation oncology⁴⁸.

Going forward, the radiation oncology sector needs to adopt a more systematic approach to reporting and understanding the causes of errors and harm. Clear criteria and definitions need to be agreed to categorize different types of errors and their causes, and to be able to facilitate analyses that lead to methods of prevention³⁶. The establishment of a national radiation oncology incident monitoring system would be a significant step in establishing and enhancing safe delivery of radiation oncology in Australia.

Engendering Leadership and Fostering a Culture of Quality

Sustainability of a quality system

Even with a quality system in place, its adoption by the users is contingent on the quality system becoming part of the culture of the workplace. In radiation oncology, a nationally consistent approach to a quality culture, both from an informed expectation of the patients and the healthcare professionals, would encourage the adoption of a quality management system and adherence to the Radiation Oncology Practice Standards.

To ensure the ongoing sustainability of a quality system established under the Radiation Oncology Strategic Plan, the culture of quality should be fostered. Some organisations have identified several aspects which foster the required culture, which are:

- Identifying that all members of the radiation oncology community are in this together including jurisdictions, facilities, suppliers and patients;
- Understanding that there should be no subordinates or superiors allowed which inhibit free communication or democratic decision making;
- Valuing open and honest communication;
- Providing access to all information on all operations to everyone, within the limitations of privacy;
- Focusing on processes, which are constantly improved by evaluating outcomes and using evidence-based best practice;
- Recognising that both successes and failures are opportunities for learning.

These aspects need the investment of resources such as an information and communications system being able to be shared by all users. Establishing and promoting this culture of quality may be challenging given concerns for patient privacy and commercial interests between private and public practices. However, some elements may be implemented across Australia, while other elements supported and encouraged within a facility through incentivisation schemes or professional learning opportunities. This would include support for succession planning and networking for those individuals within a facility who are responsible for quality management. This leadership in quality management within radiation oncology should be developed and resourced throughout Australia to provide the means to sustain an on-going quality culture.

It has occurred in the past that centres would shut down services when change of management occurs. This can result in patients losing local access to treatment either part way through their treatment or for a period a time after diagnosis. These events should be managed in such a way for the continuity of service delivery to be met through appropriate service planning which may include transfer of patient referrals so that access to radiation oncology services are minimally disrupted. These events should be coordinated through the national strategic planning framework and will require collaboration of public and private providers possibly across jurisdictional boundaries.

Recommendations

A forward-looking strategy to deliver improved radiation oncology services

Importance of planning

1. Planning of radiation oncology services must be based upon achieving the agreed optimal target utilisation of radiotherapy for new cases of cancer (currently set at 52.3%).
2. The commitment needs to be made now so that the target optimal utilisation rate for radiotherapy can be met by 2022.
3. Radiation oncology service planning needs to occur:
 - 3.1. Regularly on a long-term basis and coordinated at a national level.
 - 3.2. With reference to other cancer therapies.
 - 3.3. Ensuring that patients have clinically appropriate and affordable therapies.

Keeping pace with radiotherapy techniques and technologies

4. Health technology assessment processes at all levels must be improved so innovations that provide value for both the cancer patient and the health system are effectively implemented.
5. There needs to be a sustainable financial model for the introduction of new radiotherapy techniques and technologies based on comparative effectiveness.
6. A radiation oncology registry of treatments and outcomes needs to be established to provide data capture and post-market surveillance.

Harmonisation of legislation

7. Regulatory legislation and processes should be harmonized across jurisdictions.

Minimum radiation oncology data set

8. A minimum radiation oncology dataset must be established, implemented and incorporated into a future national cancer data set.
9. All radiation oncology services must comply with the requirements of a radiation oncology national dataset and provide data.

The availability of radiotherapy to all patients for whom it is clinically appropriate which can be accessed in a timely manner

Timely access

10. Planners, decision-makers and service-providers must ensure that radiation oncology services have the capacity for patients to receive radiotherapy within clinically appropriate timeframes.
11. National targets for timely access to radiotherapy (as recommended by National Health and Hospital Reform Commission) should be set and services should be reporting against these targets.

Financial impact on patients, families and carers

12. The financial impact of accessing cancer treatment should be minimized to ensure that optimal treatment is available to all patients.
13. Legislative issues must be resolved to allow out-patient radiation oncology to qualify for private health insurance

A patient-centred, evidence-based and multidisciplinary approach to practice

Empowered consumers

14. Patients, carers and families need to be empowered such that:
 - 14.1. They are provided with current, relevant and evidence-based information regarding radiotherapy.
 - 14.2. Information is available in languages other than English, where appropriate.
 - 14.3. Any costs associated with treatments are clearly described prior to treatment.
 - 14.4. Current radiotherapy waiting times information is made publicly available.
15. There needs to be a central information resource on radiation oncology that is:
 - 15.1. Reliable and appropriate
 - 15.2. Readily accessible in all geographic locations

Radiation oncology practice standards

16. The Radiation Oncology Practice Standards must be mandatory.
 - 16.1. A mechanism for oversight of compliance with the Standards needs to be established and funded.
 - 16.2. The professions to regularly review and keep the Standards contemporary.

Evidence based multi-disciplinary oncology practice

17. Multidisciplinary Team management is the gold-standard of cancer care and must be supported by services, professionals and planners.

Clinical peer-review audit

18. Peer-review practices should be supported and increased to minimise process variation and ensure that treatments comply with best practice.

Ongoing evaluation of quality assurance, patient quality of life and survivorship

Quality assurance for safety and quality care

19. A national framework for quality assurance should be developed to make radiotherapy more consistent and to ensure patient safety.

Dosimetry

20. The Australian Clinical Dosimetry Service must be made permanent to ensure safe delivery of radiotherapy.

Quality of life and survivorship

21. Patient survivorship must be a focus of cancer management.

Continuous quality improvement

A quality management system for radiation oncology

22. There must be a national reporting framework to identify issues associated with quality.
23. A formal benchmarking exercise across jurisdictions and radiation oncology facilities must be undertaken, including activity targets, waiting times and clinical patterns of care variation:
 - 23.1. Service and planning benchmarks must be agreed nationally
 - 23.2. Variability between services must be measured and reported
 - 23.3. Individual plans must be developed for services to meet the benchmarks

Incident monitoring

24. A national incident monitoring system specific to radiation oncology must be implemented.

Engendering leadership and fostering a culture of quality

25. Quality management and leadership must be included in all professional training programs.

References

1. American College of Medical Quality. Policy 1: Definition of medical quality and Policy 2: Definition of clinical quality improvement. [Internet]. 2012 [cited 2012 Feb 7]. Available from: <http://www.acmq.org/policies/policies1and2.pdf>
2. Radiation oncology practice standards. A tripartite initiative. 2011. Available from <http://www.ranzcr.edu.au/.../tripartite-radiation-oncology-practice-standards>
3. Australian Government Department of health and Ageing. Radiation Oncology Lessons Learned from Previous Oncology Related Capital Works Programs – Presentations. [Internet] 2010. [Page last modified 2010 Nov 10; cited 2012 April 04] Available from http://www.health.gov.au/internet/.../roric_lesson_learned_symposium_presentations
4. Royal Australian and New Zealand College of Radiologists. Faculty of Radiation Oncology Position Paper on Techniques and Technologies in Radiation Oncology – 2011 Horizon Scan. Sydney: 2011
5. Sullivan R, Peppercorn J, Zalberg J, Meropol NJ, Amir E, Khyat D et. al. Delivering affordable care in high-income countries. The Lancet Oncology Commission Vol 12, September/October 2011; p933-980.
6. Australian Government Department of health and Ageing. Review of Health Technology Assessment in Australia. December 2009. Available from: <http://www.health.gov.au/internet/.../hta-review-report.pdf>
7. Delaney GP, Shafiq RJ, Jalaludin BB, Barton MB. Technology enhancements and changes in radiotherapy throughput in New South Wales. *Clinical Oncology* (2005) 17: 305-310
8. Cancer Australia. Data Set Development [Internet] 2012. [updated 2012 Feb 16; cited 2012 Apr 12]. Available from: <http://www.canceraustralia.gov.au/cancer-data/data-set-development>
9. SBU, The Swedish Council on Technology Assessment in Health Care: radiotherapy for cancer, ACTA ONCOL 1996; 1:35
10. Australian Bureau of Statistics. Heart diseases decrease over a decade [Internet] 2012. [updated 2012 Mar 20; cited 2012 Apr 12]. Available from: <http://www.abs.gov.au/ausstats/.../63AFD409CBAA7592CA25757C00272CF2?OpenDocument>
11. Australian Institute of Health and Welfare 2012. Cancer incidence projections: Australia, 2011 to 2020. Cancer Series no. 66. Cat. No. CAN 62. Canberra: AIHW.
12. Delaney GP, Jacob S, Featherstone C, Barton MB. Radiotherapy in cancer care: estimating optimal utilisation from a review of evidence-based clinical guidelines. Collaboration for Cancer Outcomes Research and Evaluation (CCORE), Liverpool Hospital, Sydney, Australia, 2003. Available from [http://www.canceraustralia.gov.au/sites/default/files/publications/radiotherapyreport\[1\].pdf](http://www.canceraustralia.gov.au/sites/default/files/publications/radiotherapyreport[1].pdf)
13. Allen Consulting Group. Implications of underutilisation of radiotherapy services, developed for the Tripartite Committee. April 2012.
14. Delaney G, Barton M, Iedema R, Winters M, Jacobs S. Comparison of face-to-face and videoconferenced multidisciplinary clinical meetings. *Australasian Radiology* 48(4): 487-492, 2004.
15. Cancer Council Australia. Cancer Forum. A Rodger Radiotherapy services beyond the major metropolitan areas: a debate [Internet]2010.[Last updated 2010 Mar 4; cited 2012 Feb 20]. Available from http://www.cancerforum.org.au/.../Radiotherapy_services_beyond_the_major_metropolitan_areas.htm
16. Lee, C C Y. Cheng, A C K. Lam, N H K. Chan, L C Y. Yau, C C. Improving Waiting Times for Radical Radiotherapy Treatment of Nasopharyngeal Cancer Based on Logistics Re-engineering. *Hong Kong College of Radiologists*. 2010 Volume 13: p181
17. Mackillop W J. Killing time: The consequences of delays in radiotherapy. *Radiotherapy and Oncology*. 2007 April; Volume 84 (1): P1
18. Chen Z, King W, Pearcey R, Kerba M, Mackillop W J. The relationship between waiting time for radiotherapy and clinical outcomes: a systematic review of the literature. *Radiotherapy and Oncology*. 2008 April; Volume 87 (1): P3
19. NSW Department of Health. Auditor-general's report performance audit. Tackling Cancer with Radiotherapy. June 2009 P5

20. Australian Government Department of Health and Ageing. A Healthier Future For All Australians – Final Report of the National Health and Hospitals Reform Commission – June 2009. Available from http://www.health.gov.au/internet/nhhrc/.../Final_Report_of_the%20nhhrc_June_2009.pdf
21. Thomas R, Thornton H and Mackay J. Patient information materials in oncology: are they needed and do they work? *Clinical Oncology* 1999; 11(4): 225-231 2.
22. Rainey LC. Effects of preparatory patient education for radiation oncology patients. *Cancer* 1985; 56:1056-1061
23. D'haese S, Vinh-hung V, Bijdekerke P, et al. The effect of timing of the provision of information on anxiety and satisfaction of cancer patients receiving radiotherapy. *Journal of Cancer Education* 2001; 15:223-227
24. Andersen BL, Karlsson JA, Andersson B, Tewfik HH. Anxiety and cancer treatment: response to stressful radiotherapy. *Health Psychol* 1984; 3: 535-551
25. Halkett GKB, Short M, Kristjanson LJ. How do radiation oncology health professionals inform breast cancer patients about the medical and technical aspects of their treatment? *Radiotherapy and Oncology*. 2009; 90: 153-159
26. Michael J. Barry, M.D., and Susan Edgman-Levitan, P.A. Shared Decision Making — The Pinnacle of Patient-Centered Care [Internet]. 2012 [updated 2012 Mar 1; cited 2012 Mar 27]. Available from: <http://www.nejm.org/doi/full/10.1056/NEJMp1109283>
27. Cancer Institute NSW. Multidisciplinary teams in New South Wales: 2006 and 2008. 2010 May [cited 2012 Feb 21]. Available from: http://www.cancerinstitute.org.au/media/24343/2010-5-12_multidisciplinary_teams_in_nsw_2006_and_2008.pdf
28. Cancer Australia. Cancer Australia Strategic Plan 2011-2014. Strawberry Hills NSW: 2011
29. Cancer Institute NSW. Coordination of Care [Internet] 2012 [updated 2012 Feb 3; cited 2012 Feb 21]. Available from: <http://www.cancerinstitute.org.au/supporting-best-practice/treatments-and-protocols/coordination-of-care>
30. Pawlicki T and Mundt AJ. Quality in radiation oncology. *Medical Physics* (2007); 34(5): 1529-1534
31. Review by Peers: a guide for professional, clinical and administrative processes, Australian Commission on Safety and Quality in Healthcare. [Internet]. 2012 [cited 2011 Jan 18] Available from: <http://www.health.gov.au/internet/safety/publishing.nsf/Content/prog-credentialling-lp>
32. Medical Board of Australia. Registration Standards. Continuing Professional Development Registration Standard. [Internet]. 2011 [page last reviewed 2011 Oct 10; cited 2011 Jan 12]. Available from: <http://www.medicalboard.gov.au/Registration-Standards.aspx>
33. Royal Australian and New Zealand College of Radiologists. Peer Review Audit Instrument. [Internet]. 2011 [cited 2012 Jan 13]. Available from: <http://www.ranzcr.edu.au/cpd/forms/log-book-templates/log-book-templates-radiation-oncology>
34. Royal Australian and New Zealand College of Radiologists. Recency of Practice Guidelines – Radiation Oncology. [Internet]. 2011 [cited 2012 Jan 13]. Available from: <http://www.ranzcr.edu.au/resources/professional-documents/guidelines>
35. Royal Australian and New Zealand College of Radiologists. Radiation Oncology CPD Program Guide 2010-2012. [Internet]. 2011 [cited 2012 Jan 13]. Available from: <http://www.ranzcr.edu.au/cpd/radiation-oncology/radiation-oncology-eligible-activities>
36. Marks LB, Jackson M, Xie L, et al. The challenge of maximising safety in radiation oncology. *Practical Radiation Oncology* (2011); 1(1): 2-14.
37. Saw CB, Ferenci MS, Wagner H. Technical aspects of quality assurance in radiation oncology. *Biomedical Imaging and Intervention Journal* (2008); 4(3): e48
38. Ishikura S. Quality assurance of radiotherapy in cancer treatment: Toward improvement of patient safety and quality of care. *Japanese Journal of Clinical Oncology* (2008); 38(No 11) p723
39. World Health Organisation. Radiotherapy Risk Profile: Technical Manual. 2008. Switzerland. World Health Organisation 2008: p6
40. Solberg TD and Medin PM. Quality and safety in stereotactic radiosurgery and stereotactic body radiation therapy: Can more be done? *Journal of Radiosurgery and SBRT* (2011); 1: 13-19

41. Kolybaba M, Kron T, Harris J, O'Brien P, Kenny L. Survey of Radiation Oncology Centres in Australia: Report of the Radiation Oncology Treatment Quality Program. *Journal of Medical Imaging and Radiation Oncology*. 2009 July; Volume 53(No 4): p382
42. Australian Clinical Dosimetry Service, private communication with RANZCR.
43. Department of Health and Ageing. Increased Safeguards for Radiotherapy Treatment. [Internet]. 2011 Feb 4 [cited 2012 Mar 14]. Available from: <http://www.health.gov.au/internet/ministers/publishing.nsf/Content/mr-yr11-ck-ck004.htm>
44. Leigh S. Myths, monsters, and magic: Personal perspectives and professional challenges of survival. *Oncology Nursing Forum*, (1992), 19, 1475-1480
45. Dow KH, Lafferty P. Quality of life, survivorship, and psychosocial adjustment of young women with breast cancer after breast-conserving surgery and radiation therapy, *Oncol Nurs Forum*, 2000;27:1555-64
46. Pawlicki T, Mundt AJ. Quality in radiation oncology. *Medical Physics* (2007); 34(5): 1529-1534
47. The Royal College of Radiologists, Society and College of Radiographers, Institute of Physics and Engineering in Medicine, National Patient Safety Agency, British Institute of Radiology (2008) *Towards Safer Radiotherapy*. The Royal College of Radiologists, London. Available from: www.rcr.ac.uk/index.asp?PageID=149&PublicationID=281
48. Radiation Oncology Safety Information System. About ROSIS. 2012 [cited 2012 Apr 17]. Available from: <http://www.rosis.info/index.php?content=about>