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ASMIRT

MR in RT Linac Staffing Model

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Australian Society of Medical Imaging and Radiation Therapy
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There are a number of protected titles for medical radiation practice. They include:

Medical Radiation Practitioner (MRP)

Diagnostic Radiographer (DR)

Medical Imaging Technologist (MIT)

Radiographer

Nuclear Medicine Scientist (NMS)

Nuclear Medicine Technologist (NMT)

Radiation Therapist (RT).

For the purposes of our documentation we use the broad descriptor Medical Radiation Practitioner (MRP) recognising that it covers a range of areas of practice.



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Disclaimer:

In the creation of this document, certain base assumptions have been made.

ASMIRT recognises that every radiation therapy department in Australia have their own philosophy and strategic direction to cancer care and treatment. However, the core capabilities expected of a Radiation Therapist remain the same albeit re-deployed to meet the services' requirements.

There is a requirement for Radiation Therapists (RTs) to be able to independently practice and undertake planning and treatment. Staffing levels/processes should reflect the individual current workplace – encompassing any multidisciplinary (MDT) requirements such as Oncologists, Physicists, nursing staff to name a few. Literature by Smith et al, suggests that 3.4 full-time equivalent (FTE) staff are required to cover treatment for one treatment unit, and 1.39 Rts per linac operating hour for a single linac department. The allocation of which is dependent upon the department's needs, caseload complexity and staff distribution.

Radiation therapy practice needs to occur in a safe work environment to treat a full machine workload over an 8-hour workday, five days a week. To operate a Linac, a minimum of three qualified radiation therapy staff is recommended (Smith et al, 2016), but this does not include the additional radiation therapy duties on top of the treatment aspect. Additional duties include planning, image/QA checks/assessments, students, charge checks, input checks, administration, addressing patient issues and referrals.

In the current Australian radiation therapy environment, an MR-Linac is unlikely to be installed within a standalone service. Staffing within this document assumes an existing departmental structure of management and administration.

Scope of document

The Australian Society of Medical Imaging and Radiation Therapy (ASMIRT) is the peak body representing medical radiation practitioners in Australia. Our aims are to promote, encourage, cultivate and maintain the highest principles of practice and proficiency of medical radiation science.

With the introduction and implementation of MR-Linacs and MR-Sims into Australian radiation therapy departments, it is incumbent upon ASMIRT to ensure safety and quality is maintained with this new delivery of service. ASMIRT acknowledges that provision of this service requires training, education and credentialling of radiation therapy staff in Magnetic Resonance (MR), in addition to leadership and guidance on adaptive treatment planning and verification processes. Radiation therapy practitioners are part of a multidisciplinary team (MDT) responsible for accurate target delineation and treatment delivery. Current practice utilising MR-Linacs has resulted in a change of role for Radiation Therapists and their MDT. (Hogan et al, 2022)

This document acknowledges that there are online adaptive based treatments including other adaptive systems on the market that do not utilise MR image guidance. Those systems will have similarities to the content described in this document, however, the scope of this document will not cover the staffing requirements of those systems.

**This document will not discuss specific vendor equipment.*

Background

The implementation of magnetic resonance imaging (MRI) has the capacity to improve soft tissue visualization of tumors, reduce the planning organ at risk volume (PRV) whilst does escalating, making radiation treatment adaptation possible (Randall et al, 2022).

Australia is in its infancy with the use of the MR-Linac technology. Organizations wishing to implement an MR-Linac need to be cognizant of how this will be integrated into their respective radiation therapy departments. An understanding of workflows, human resource requirements, training, education and credentialing elements requires sound strategy. The introduction of this technology will include significant planning and lead time, and strong communication and leadership within the department and with external stakeholders that form part of the multidisciplinary team.

Literature from counterparts in the UK and the US that have implemented an MR-Linac service detail some of the obstacles and roadblocks that need to be considered. Whilst this is a good foundation to understand the origins of MR-Linac implementation, the roles and capabilities of an Australian Radiation Therapist engenders a different scope of practice. It must be noted that each radiation therapy department operates in a different health and economic environment. Surges in staffing are based on new technology, tools, upgrades, and types of techniques. Departments demand staff with knowledge and ability to be competent in their practice. This is a complex situation, given the rapidly and constantly changing environment, requiring staff to be adaptable and flexible and organisations willing to work within this dynamic framework. It is a delicate balance between technology and operational requirements.

It also needs to be recognised that much of the initial work internationally in the MR-Linac arena derived from research through university affiliated programs. The theoretical framework derived from this international research provided a platform for early publications on treatment delivery. This is not the structure within Australia, with very few radiation therapy centres affiliated with an Australian university. As such, the context of how the MR-Linac is utilised within the Australian environment is quite different to that contained in the reported literature.

The Australian Environment

Australian Radiation Therapy practitioners are registered with the Australian Health Practitioners Regulatory Agency (AHPRA). As part of that registration, RTs adhere to the “MRPBA professional capabilities for the medical radiation practitioner” document. This document “recognises the various roles that a practitioner undertakes in practice, including the professional role, the partner in care, the communicator and collaborator, the educator, and the medical radiation safety expert.” (MRPBA, 2022). It provides information on the RTs scope of practice and foundation skills required for general registration.

Australian Radiation Therapists are already trained to a high level and are skilled in many of the processes that are required for a safe and accurate planning and delivery of treatment using MR-Linac technology. The introduction and progression of this new technology has provided an opportunity for RT education to be adopted in this space. It is acknowledged that specific training

and upskilling of Radiation Therapists is still required to successfully integrate an MR-Linac into a department using this knowledge as a solid framework to build upon to create a fully functioning service. This is an evolution of these specific professional capabilities, that have been utilised in previous technological and service developments, including CT-based simulation and planning, and intensity modulated radiation therapy (IMRT).

The expected level of additional education or upskilling is similar to when CT scanners were first introduced into Australia for radiotherapy simulation, Sim-CT. These dedicated CT scanners required increased knowledge and skill to operate safely and effectively, with training, policies, processes and credentialing generated by RTTs within their respective departments. As with the Sim-CT, the ability for RT practitioners to upskill in this area of MR will provide the knowledge that is already core knowledge in medical imaging counterparts. Fusion = registration

Radiation Therapist Roles and Responsibilities

Australian RTs undertake many tasks and responsibilities as defined in their scope of practice. Many of these skills and knowledge have been taught through an undergraduate Bachelor's, or post-graduate Master's degree program with clinical skills refined in clinical environments. The following is a non-exhaustive list of skills:

- Patient education
- Accurate and safe patient positioning and immobilisation during simulation
- Acquisition and registration of multimodality images
- Contouring of patient anatomy for Organs at Risk (OARs) and targets
- Design of treatment plan
- Evaluation of plan dosimetry
- Participation, consultation, and documentation of plan quality assurance in conjunction with Radiation Oncology Medical Physicists (ROMPs)
- Perform daily image guidance

The Australian RT is skilled in both the planning and treatment areas. An MR-RT is a fully qualified RT that must be able to execute both these functionalities simultaneously. Whilst there are distinct skill sets required to learn this new technology, many of the key RT skills are overlapping. It is just a re-assortment of capabilities.

As such, they are required to possess:

- Enhanced understanding of MRI safety and risks for patients and staff. MR-RTs are responsible for all aspects of MR safety in the daily operation of the unit. Including screening of patients, staff and any visitors.
- Understand the process of image acquisition within the MRI environment, its limitations and how to troubleshoot issues
- Enhanced image verification skills
- Excellent and efficient contouring skills for both MR and CT images
- Advanced planning skills to support the efficient treatment planning on the daily image acquisition (in the case of requirement for re-planning)
- Level 2 MR safety training to maintain responsibility for all aspects of MR safety in the daily operation of the unit, which includes screening of patients and visitors.

Education and Credentialling

So how are the RT skills enhanced for this environment?

ASMIRT suggests that there is a theoretical and practical component of learning required. Initially, with the purchase of the equipment, there will be a significant reliance on vendor training. Additional education can come in the form of MRI short courses, advanced anatomy courses, external site visits to look at protocols with onsite training of other members of the team. Post graduate education is also available in the field of MRI, and whilst of a generic diagnostic nature, contains robust foundational concepts.

Each department may choose to formalise these educational processes as detailed by Hogan et al, 2022, which details training requirements for those involved with the technology and other internal credentialling as part of their framework. Regular credentialling is recommended on a yearly basis to ensure staff meet the required numbers of patient cases and type of complexity for the work area to maintain practice efficiency and accuracy. Departments may choose to establish additional performance indicators and rating scales for valid measurement of education and assessment purposes.

It is of note that university providers recognise the implementation of this new technology and are updating their syllabi to include training and teaching of this advancement of technology into their courses.

Departmental Procedures and Equipment Procedures prior to RT planning

MR-Sim vs MR-Linac. Departmental equipment different however cover main principles only.

- RTs have the clinical knowledge to determine what will be the best position for the patient to be in for treatment and are primarily responsible for patient setup and simulation in the CT and MRI environments.
- The role and responsibilities of an RT during the simulation process are largely determined by the type of medical equipment a department has. This will be dependent upon whether the department has an MR-Simulator/MR-Linac or both, and whether the MR-Linac is being used to acquire the MR simulation scans.
- The aim of the simulation process is to acquire the highest quality images possible to aid in the planning process. So in either case, MR-RTs must have a clear understanding of MRI physics so as to use appropriate imaging techniques and troubleshoot any image issues, i.e. artefact.
- Training/education
 - o MR-RTs need to have undertaken vendor training or be trained by those that have completed it
 - o It is highly recommended that all staff complete dedicated education and training in the basics of MR imaging
 - o It is considered useful to have senior staff undertake further MR education and image acquisition training
 - o Access to a MR Radiographer will also assist in the integration of MR-simulation.

Planning Procedures

- The planning process for patients being treated on the MR-Linac follows the same established principles of RT. Radiation Therapists are the sole professional group within Australia that is trained and qualified to do so legally.
- There is a large overlap within the preexisting skillsets of Australian RTs that make us uniquely suitable to develop MR-Linac treatment plans, then adapt them daily for treatment.
- Primary differences in MR-Linac planning and knowledge requirements include the effect of the magnetic field on primary and secondary radiation, limitations in beam angle, and physical limitations of the machine, i.e. fixed collimator angle or isocentre.
- Additional training may be required to become competent, but it should be treated the same as other sub-specialist roles like Stereotactic Radiotherapy.

Factors affecting staffing numbers:

It is recognised that as this technology is still in its infancy, the numbers of trained MR-RTs are limited. Whilst the numbers of trainers and trainees are increasing, the critical mass of skilled RTs in this area has not been reached on a local departmental and national professional scale. Therefore, staffing numbers will be heavily affected by illness, annual and other leave, training that is in progress and credentialling. Additional factors affecting staffing numbers include departmental constraints, budget, funding, support from institution, justification of patient numbers and nature/type of treatments.

Recommended Numbers

ASMIRT recommends that ideally, 6-8 fully trained/credentialled full time RTs that have the capabilities to step in to cover any illness/leave etc on the MR-Linac for planning and treatment are required for a single MR-Linac.

ASMIRT recommends that staffing for an MR-linac follow that of conventional linacs (Smith et al, 2016), and within that context specifically recommends 6-8 fully trained FT RTs.

As with current linacs the numbers of staff per additional machine will increase in a nonlinear fashion and in line with local use case and policies, with patient and staff safety in mind.

Best practice requires that there is a minimum of two RTs present to treat a patient. Additional RT numbers are contingent upon machine clinical hours (the numbers of cases/patients), and individual department structures, requirements and usage of the machine.

The number of staff will also be dependent upon the complexity of the case mix, and utilisation of fully adaptive workflows.

It is assumed that at the beginning of any service offering MR-Linac treatment, the development of protocols and increased training requirements may result in larger staff numbers until the service operates in a business-as-usual fashion.

As this is a new and rapidly evolving space within radiation therapy, additional staff may be required periodically to implement, update or consolidate techniques and clinical practice.

Additional Recommendations/Future Direction

ASMIRT recognises that there is a balance between development/progression and day-to-day operations vs continuity of service. Given the newness of the technology and the rapid changes that are occurring in this space, it is recommended that the model be reviewed and refreshed at least every 3 years to ensure that it remains reflective of contemporary practice.

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