# Medical radiation practice workforce analysis

### Key points

- The number of medical radiation practitioners in Australia grew by 6.0 per 100,000 population (12.2%) over the five years between 2017/18 and 2021/22.
- The change was driven by an increase in the proportion of diagnostic radiographers, with a decrease in radiation therapists and nuclear medicine technicians.
- The greatest growth was seen in the Northern Territory (where there has been a shortage of medical radiation practitioners) and South Australia.

Disclaimer: The information in this report was current at the time of completion in January 2023. Significant new research and information may become available at any time, and the data sources provided in this report may have been archived, decommissioned or integrated into another portal.

## Introduction

This report is provided as a resource to help and inform the National Board in its regulatory work and planning. The demographic analysis, which is based on the National Scheme and published data from other sources, complements the published demographic snapshot with a more detailed description and discussion of trends in the medical radiation practice workforce.

## Current state – general demographic characteristics

### Profession overview

At 30 June 2023, 18,509 medical radiation practitioners were registered in Australia, of which 97.5% held some form of practising registration.

Medical radiation practice constitutes 2.2% of the regulated health practitioner workforce, with 69.9 practising medical radiation practitioners per 100,000 head of population. Across the profession, 97.4% of registrants held general registration, 0.1% held provisional registration, and 2.5% held non-practising registration.

The gender division for medical radiation practitioners was 68.9% female and 31.1% male. The average age of Australian medical radiation practitioners was 39.1 years, with 44.7% aged under 35 years and 12.6% aged 55 years or older. Most medical radiation practitioners (84.4%) got their initial qualification in Australia. Medical radiation practitioners worked mostly in a hospital setting, in a major city, and worked an average of 35.6 hours per week.

## Medical radiation practitioners with general registration

At 30 June 2022, there were 17,932 medical radiation practitioners with general registration in Australia. Medical radiation practitioners included 14,054 diagnostic radiographers (excluding 227 on the sub-register), 2,641 radiotherapists, and 1,122 nuclear medicine technicians, as well as 13 practitioners who held dual registration as a diagnostic radiographer and a nuclear medicine technician, and two holding dual registration as a diagnostic radiographer and radiotherapist. The average age of practising medical radiation practitioners was 39.1 years, of which 68.3% were female, 31.7% were male and two for whom gender was either not stated, inadequately described, intersex or indeterminate.

Nationally, there were 69.2 medical radiation practitioners per 100,000 people, which were distributed unevenly across jurisdictions. There were 78.8 medical radiation practitioners per 100,000 people in South Australia, 73.9 per 100,000 in New South Wales, 71.6 per 100,000 in the Australian Capital Territory, 71.5 per 100,000 in Queensland, 65.2 per 100,000 in Tasmania, 64.8 per 100,000 in Victoria, 56.7 per 100,000 in Western Australia and 56.0 per 100,000 in the Northern Territory.

The 2020 National Health Workforce Survey by the Commonwealth Department of Health, Disability and Ageing, found that there were 60 full time equivalent (FTE) (38 hours per week) medical radiation practitioners per 100,000 population in major cities, 48.6 per 100,000 in inner regional areas, 34.4 per 100,000 in outer regional areas, 24.3 per 100,000 in remote areas and 14.1 per 100,000 in very remote areas.

Around 90.6% of general registrants were employed in the profession in Australia (78.0% as a diagnostic radiographer, 15.0% as a radiation therapist, and 7.0% as a nuclear medicine technician), working an average of 34.9 hours per week [1]. 93.9% of medical radiation practitioners with general registration defined their principal role as a clinician. The remainder identified themselves as administrators (including managers not providing clinical services), teachers, educators, researchers or working in other roles.

Of those medical radiation practitioners who provided information about their work setting, 56.6% reported that their primary work setting was in a hospital, and 38.5% worked in private practice (32.0% in a group practice, with the remaining 6.5% in solo practice, a locum service, or another arrangement). A further 1.4% worked in a community health setting, 1.0% worked as a teacher/educator, and 1.0% worked in a government setting (including the defence forces). The remainder worked in a sports centre or other commercial business service, Aboriginal health centre or another (unspecified) setting.

When adjusted for FTE, 51.6% of clinicians worked in the private sector and 48.4% in the public sector in their principal role.

### Diagnostic radiographers

At 30 June 2022, there were 14,054 diagnostic radiographers, of which 67.2% were female, 32.8% were male, and the gender of one was not stated/inadequately described/intersex/indeterminant. The average age of diagnostic radiographers with general registration was 39.4 years, with 43.5% aged less than 35 years and 15.3% aged greater than 55 years.

Across jurisdictions, 33.4% had a principal place of practice in New South Wales, 23.3% in Victoria, 20.9% in Queensland, 8.9% in Western Australia, 8.0% in South Australia, 2.0% in Tasmania, 1.7% in the Australian Capital Territory and 0.9% in the Northern Territory. A further 0.9% were registered in Australia but practised overseas. Across geographic areas, 77.1% practised in a major city of Australia, 5.8% in an inner regional area, 5.5% in an outer regional area and 0.7% in a remote or very remote area.

### Radiation therapists

At 30 June 2022, there were 2,641 radiation therapists registered in Australia, of which 75.1% were female and 24.9% were male. The average age of radiation therapists was 38.0 years, with 42.0% aged less than 35 years and 8.4% greater than 55 years. Australia was the country of birth for 73.2% of radiation therapists.

Across jurisdictions, 31.3% had their principal place of practice in New South Wales, 24.2% in Victoria, 23.2% in Queensland, 8.5% in Western Australia, 6.8% in South Australia, 2.8% in Tasmania, 2.0% in the Australian Capital Territory and 0.5% in the Northern Territory. A further 0.8% were registered in Australia but practiced overseas. Across geographic areas, 80.4% practised in a major city of Australia, 14.9% in an inner regional area, 3.8% in an outer regional area and three practised in a remote or very remote area.

### Nuclear Medicine Technicians

At 30 June 2022, there were 1,222 nuclear medicine technicians, of which 66.4% were female, 33.5% male and the gender of one was either not stated, inadequately described, intersex or indeterminate. The average age of nuclear medicine technicians was 37.8 years (compared to the overall average of 39.1), with 47.2% aged less than 35 years and 9.1% aged greater than 55 years. Australia was the country of birth for 83.3% of nuclear medicine technicians.

Across jurisdictions, 36.1% had a principal place of practice in New South Wales, 26.3% were in Victoria, 16.2% in Queensland, 9.2% in South Australia, 7.0% in Western Australia, 2.5% in the Australian Capital Territory, and 1.5% in Tasmania and five nuclear medicine technicians practised in the Northern Territory. A further 0.9% were registered in Australia and practised overseas. Across geographic areas, 82.7% practised in a major capital city of Australia, 13.2% in an inner regional area, 3.1% in an outer regional area and one in a remote region.

## Trends from 2018 to 2022

The number of practising medical radiation practitioners increased by 12.2% between 2018 and 2022, from 16,019 in 2017/18 to 17,970 in 2021/22.[1] Over this period, the proportion of female registrants increased from 68.0% to 68.3% and the proportion of male registrants decreased from 32.0% to 31.7%. The proportion aged less than 35 years decreased from 44.5% to 43.5%, while the proportion aged more than 55 years decreased from 21.5% to 13.6%.

Between 2017/18 and 2021/22, the proportion of medical radiation practitioners with general registration increased from 97.4% to 99.8% while the proportion with provisional registration decreased from 2.6% to 0.2%.[2] Over the five years, there was only one practitioner with limited registration.

Over the same period, the proportion registered as diagnostic radiographers increased slightly from 77.4% to 78.4%, while the proportion of radiation therapists and nuclear medicine technicians decreased from 15.2% to 14.7% and 7.3% to 6.8%, respectively. The number of medical radiation practitioners with dual registration as a diagnostic radiographer and nuclear medicine technologist decreased from 17 to 13, and two registrants held dual registration as a diagnostic radiographer and radiation therapist across the five years.

Based on the 2020 National Health Workforce Survey, there was a small increase in the average number of hours worked per week, from 34.8 hours in 2016 to 34.9 hours in 2020. Of the medical radiation practitioners who provided information on their number of hours worked, there was no change in the proportion working more than 35 hours per week (67.7%) and a very slight decrease in those working 50 or more hours per week (from 5.8% to 5.3%).

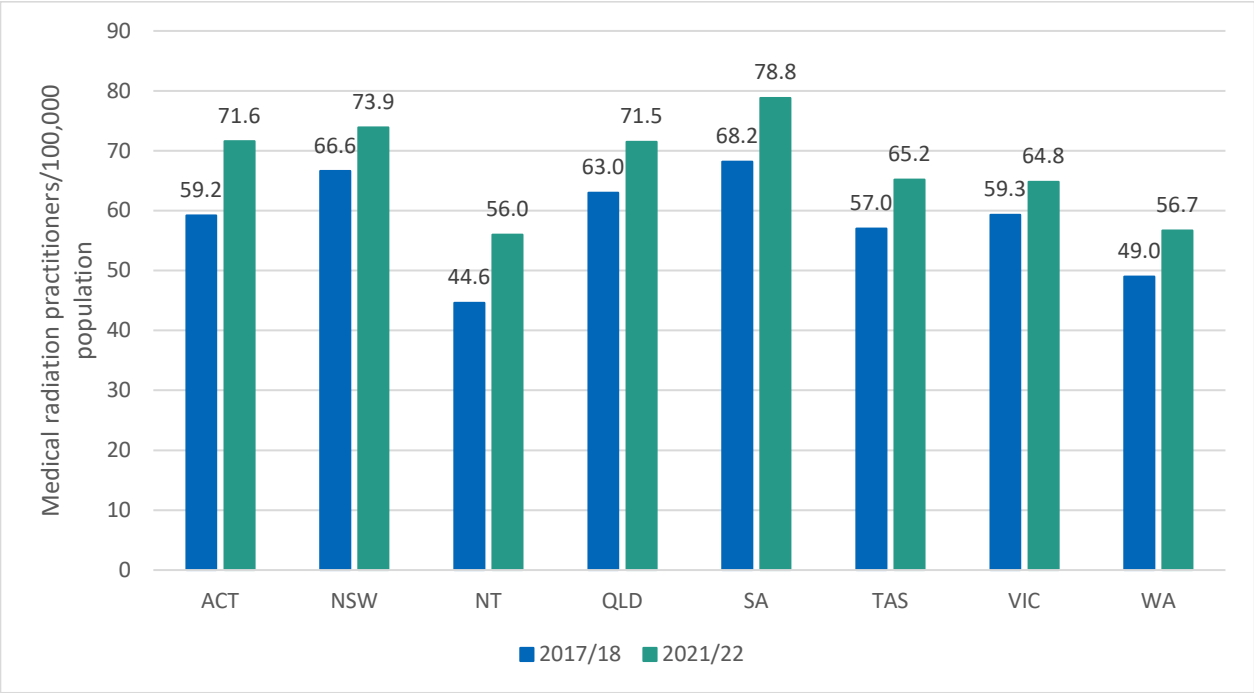
Nationally, the number of medical radiation practitioners with general registration increased from 61.6 medical radiation practitioners per 100,000 population in 2017/18 to 69.2 per 100,000 in 2021/22. The change in the distribution of medical radiation practitioners across jurisdictions over the five years is shown in Figure 1.

Between 2017/18 and 2021/22, the greatest increases were seen in the Australian Capital Territory, which increased from 59.2 to 71.6 medical radiation practitioners per 100,000 population, the Northern Territory (from 44.6 to 56.0 per 100,000) and South Australia (from 68.2 to 78.8 per 100,000). In Queensland, the rate increased from 63.0 to 71.5 per 100,000, Tasmania from 57.0 to 65.2 per 100,000, Western Australia from 49.0 to 56.7 per 100,000 and New South Wales from 66.6 to 73.9 per 100,000. Victoria increased from 59.3 to 64.8 medical radiation practitioners per 100,000 over the same period.

[1] Includes general, limited and provisional registration, excludes non-practising registration.

[2] The number of non-practising medical radiation practitioners increased from 238 in 2017/18 to 404 in 2021/22.

**Figure 1: The distribution of medical radiation practitioners with general registration per 100,000 population across jurisdictions for 2017-18 and 2021-22**




Based on the 2016 and 2020 National Health Workforce Surveys, the geographic distribution of medical radiation practitioners in major cities of Australia increased from 55.0 to 60.0 FTE medical radiation practitioners per 100,000 population, for inner regional areas from 43.7 to 48.6 per 100,000, for outer regional areas from 30.1 to 34.4 per 100,000 and for remote areas from 23.5 to 24.3 per 100,000. For very remote areas, there was a decrease from 14.9 practitioners to 14.1 per 100,000.

Over the same period, the proportion of medical radiation practitioners whose principal work setting was a hospital increased from 51.3% to 56.6%, while the proportion working in private practice increased from 35.5% to 38.5% (from 29.9% to 32.0% in a group practice and decreasing from 6.6% to 6.5% for solo practice, a locum service or another arrangement). Over the same period, the proportion of medical radiation practitioners working in a community health setting increased from 1.2% to 1.4%, the proportion working as a teacher/educator remained the same (1.0%), and the proportion working in a government setting decreased from 1.2% to 1.0%. The 2020 National Health Workforce Survey showed three medical radiation practitioners were employed by an Aboriginal health centre, compared to none in the 2016 National Health Workforce Survey.

# Supply and demand – observations and insights

## The domestic 'pipeline'

At 30 June 2022, there were 5,042 students enrolled in an approved program of study to become a medical radiation practitioner, following a steady annual increase from 4,424 in 2017/18, except 2020/21 when numbers decreased (an overall increase of 33.6%). Based on data from the student register, 69.8% of medical radiation practice students in 2021/22 were female, which is slightly higher than the proportion of female registrants in the same year (68.4%).[3] Around 80.16% of students were under the age of 25 years, 95.6% under the age of 35, 99.3% were aged under 45 years and 0.7% were aged 45 years or older.

At 30 June 2022, ten education providers were offering 20 approved programs of study for diagnostic radiography (three in New South Wales, two in Queensland, two in Victoria, and one each in the Australian Capital Territory, South Australia, and Western Australia). There were no courses offered in

[3] Due to ongoing improvements in validation and reporting of the student registers, these figures are indicative only and changes over time need to be interpreted with caution.

Tasmania or the Northern Territory. Of these, nine programs of study led to a bachelor's level qualification, one to a bachelor's level qualification specialising in diagnostic radiology, eight to a bachelor's (honours) qualification and two were at master's level. This is an increase of eight new programs of study compared to those available on 1 July 2017.

Seven education providers were offering 12 approved programs of study for radiation therapy (two each in New South Wales and Victoria, and one each in Queensland, South Australia and Western Australia). No courses were offered in the Australian Capital Territory, the Northern Territory or Tasmania. Of the 12 approved programs of study, five led to a bachelor's level qualification, one to a bachelor's level qualification with a specialisation, five to a bachelor's (honours) qualification and one to a master's degree. This is an increase of nine new programs of study compared to those available on 1 July 2017.

At the same time, four education providers offered seven approved programs of study for nuclear medicine technicians (two in New South Wales, and one each in Victoria and South Australia). No courses were offered in the Australian Capital Territory, the Northern Territory, Queensland, Tasmania or Western Australia. Of the seven approved programs of study, three led to a bachelor's level qualification, one to a bachelor's level qualification specialising in nuclear medicine and three to a bachelor's (honours) qualification. This is an increase of three new programs of study compared to those available on 1 July 2017.

In 2018, horizon scanning and scenario generation for medical radiation practitioners conducted by the New South Wales Ministry of Health identified that there was a higher number of students than available clinical placements, putting undue pressure on the public system to provide student placements, particularly for the diagnostic radiography and radiation therapy professions [2]. At 30 June 2022, there were 5,042 medical radiation practice students nationally, representing an increase of 2.6% from 2019/20. Being able to provide the appropriate placements for these students may be challenging if graduate numbers continue to rise.

A further point of interest is the shortage of radiographers in other English-speaking countries. The United Kingdom 2020 radiographers census, for example, found an average vacancy rate of 10.5% for diagnostic radiology jobs [3]. A similar 2019 survey in the United States revealed 8.5% understaffing by radiology technicians [4]. This could entice Australian graduates to seek employment overseas, contributing to a skill shortage in Australia.

## Overseas-trained practitioners

Indicators of Australia's reliance on overseas-trained practitioners (OTPs) include: the number of registered practitioners who initially qualified overseas; the number of OTPs added to the register each year; and the number of practitioners entering Australia each year via skilled work visas. These are outlined below as they relate to medical radiation practitioners.

### Overseas qualifications

According to the National Health Workforce Surveys reported by the Department of Health in 2016 and 2020, the proportion of medical radiation practitioners who got their initial qualification outside of Australia decreased from 14.1% to 12.4% over the five years, while the proportion that qualified in Australia increased from 78.3% to 82.3%. (Country of qualification was not specified for 7.6% and 5.4% of respondents to the 2016 and 2020 National Health Workforce Surveys, respectively).

Ahpra data shows that between 2017/18 and 2021/22, the proportion of general registrants who got their initial qualification in another country dropped from 7.9 to 6.4%, and the proportion who qualified in Australia decreased from 80.6% to 76.9%. The country of qualification is unknown for 11.5% of general registrants in 2017/18 and 16.6% of registrants in 2021/22.

Data from the National Health Workforce Survey is the most reliable indicator of the proportion of medical radiation practitioners with overseas qualifications, as the Ahpra data is more incomplete.

### Additions to the register

Sixty-seven internationally qualified medical radiation practitioners were added to the register in 2019/20, bringing the five-year total to 373 [5]. Internationally qualified medical radiation practitioners added to the register made up 0.4% of all medical radiation practitioner registrants, a slight increase from 0.3% in 2015/16.

### Visa statistics

The Department of Home Affairs data shows that in 2017/18, 29 temporary resident skilled visas were granted to medical radiation practitioners (all diagnostic radiographers). Over the following five years, the number gradually decreased to 21 temporary resident skilled visas (17 to diagnostic radiographers, less than five radiation therapists, and less than five nuclear medicine therapists) in 2021/22 [6].

It should be noted that the available data only relates to primary applicants in specific visa classes (for example, occupation is not collected for partners and/or children of visa applicants). Further, the assessment for a visa to migrate is a separate process to registration as a medical radiation practitioner in Australia.

## Trends and intentions

A review of the 2020 National Health Workforce Survey item 'years intended to work', broken down by age, provides an indication of likely attrition over the next few years. As a practitioner intending to work for a particular number of years is not intending to work beyond that number, the question can also be interpreted as a measure of intention to cease practising.

The combination of historical growth rates, the age profile of the existing workforce, and expressed intention to work enables an assessment of likely exit points from the profession and an indication of whether the replacement rate of new entrants is likely to meet the exit rate over the coming years. An assessment of a low replacement rate does not equate to a workforce shortage, as shortage is relative to demand.

Based on the National Health Workforce Survey, the Department of Health estimated that the replacement rate for medical radiation practitioners in 2020 was 1.6, which is slightly higher than that for 2016, which was 1.3. That is, for every medical radiation practitioner who left the register, another 1.6 (or 1.3 in 2016) were added. This figure is based on the number of medical radiation practitioners with general registration who were employed at the time of the survey. Between 2016 and 2019, the replacement rate gradually increased from 1.3 to 2.1 before dropping to 1.6 in 2020. It is not known why the replacement rate rose slightly in 2019, although one could speculate that it may be due to the first graduates from new medical radiation practice courses entering the workforce.

The analysis in this section is intended to be indicative only. It is based on current age profiles, expressed intentions, and historical growth rates. It takes no account of people currently in the training pipeline or demand factors.

The National Health Workforce Survey revealed that in 2020, medical radiation practitioners had worked an average of 14.3 years and intended to work for an average of 20.6 more years. About 79.8% of medical radiation practitioners aged under 35 years intended to work for at least another 10 years. The proportion of medical radiation practitioners intending to work until (or close to) the usual retirement age of 65 years increased with age, ranging from 51.7% for those aged under 35 years to 66.0% for those aged 35-44 years, to 80.6% for those aged 45-54 to 84.3% for those aged 55 to 64 years.

In 2021/22, Ahpra data shows that 15.3% of registered medical radiation practitioners were aged 55 or older. National Health Workforce Survey data from 2020 shows that medical radiation practitioners in this age group intended to work an average of 6.1 years. More than half (57.8%) of this cohort did not intend to be working in five years and 91.4% did not intend to be working in 10 years.

Unpublished data held by Ahpra on lapsed registrations showed that 3,089 medical radiation professionals left the profession in 2021/22, which was equivalent to 0.9% of the medical radiation professional workforce (14.6% of diagnostic radiographers, 27.0% of radiotherapists and 27.4% of nuclear medicine technicians).

More recently, a survey of medical radiation practitioners conducted by Ahpra in December 2023 found that 75.5% of respondents intended to remain in the profession, 7.3% to leave and 7.7% were unsure (n=3,262 participants) [7]. Across all allied health professions, factors influencing practitioners' intention to stay in the profession were age older than 60 years, male, work more than 50 hours per week and not be self-employed.

Overall, these figures translate into a likely attrition rate that is consistent with that observed in recent years. If historical growth and attrition rates continue to apply, the trend would be for new entrants to exceed exits, resulting in overall growth in the medical radiation practice workforce over the coming years.

## Demand – employment projections, workforce shortages and demand drivers

### Employment projections

The Department of Employment and Workplace Relations (DEWR) publishes employment figures and projections (derived from the Australian Bureau of Statistics (ABS) Labour Force Survey) for occupations categorised using the Australian and New Zealand Standard Classification of Occupations (ANZSCO) structure [8]. The ANZSCO includes medical diagnostic radiographers, radiation therapists and nuclear medicine technologists.

The DEWR estimates that the number of employed medical imaging professionals (including sonographers) in 2021 was 15,900 and projects that there will be 18,200 medical imaging professionals employed in 2026, representing 14.7% growth over the 5 years. (Please note, these figures are for total employment, such as both full-time and part-time employment) [9].

The DEWR breakdown by occupation for 2021 is based on 8,218 employed diagnostic radiographers, 1,870 radiation therapists and 705 nuclear medicine technicians, which represents 89.0% of registrants at 30 June 2021 (the nearest quarter for which figures are available). A breakdown of DESE's projected growth by division is not available.

### Workforce shortage

In October 2022, the National Skills Commission (NSC) released a Skills Priority List that provides a detailed view of shortages and the expected future demand for around 800 occupations across Australia [10].

The NSC identified diagnostic radiographers as being in short supply in the Northern Territory, but not in other jurisdictions. Radiation therapists and nuclear medicine technologists were not identified as being in short supply in any jurisdiction. The NSC predicted a strong future demand for all three occupations.

Historical workforce shortage ratings from 1986 to 2018 show that, between 2008 and 2018, diagnostic radiographers were only in shortage in 2010-12 and 2018 [11]. Between 2008 and 2018, the only year that radiotherapists were in short supply was 2010. Nuclear medical technologists were not in short supply at any time between 2008 and 2018.

### Drivers of demand

In 2018, horizon scanning and scenario generation for medical radiation practitioners conducted by the New South Wales Ministry of Health identified service pathways and referrals, population demographics and the increasing incidence of complex chronic disease and cancer, government funding and policy, technology and innovation, service coverage and accessibility, and service awareness as the main drivers of demand [2].

#### Service pathways and referrals

Stakeholders identified service pathways and referral practices as a major driver of demand for medical radiation practitioners. Service pathways and referral practices vary between the public and private sectors, work settings and the type of service required. The 2020 National Health Workforce Survey found that, when adjusted for full-time equivalence, slightly more medical radiation practitioners in clinical practice worked in the private sector (51.6%), the remainder working in the public sector (48.4%). Over half (56.6%) worked in a hospital (public and private) and 38.5% worked in private practice.

The horizon scan included focus groups conducted to understand how service pathways and referral processes influence the demand for services for practitioners in each division. The findings are summarised below:

The main referral pathways for diagnostic radiography are: referral from a general practitioner/medical specialist/other allied health professional (for example, physiotherapist); referral during triage in a hospital emergency department; and referral from a public hospital inpatient. Stakeholders reported that up to 70% of referrals were from emergency departments, resulting in an often-unpredictable caseload. Further

complexity results from diagnostic radiography generally being provided on a 24/7 basis in a public hospital setting.

Diagnostic radiographer stakeholders reported that referring health practitioners may over-order diagnostic imaging, which can lead to resourcing issues, particularly in public hospital settings. Key performance indicators for diagnostic imaging in public hospitals include imaging and reporting turnaround times. A range of initiatives have been introduced to address the over-servicing issue, including New South Wales Health's trial of a clinical decision support tool at Liverpool and the Royal North Shore hospitals, which is combined with evidence-based referral guidelines for appropriate imaging [12]. In addition, the Australian Government's National Prescribing Service's Choosing Wisely Initiative, introduced in 2018, includes guidelines to diagnostic imaging in emergency departments [13].

In contrast, radiation therapist stakeholders reported their services as being significantly underutilised. The '45 and Up Study' included 17,873 patients with newly diagnosed cancer, of whom 30.3% received radiation therapy [14]. Cancer patients who were aged less than 60 years, or more than 80 years, and female were found to be the least likely to receive radiation therapy. This population group generally had at least one co-morbidity, required help with the activities of daily living or lived 100 km or more from the nearest radiation therapy centre

A survey of medical practitioners responsible for the treatment of patients with cancer in New South Wales (n=253) found that the major factors taken into consideration when referring cancer patients for radiation therapy are the potential acute side effects of radiation therapy and their management, the likely impact on work and family commitments and treatment-related travel or relocation [15].

Referrals to services provided by nuclear medicine technologists come from specialists and general practitioners [2]. Stakeholders identified the main challenge they need to overcome is the fear that radiation from nuclear medicine procedures would increase the risk of cancer, driving demand away from their services. They suggested that this could be eased by better public education about the safety of nuclear medicine, as well as ensuring that medical practitioners clearly explain why radiation may be necessary at the time of referral, including the potential risks and benefits.

**Population demographics and the increasing incidence of complex chronic disease and cancer**

Population demographics and the increasing incidence of complex chronic disease and cancer were identified as a strong driver of demand for medical radiation practitioners in the 2018 New South Wales horizon scan. The expected growth and ageing of the Australian population, as well as the increased focus on chronic disease and cancer, will put significant pressure on the health workforce, including medical radiation practitioners.

Based on conservative assumptions, the ABS estimates that the Australian population will reach around 36.1 million people by 2050, with more than 1.3 million people aged over 85 years [16].[4,] The most recent National Health Survey (NHS) found that the prevalence of Australians living with one or more chronic conditions rose from 42.2% in 2008/09 to 46.6% in 2020/21, with an increase in prevalence with age [17]. The most prevalent age-associated chronic conditions identified through the NHS were back problems (15.7% of respondents), arthritis (12.5%), diabetes (5.3%), cardiovascular disease (4.0%) and osteoporosis (3.6%).[11] Two or more chronic conditions were reported by 18.6% of respondents, potentially adding to the complexity of diagnosis and treatment.

Although the prevalence of cancer was somewhat lower than the chronic diseases outlined above, being reported by 1.6% of NHS respondents, in 2018, cancer was the leading burden of disease, accounting for 18% of the total disease burden [18]. The NHS found increased prevalence of cancer in people aged 65 and over compared to other age groups (5.6% of respondents with cancer compared to less than 0.8% of people aged 44 or less) and 75% of respondents with cancer reported an additional chronic condition. The latter is supported by a longitudinal Australian study that found that 61% of cancer patients had at least one additional chronic condition over a ten-year study period, with 21% reporting three or more chronic conditions [19].

It can be surmised that the increasing prevalence of obesity in Australia (from 27.9% to 31.3% between 2014/15 and 2017/18) could signal a future increase in chronic disease, as overweight and obesity are known to be linked with an increased risk of diabetes and other chronic diseases, including many forms of

[4] Assumptions applied to data set – low fertility, medium life expectancy, medium net overseas migration

cancer [20-23]. This suggests that the demand for medical radiation practitioners is likely to increase in the future.

### Government funding and policy

Government funding and policy direction directly impacting medical radiation practitioners are discussed in the following section.

### Technology and innovation

The uptake of new technology and innovations was a significant driver of demand for medical radiation services. Medical radiation practice is a highly technical field, with the introduction of new technology having the potential to improve patient care while evolving the role of the medical radiation practitioner.

The uptake of new technology depends on decision-making by radiologists, who are more likely to request medical radiation practitioners use new technologies if they are publicly funded. A recent review of funding decisions for imaging tests with diagnostic, staging and screening indications considered by the Medical Services Advisory Committee between 2006 and 2021 showed that demonstrated cost-effectiveness was the largest contributor to a decision to fund these services [24]. Common concerns with rejected applications were limited or low-quality evidence, inappropriate reference standards and poor applicability to the target population.

The emergence of new technologies leads to specialisation within the medical radiation practitioner workforce, as well as creating a demand for practitioners who can operate the new technologies.[12] Examples include the use of artificial intelligence to diagnose at the point of care, hybrid imaging, and stereotactic brain and lung surgery in cancer treatment.

Future directions for medical radiation practice are reflected in research priorities identified by European radiography scientists, which include: the benefits of artificial intelligence in radiography, the safe integration of artificial intelligence into practice, the impact of new technologies, evidence-based clinical practice, radiation safety, radiation optimisation, patient outcomes in medical imaging and image interpretation [25]. The future medical radiation workforce will need to be adequately skilled and resourced to respond to the changing demands placed on it.

Within the health system, innovations such as the integration of imaging services have the potential to improve communication between service providers and reduce duplication. Integration of imaging services has been introduced in many jurisdictions. South Australian Medical Imaging, for example, provides specialist, integrated, multi-disciplinary medical imaging services to public and private inpatients, outpatients, and emergency department patients across six metropolitan and four country hospitals as well as reporting services to a further 37 country hospitals and a mobile bone density unit that visits towns in rural South Australia [26].

### Service coverage and accessibility

People living in rural and remote areas of Australia are often disadvantaged in access to primary health-care services and have higher rates of risky health behaviours such as smoking and heavy alcohol use [27]. The 2020 National Health Survey found that the number of medical radiation practitioners per 100,000 population decreased with increasing rurality. While there were 60.0 medical radiation practitioners per 100,000 in major cities of Australia, that decreased to 48.6 per 100,000 in inner regional areas, 34.4 in outer regional areas, 24.3 in remote areas, and 14.1 in very remote areas.

While the number of medical radiation practitioners per 100,000 population working in all but very remote geographic areas increased over the previous five years, the increases were smallest in outer regional and remote regions. There was a slight decrease in the number of medical radiation practitioners per 100,000 population in very remote regions. The choice of rural practice for medical radiation practitioners is 3.5 times greater in graduates who have a rural origin [28]. Specialisation is another major factor in choice of a rural career, with nuclear medicine technicians only employed in major cities or inner rural areas because that is where the main demand and equipment is, diagnostic radiography graduates are 5.5 times more likely to choose a rural career than nuclear medicine technicians and radiation therapists were 3.9 times more likely.

In 2012, geocoding of Medicare claims against departmental population statistics revealed that over 90% of Australians live within 100 km of a comprehensive diagnostic imaging facility, providing magnetic

resonance imaging (MRI), computed tomography (CT), ultrasound and diagnostic radiology [29]. Some 83% of patients lived within 10km of a CT machine and 63% of patients lived within 10km of a Medicare-eligible MRI unit. Unfortunately, this analysis has not been updated since that time.

Despite the reported availability of diagnostic imaging devices across Australia, stakeholders contributing to the horizon scan reported that rural and remote service considerations were still a major driver for the medical radiation practitioner workforce, particularly regarding access to radiation therapy [2]. The rural disadvantage is shown in the five-year survival rate for all cancers, which drops from 63% in major cities to 55% in very remote areas, and the cancer mortality rate, which increases from 151 deaths per 100,000 population in major cities to 191 deaths per 100,000 in very remote areas [22]. Cancer mortality is 1.4 times higher for Indigenous Australians than for non-Indigenous Australians. Although around half of all cancer patients could benefit from radiation therapy, only around a quarter of cancer patients use it, and use by Aboriginal and Torres Strait Islander Peoples is even lower [30-32]. While the need for rural and remote residents to travel long distances to access radiation therapy, the lack of radiation therapists and radiologists in rural areas is another important factor [31, 33]. Approaches that have been taken to improve access to radiotherapy in rural and remote areas include: locating new cancer treatment centres in rural regions, telehealth and shared care, through for example, New South Wales Health's Medical Imaging Program and the South Australian Medical Imaging Program [32, 34-37]. The Radiation Oncology Alliance has developed a document that sets out the minimum requirements for the establishment and management of radiation therapy centres in regional and rural areas, including radiation therapist staffing levels [38].

Stakeholders noted that service coverage and access were less of an issue for nuclear medicine technicians, as it is a metropolitan-based workforce. Stakeholders from the nuclear medicine profession reported that there is less demand for nuclear medicine imaging from rural and remote hospitals, where patients requiring those kinds of scans are often referred to local private practices.

**Service awareness**

The horizon scan identified service awareness as potentially increasing demand for medical radiation practitioners. Increased health literacy flowing from greater access to medical information through the internet and social media was perceived to increase health expectations, particularly regarding cancer treatment using radiation therapy.

Stakeholders also identified that the move toward more patient-centred health care, including increased demand for treatment that is closer to home, may affect demand. As outlined above, mobile clinics may help in meeting this demand, with recent research focusing on priority populations (including nursing home residents, the frail elderly, persons with substance use disorders, and people seeking asylum) showing that they are of comparable quality to hospital services [39, 40].

# Policy developments and considerations

Policy developments and considerations include revised Medicare subsidies for diagnostic imaging, the addition of diagnostic radiographers to Ahpra's COVID-19 pandemic sub-register, and changes to the higher education system.

## Revised Medicare subsidies for diagnostic imaging

Radiologists can claim Medicare subsidies for diagnostic imaging performed by medical radiation practitioners employed by them. A review of the Medical Benefits Schedule (MBS) for diagnostic imaging items in 2018 led to numerous changes to the MBS items and rules [41]. From 1 July 2020, more than 90% of diagnostic imaging services are indexed. Accredited practices are eligible for Medicare subsidies for CT scans, MRI scans, nuclear medicine scans, X-rays and sonography [42]. To be eligible for a Medicare subsidy, service providers must ensure that their equipment is up-to-date and within its expected life span (except for positron emission tomography). This is to ensure that practices regularly update and replace their equipment, so that patients have access to high-quality services.

## Changes to higher education support

In October 2021, the *Higher Education Support Amendment (Job-Ready Graduates and Supporting Regional and Remote Students) Act 2020 (JRG Act)* was passed, which legislated a decrease in funding for domestic Commonwealth-supported students, as well as other changes to higher education programs

from 1 January 2021. These changes were made following a 5.1% decline in enrolments and a 23% decline in commencements by overseas students to December 2019 compared to December 2020 due to COVID-19 travel restrictions, resulting in an estimated loss of $1.8 billion to the higher education sector [43].

Introduced on 1 January 2021, the stated intention of the reforms is to 'deliver more job-ready graduates in the disciplines and regions where they are needed most and help drive the nation's economic recovery from the COVID-19 pandemic [44]. Allied health disciplines, including medical radiation practitioners, are identified as an area of priority. The reforms reduce the Australian Government contribution for domestic students in medical radiation practice courses by $297/equivalent full-time study load (EFTSL) and decrease the student contribution by $1,748/EFTSL, representing a net decrease in course income of $2,045/EFTSL for universities [45].

The changes to higher education also include a National Priorities and Industry Linkage Fund (NPILF) that allocates block grants to universities to support better collaboration between universities and industry. This is to design courses that equip students with job-ready skills and experience through, for example, internships, practicums, and other work-based learning opportunities. A pilot of the NPILF is being conducted from 2022 to 2024, which may increase opportunities for medical radiation practice students to undergo a clinical placement.

Another change is that more university places have been made available for students from metropolitan areas to study priority area courses, including medical radiation practice, in regional areas. This funding relates to the campus location, not the location of the student. At 30 June 2022, three education providers offered courses to qualify as a diagnostic radiographer across four rural locations (Port Macquarie and Wagga Wagga, in New South Wales; Mackay in Queensland; and, Waurn Ponds in Victoria); one education provider offered courses to qualify as a radiotherapist in one rural location (Wagga Wagga, New South Wales); and, one education provider offered a course to qualify as a nuclear medicine technician in two rural locations (Port Macquarie and Wagga Wagga, New South Wales). A further campus offers courses to qualify for all three divisions in a non-capital major city (Newcastle, New South Wales).

## Concluding comments

The number of medical radiation practitioners in Australia grew by 6.0 per 100,000 population (12.2%) over the five years between 2017/18 and 2021/22. The greatest growth was seen in the Northern Territory and South Australia, with slower growth in other jurisdictions. Most of the increase was in major cities and inner regional areas of Australia, with smaller increases in outer regional and remote areas, and a slight decrease in very remote regions. According to the NSC, there was a shortage of medical radiation practitioners in the Northern Territory, but not in other jurisdictions and future demand is likely to be strong.

This review found that the number of medical radiation practice students increased by 33.6% over the same five years. The introduction of the Job Ready Graduates Package on 1 January 2021 was designed to encourage enrolment in (among other desirable subjects) allied health courses, including medical radiation practice, by substantially reducing university fees for students. It remains to be seen whether this approach will have the intended effect, given that it results in universities having less income per student to deliver the same courses with the same accreditation requirements. Encouraging new graduates to work in underserved areas is a challenge facing the profession.

There has been consistent growth in the medical radiation practitioner workforce over the last 5 years, with a moderate replacement rate; however, there may be increasing demand for Australian graduates to work overseas. Within Australia, the increasing prevalence of chronic disease (including cancer) and Australia's ageing population are likely to increase demand for medical radiation practitioners. The need for better service and referral pathways, sufficient clinical placements, more diagnostic radiographers and radiation therapists in rural and remote locations and the changing role of medical radiation technologists are challenges that face the medical radiation practice profession for the foreseeable future.

## References


1. Australian Government Department of Health Disability and Aged Care. *Factsheet Selector Dashboard*. 2020 3 August 2022]; Available from: hwd.health.gov.au/alld-dashboards/index.html.
2. Francis Health, *Medical Radiation Sciences - horizons scanning and scenario generation report*. 2018, NSW Health: Sydney, Australia. p. 47.

3. Society of Radiographers. *Radiographer reporting grows as NHS struggles with radiology staff shortages*. 2021 17 August 2022]; Available from: sor.org/news/government-nhs/radiographer-reporting-grows-as-nhs-struggles-with#:~:text=The%20report%20echoes%20the%20findings,of%2010.5%25%20in%20diagnostic%20radiographers
4. American Society of Radiologic Technologists. *Radiologic technologist staffing and workplace survey*. 2019 17 August 2022]; Available from: asrt.org/search?q=technologist%20staffing
5. Australian Health Practitioner Regulation Agency. *Internationally qualified practitioners by year, profession, gender and state from 2014/15 to 2019/20*. 2020; Available from: AHPRA.gov.au/about-AHPRA/what-we-do/statistics.aspx#previous-requests.
6. Department of Home Affairs. *BP0014 Temporary work (skilled) visas granted pivot table report*. 2022; Available from: data.gov.au/dataset/ds-dga-2515b21d-0dba-4810-afd4-ac8dd92e873e/details.
7. Tan, J., et al. *Trends in retention and attrition in nine regulated health professions in Australia*. Australian Health Review, 2025. **49**, 8.
8. Australian Bureau of Statistics, *1220.0 Australian and New Zealand Standard Classification of Occupations, 1st edition, 1st revision*. 2009, Australian Bureau of Statistics: Canberra, ACT.
9. Australian Government Jobs and Skills Australia. *2021 Employment projections for the five years to May 2026*. 2022; Available from: labourmarketinsights.gov.au/our-research/employment-projections/#4.
10. National Skills Commission. *Skills Priority List*. 2022; Available from: nationalskillscommission.gov.au/topics/skills-priority-list.
11. Department of Education Skills and Employment. *Labour market analysis of skilled occupations 2018-19*. 2018 [cited 2020 December]; Available from: jobsandskills.gov.au/.
12. NSW Health Clinical Excellence Commission. *Clinical decision support trial in NSW (2016-2018)*. 2017 5 August 2022]; Available from: cec.health.nsw.gov.au/about-the-cec/news/Clinical-Decision-Support-Trial-in-NSW-2016-2018.
13. National Prescribing Service. *Choosing Wisely Australia: eliminating unecessary tests, treatments and procedures.* 2018 5 August 2022]; Available from: choosingwisely.org.au/home
14. Yap, M.L., et al., *Actual versus optimal radiotherapy utilisation for metastatic cancer patients in the 45 and up study cohort, New South Wales.* Clinical Oncology, 2021. **33**(10): p. 650-660.
15. Sundaresan, P., et al., *Barriers to radiotherapy utilisation in New South Wales Australia: health professionals' perceptions of impacting factors.* Journal of Medical Imaging and Radiation Oncology, 2015. **59**(4): p. 535-541.
16. Australian Bureau of Statistics. *Population Projections, Australia*. 2018; Available from: abs.gov.au/statistics/people/population/population-projections-australia/latest-release.
17. Australian Bureau of Statistics. *Health Conditions and Risks*. 2022; Available from: abs.gov.au/statistics/health/health-conditions-and-risks.
18. Australian Institute of Health and Welfare, *Australian burden of disease study: impact and causes of illness and death in Australia 2018*. 2021, Australian Institute of Health and Welfare: Canberra, Australia.
19. Mahumud, R.A., et al. *The burden of chronic diseases among Australian cancer patients: evidence from a longitudinal exploration, 2007-2017*. PLoS One, 2020. **15**.
20. Australian Bureau of Statistics. *Overweight and Obesity*. 2018; Available from: abs.gov.au/statistics/health/health-conditions-and-risks/overweight-and-obesity/latest-release.
21. Hakkak, R. and A. Bell, *Obesity and the link to chronic disease development.* Journal of Obesity and Chronic Disease, 2016. **1**(1): p. 1-3.
22. Australian Institute of Health and Welfare, *Cancer in Australia 2021*. 2021, Australian Institute of Health and Welfare: Canberra, Australia. p. 172.
23. Ackerman, S.E., et al., *Insights into the link between obesity and cancer.* Current Obesity Reports, 2017. **6**(2): p. 195-203.
24. Hill, H., R. Mittal, and T. Merlin, *Evidence-based funding of new imaging applications and technologies by Medicare in Australia: how it happens and how it can be improved.* Journal of Medical Imaging and Radiation Oncology, 2022. **66**: p. 215-224.
25. Törnroos, S., et al., *Identification of research priorities of radiography science: a modified Delphi study in Europe.* Nursing and Health Sciences, 2022. **24**(2): p. 423-436.
26. SA Health. *South Australian Medical Imaging*. 6 August 2022]; Available from: sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/services/dental+diagnostic+and+pharmacy+services/sa+medical+imaging/south+australia++medical+imaging#:~:text=South%20Australia%20Medical%20Imaging%20(SAMI,4%20country%20South%20Australian%20hospitals.

27. Australian Institute of Health and Welfare. *Australia's Health 2020: in brief*. 2020; Available from: aihw.gov.au/reports/australias-health/australias-health-2020-in-brief/summary.
28. Farrugia, L., T. Smith, and J. Depczynski, *Factors influencing medical radiation science graduates' early career principal place of practice: a retrospective cohort study.* Journal of Medical Radiation Sciences, 2021. **69**: p. 182-190.
29. Australan Government Department of Health and Ageing, *Inquiry into the development of Northern Australia: review of funding for diagnostic imaging services: final report*. 2012, Department of Health and Ageing: Canberra, Australia.
30. Barton, M.B., et al., *Estimating the demand for radiotherapy from the evidence: a review of changes from 2003 to 2012.* Asia-Pacific Journal of Clinical Oncology, 2013. **112**(1): p. 140-144.
31. Gabriel, G., M. Barton, and G.P. Delaney, *The effect of travel distance on radiotherapy utilization in NSW and ACT.* Radiotherapy and Oncology, 2015. **117**(2): p. 386-389.
32. Lyford, M., et al. *An exploration of underrepresentation of Aboriginal cancer patients attending a regional radiotherapy service in Western Australia*. International Journal of Environmental Research and Public Health, 2018. **15**.
33. Smith, T., *A long way from home: access to cacner care for rural Australians.* Radiography, 2012. **18**(1): p. 38-42.
34. Thaker, D.A., et al., *Cost savings from a telemedicine model of care in northern Aueensland, Australia.* Medical Journal of Australia, 2013. **199**(6): p. 414-417.
35. Hamilton, E., et al., *Telehealth in radiation oncology at the Townsville Cacner Centre: service evaluation and patient satisfaction.* Clincial and Translational Radiation Oncology, 2019. **15**: p. 20-25.
36. Sharma, D.K., V.N. Vangaveti, and S. Larkins, *Geographical access to radiation therapy in North Queensland: a retrospective analysis of patient travel to radiation therapy before and after the opening of an additional radiotherapy centre.* Rural and Remote Health, 2016. **16**(1): p. 1-10.
37. Butler, S.M., *Changes to radiotherapy utilisation in Western NSW after the opening of a local service.* Journal of Medical Radiation Sciences, 2017. **64**(4): p. 251-258.
38. The Royal Australian and New Zealand College of Radiologists, *Establishing and sustaining regional and rural radiation therapy centres (version 2)*. 2020, The Royal Australian and New Zealand College of Radiologists: Sydney, Australia. p. 45.
39. Toppenberg, M.D., et al. *Mobile X-ray outside the hospital: a scoping review*. BMC Health Services Research, 2020. **20**.
40. Evans, K., et al., *An innovative approach to enhancing access to medical screening for miners using a mobile clinic with telemedicine capability.* Journal of Health Care for the Poor and Underserved, 2016. **27**(4 Supp.): p. 62-72.
41. Medicare Benefits Schedule Review Taskforce, *Final Report from the Diagnostic Imaging Clinical Subcommittee*. 2018, Department of Health and Aged Care: Canberra, Australia. p. 232.
42. Department of Health and Aged Care. *What we're doing about diagnostic imaging*. 2022 12 August 2022]; Available from: health.gov.au/health-topics/diagnostic-imaging/what-were-doing-about-diagnostic-imaging.
43. Universities Australia. *Media Release – 17,000 Uni Jobs Lost to COVID-19*. 2021; Available from: universitiesaustralia.edu.au/media-item/17000-uni-jobs-lost-to-covid-19/.
44. Australian Government Department of Education, *Job-ready Graduates Package*. 2021, Australian Government Department of Education: Canberra, ACT.
45. Universities Australia, *2020 Higher Education Facts and Figures*. 2020, Universities Australia: Canberra, ACT.