Radiology and Te Whatu Ora – Health New Zealand in 2022. Why we should all care

Anthony James Doyle

ABSTRACT

Radiology is a key enabler of clinical activity and has been shown to be highly cost effective. Demand and activity have increased over time, with demand for computed tomography (CT), magnetic resource imaging (MRI) and ultrasound (US) growing faster than population growth. Complexity has also increased over time. Resources in the public sector have not kept up with demand, exacerbated by the COVID-19 pandemic. A reliance on an overseas trained workforce has resulted in critical shortages. Waiting times for CT, MRI and US across Aotearoa New Zealand remain well below targets and have not improved over 10 years. Robust links between clinical activity and radiology resourcing are needed to address the deficits and thereby maintain clinical safety.

Generally speaking, patients and clinicians in the public health service in Aotearoa New Zealand are fortunate in having reasonably ready access to a wide range of medical imaging, from basic radiographs through mammography, ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), Nuclear Medicine, Interventional Radiology (IR) and other modalities. This access is vital for many clinical activities, including:

1. Confirming the presence of a clinically suspected condition.
2. Excluding a condition clinically thought unlikely to be present.
3. Monitoring response to treatment.
4. Performing surveillance for disease recurrence, complications of treatment, or ensuring stability of a process presumed to be benign.
5. Screening an asymptomatic population for clinically occult disease.
6. Treatment of an increasing range of conditions in a minimally invasive manner.

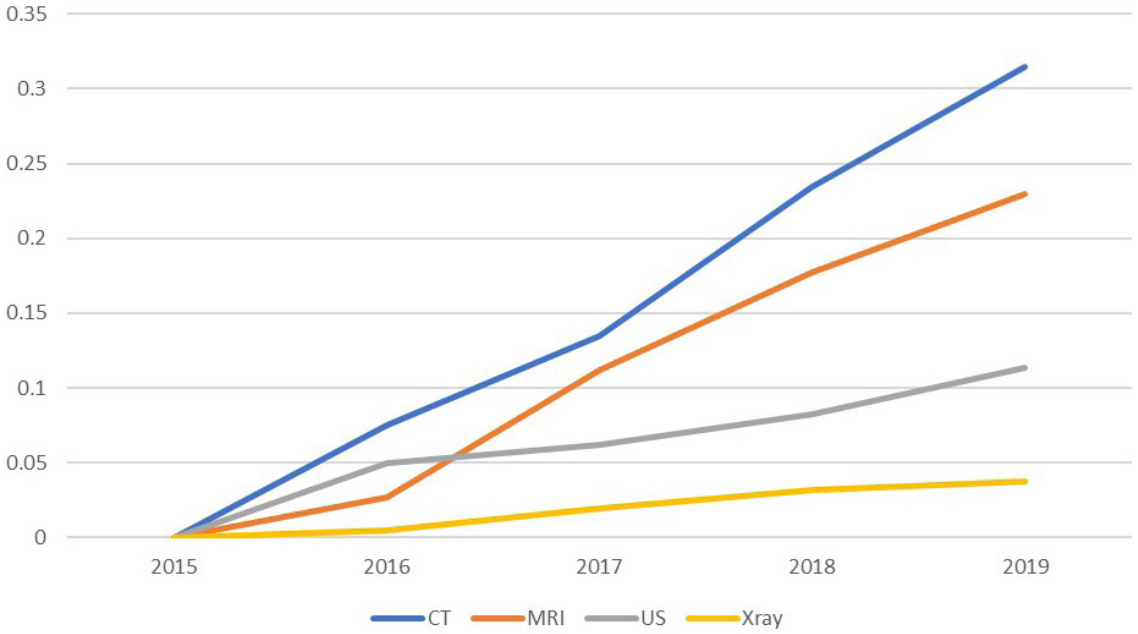
Demand for radiology in the public system continues to increase and, in recent years, has exceeded both population growth and the ability of the existing services to cope with that demand. The following figure illustrates the relative growth in radiology activity within the public system from 2015–2019.[1] (The data on which this figure is based, along with other data relating to public radiology services in this article, are in the public domain and were gathered by the author through personal communication with public radiology departments during the course of the author's work as national clinical leader in radiology with the Ministry of Health from January 2020 to the present time.)

These trendlines indicate that, for example, activity for CT will double in fewer than ten years. The public health system is not currently prepared for this increase; in fact, it has not kept up with demand for a long time. Regular reports submitted to the Ministry of Health since 2013 show that the waiting time targets for outpatient CT and MRI have never been met and that the gaps between the achieved times and the targets (15% for CT and 25% for MRI) have not changed.[2] Ultrasound has not grown at the same rate but recent data show that waitlists for US have also burgeoned, partly because of the effect of the COVID-19 pandemic (see below). This article aims to summarise the current situation and to provide a framework for addressing anticipated future needs.

Why so much growth?

Modern medicine, appropriately, is reliant on diagnostic tests to facilitate early, accurate and efficient diagnosis. MRI, since its first use for brain imaging in the 1980s, has become standard for the evaluation of spine, joints, biliary tract, complex gynaecological conditions and much else.

Figure 1: Volume increase relative to 2015 by modality.



CT—after being partly supplanted by MRI—has undergone a massive and continuing resurgence because of its powerful ability to evaluate trauma and cardiovascular disease rapidly and comprehensively, in addition to its previous role in chest, abdominal and skeletal imaging. It is also now a first-line tool for stroke management. CT scanners continue to get faster, use lower radiation doses and offer more in terms of tissue analysis, all pointing to further increase in use and usefulness. Radiology activity growth closely follows clinical activity growth, a phenomenon that has also been documented elsewhere.[3]

The personal and population health benefits of early detection and diagnosis for entities such as cancer are intuitively obvious, but the economic gains can also be quantitated: a recent Lancet Commission calculated a benefit of $179 for every $1 spent on imaging of 11 common cancers worldwide.[4] Although this magnitude of cost/benefit ratio is unlikely to be achieved in Aotearoa, there is little doubt of the highly positive societal and economic value of appropriately utilised diagnostic imaging.

The effect of COVID-19

One feature of radiology that was highlighted early on in the pandemic is that it necessitates hands-on personal contact. Whatever the possibilities of telehealth may be elsewhere, every X-ray, mammogram, CT, MRI or US involves the patient attending the radiology facility and a staff member positioning them for imaging or, in the case of US, being in close contact in the same room for up to 30 minutes.[5] This is a significant infection risk for the staff (even using protective equipment) and has only recently been ameliorated by vaccination. The strain has particularly been felt by sonographers in centres where infection rates have been high.

The first lockdown in 2020 led to severe curtailment of radiology activity for a long period, with subsequent backlogs that have yet to be fully addressed, and which have been exacerbated by the more recent Delta and Omicron outbreaks. At the time of writing, there are waiting lists for MRI and US amounting to over 30,000 and 40,000 hours, respectively, of technologist working time, with only slightly smaller waiting lists for CT and X-ray. The inevitable delays in, for example, mammographic screenings have received local public attention and are the subject of ongoing investigations here and overseas. [6,7]

Workforce

As mentioned above, every radiology examination involves hands-on work by a medical imaging technologist (MIT), MRI technologist, Nuclear Medicine technologist or sonographer. The public system has roughly 1,000 MITs, 200 MRI technolo-

gists and 220 sonographers. Even before COVID-19, the numbers of MRI technologists and sonographers were estimated to be 20–25% lower than needed. Local training programmes have never completely met needs and the workforce has always been supplemented by overseas trainees. For sonographers this has been pronounced; over the last two decades, two-thirds of the roughly 70 new sonographer licences issued annually by the Medical Radiation Technologist Board (MRTB) have been to overseas graduates, but that supply has been severely curtailed.[8] Added to the prolonged close patient contact and demanding physical nature involved in sonography, this has led to a critical shortage of sonographers.

Currently, there are four tertiary providers of MIT qualifications, but only one provider for postgraduate diplomas in US, MRI and nuclear medicine. Although these diplomas are open to graduates other than MITs, the vast majority of diploma students have MIT qualifications. All of these qualifications require clinical placements, most of which are in public hospitals. Some (but not all) private practices provide training for MITs and postgraduate students. Finding clinical placements is the principal constraint on increasing training numbers at present.

The specialist radiologist workforce in the public service includes just over 200 full-time equivalent (FTE) senior medical officers (SMO; 320 individuals, most of whom split their time between public and private) and 100 resident medical officers (RMO). The five-year RMO training programme results in an output of just under 20 SMOs per year, the withdrawal rate being extremely low. Approximately two-thirds of SMOs are locally trained, but the numbers are marginally sufficient at best and will need considerable increases over the next decade or two to cope with increasing demand. Predictions based on a robust mathematical model suggest that the number of locally trained SMO radiologists produced per year needs to more than double in order to keep up with projected demand in 5–10 years' time.[9] Almost all RMO training is provided in the public sector, with very small components in private. On top of the increased examination numbers, CT and MRI scanners keep getting faster and producing not just many more images per examination, but more complex information such as tissue decomposition and dynamic information. This has resulted in added complexity of interpretation contributing to workforce strain and the risk of "burnout", which is a global concern.[10, 11]

For the MIT, sonographer and radiologist workforce, there is good evidence that training local graduates is the most productive solution long term. For example, radiologist SMOs who are New Zealand medical school graduates and have undergone local postgraduate training have an 80% retention rate at five years post-completion, as opposed to less than 50% retention for overseas medical school graduates. Similar considerations apply to the rest of the workforce.

Facilities

New Zealand sits around the middle of the OECD when it comes to the numbers of CT and MRI facilities per head of population (although these numbers are unreliable for many reasons).[12] The public system runs 45 CT scanners and 30 MRI scanners, while the private system operates 25 CT and 50 MRI as well as 6 PET CT scanners. The high number of MRI machines in private partly reflects the amount of this work funded by ACC and private insurers, as well as the relatively high proportion of outpatients in MRI work. Hundreds of US and X-ray machines make up the remainder. The workforce for all these facilities is mostly trained in the public system or comes from overseas, with some MIT, sonographer and MRI technologist training in private.

Many public facilities rely on a single CT or MRI scanner, creating vulnerability when these either fail or are being upgraded. Although the private sector provides invaluable backup in some areas, this is not universal. Aotearoa does not have any mobile CT or MRI (or even US) units to supplement the fixed facilities. Although inadequate roading infrastructure has been raised as a possible barrier to mobile units, improvements in both the road network and the types of vehicles available have mostly solved this issue. The existing mobile operating theatres and lithotripsy service are good models. The facility shortfall here reflects the position in other jurisdictions. A recent review of the NHS in the United Kingdom recommended that "*CT scanning capacity should be expanded by 100% over the next five years*", along with increases in MRI, US and others.[13]

Managing, driving and interconnecting these facilities are information technology (IT) systems. These are, unfortunately, highly heterogeneous in terms of performance, scope, specification and age. Many are barely fit for purpose and are difficult for staff to use properly.

Clinical impact

A high proportion of clinical activity in Aotearoa involves radiology one way or another. Best estimates are that patients have radiology examinations as part of their healthcare journey in 40% of emergency department encounters, 70% as an inpatient and around 50% over time during care as an outpatient or in the community.[14] In many instances, radiology is indispensable for diagnosis and treatment planning; suspected spinal cord compression, bowel obstruction or a simple undisplaced fracture are among hundreds of examples. Lack of or delayed access to these examinations can result in severely adverse consequences, not just clinical frustration. The long-term personal, social and economic effects of an overlooked fetal anomaly or a stroke that could have been reversed with early treatment are enormous.

Appropriate use of diagnostic imaging can sometimes be a challenge for clinicians. There may be situations in which the suitability is not clear, or where imaging might seem to be useful but in actuality adds little value to immediate management. Most public facilities engage in vetting and prioritisation of radiology requests to some degree, often in collaboration with clinicians, but the concept of this as a "gatekeeping" role is seriously outmoded. Overall, somewhere between 90–95% of requested imaging ends up being performed one way or another. This means that engagement in and refinement of appropriate clinical pathways by clinicians and radiology facilities is vital for ensuring that the use of imaging is optimised.

Funding

The funding of public radiology in New Zealand is too complex, inconsistent and illogical to encompass in this article. Suffice it to say that, although demand for radiology services is almost entirely driven by clinical activity, there is no linkage between that demand and the funding for increased services in most areas. This inevitably leads to multiple instances in which demand exceeds capacity without the funding resources to increase capacity in terms of workforce or facility. An example is Section 88, the legislation covering maternal US; the remuneration per examination provided under this has not changed in 20 years.

Funding for training is, similarly, highly variable and, importantly, is neither ring-fenced nor linked to realistic need. It is hoped that the funding structures will become more coherent and appropriate under Te Whatu Ora and Te Aka Whai Ora. The recent announcement by the Minister of Health regarding increased radiology trainee numbers under Te Whatu Ora is a step in the right direction.

Private sector role

The private sector plays a significant role in servicing public radiology demands, particularly for elective imaging. Considerable volumes of CT and MRI are outsourced to private providers, along with smaller volumes of US and reporting. Although there are no comprehensive figures available, the overall rate of outsourcing over the last decade has made up a small fraction of total public radiology activity, except in some smaller districts where, for example, all MRI or CT is contracted to the private sector. Outsourcing has recently been increased as a deliberate strategy to offset the effects of the COVID-19 pandemic, but the private sector also has finite capacity. Teleradiology services worldwide are, essentially, at capacity.

All PET/CT in Aotearoa New Zealand is performed in private, since the public system has not yet acquired this modality. Many maternity US, including for pregnancies handled by public lead maternity providers, are performed in private. However, as indicated above, the remuneration for this has fallen behind and there is a high risk of private providers exiting this service, with no public capacity to compensate for that.

Summary

Public radiology in Aotearoa provides a high-quality service for patients and clinicians but is marginally sustainable, even without the effects of the COVID-19 pandemic.

Recommendations and next steps

Workforce

Local training must be increased, particularly for sonographers, MRI technologists and radiologists. Increasing clinical placements in public and private and encouraging non-MIT graduates to train in US or MRI are priorities. RMO numbers and private sector RMO training need to increase significantly. The "train to retain" principle should be followed.

Facilities

CT capacity needs to double over the next 5–10 years, with smaller increases in MRI and US. Mobile units should be set up to supplement fixed sites and improve equity of access.

IT systems need to be upgraded and to have improved connectivity. There is a realistic prospect of this being accomplished within Te Whatu Ora, although it will take time.

Funding

Equitable funding of publicly provided radiology services, independent of geography and demographic, needs to be achieved. A more coherent, consistent and equitable national approach is needed for the funding of workforce, facilities and training. A national pricing model for contracting outsourcing is being worked on and needs to be agreed.

Clinical activity

There need to be robust links to ensure that any increase in clinical activity is accompanied by matching increases in radiology resources. Collaborative development of clinical pathways should continue, in order to foster appropriate use of imaging.

COMPETING INTERESTS
Nil.

CORRESPONDING AUTHOR INFORMATION
Anthony James Doyle: Consultant Radiologist, Auckland District Health Board; Associate Professor, Anatomy and Medical Imaging, Faculty of Medical and Health Sciences, The University of Auckland, Grafton, Auckland, 1023 New Zealand.
E: adoyle@adhb.govt.nz

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