

Post-COVID19 “New Normal” for Nuclear Medicine Practice: An Australasian Perspective

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Compliance with ethical standards

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Abstract

The COVID19 pandemic has redefined the way nuclear medicine is practiced. The threat from COVID19 to health and to the nuclear medicine community is rapidly changing. During the acute phase of COVID19, there were significant direct and indirect impacts on nuclear medicine practice that have been previously detailed (1,2). It is useful to consider how COVID19 will shape nuclear medicine practice as we re-emerge from the acute phase (first wave) and prepare for both the second wave and practice after the COVID19 crisis. With the impact and the Government responses varying across the globe, there is some value in gleaning a global perspective. Here, a perspective from an Australian and New Zealand context is provided.

COVID19 Impact

It is important to contextualize COVID19 in Australia. Australia is a large country with a small population that is geographically sparse and dispersed. The land area is 79% of that of the USA yet the Australian population is only 7.5% of that of the USA. This produces a 12 times lower population density than the USA. Furthermore, Australia is geographically isolated in the southern hemisphere with no land borders with other countries.

In Australia, at the time of writing (late May), there had only been 7080 COVID19 cases and 100 deaths (3). Government lockdowns and restrictions significantly flattened the curve. Nationally, the economic implications of COVID19 restrictions have been significant with the dollar falling against international currencies, 70% of businesses suffering loss and 10% unemployment despite Government investment of the equivalent of 16% of GDP in measures to preserve jobs and the economy.

New Zealand is also a geographically isolated island nation with a sparsely dispersed population of just 5 million people. Rapid border lockdown and Government restrictions saw only 1500 COVID19 cases, 21 deaths with only 28 active cases nationally at the time of writing (4). Approximately 15% of the New Zealand population live in Australia.

Acute Impact on Practice

Across Australia and New Zealand (ANZ), widespread lockdown was imposed to limit the spread of COVID19. Only essential travel was permitted, public gatherings banned and borders were closed. Staff who could work at home, were required to do so. These restrictions reduced access to and demand for nuclear medicine services. Furthermore, strategies aimed at urgent / acute only services in many departments, with cancellation of elective studies, compounded the reduction in nuclear medicine services. Centralized pharmacies reported 30% reduction in dose demand generally and 50% in larger centers. Referrals for nuclear medicine services had significantly reduced in the order of 50-90%. With several exceptions associated with radionuclide or patient transport issues, positron emission tomography (PET) services were largely unaffected because the studies were not viewed as being elective.

First Wave Recovery

The challenge moving forward is to re-emerge with nuclear medicine operations while being cognizant of potential for patients to be COVID19 positive or present with flu-like symptoms that may or may not be COVID19. Balancing protection of vulnerable patients (and staff) while exploring the role nuclear medicine plays in COVID19 and improving patient outcomes is essential (5). Nuclear medicine is uniquely positioned to adapt to COVID19 recovery with some commonality between the already implemented radiation safety procedures and those now required for biological risk (1,6). By late May 2020 as Government restrictions were eased, reports from rural nuclear medicine departments suggest patient numbers had returned to near normal and, in some cases, with higher referral patterns than prior to COVID19. Indeed, some rural sites where there were no or few COVID19 cases, less than a 10% reduction to patient numbers was reported. A cluster of sites that reduced staff hours by 70% in the acute phase have now scaled back up to 80% of normal operation. Some major teaching hospitals with no changes to PET numbers crashed to 50% of general nuclear medicine load and report in late May numbers returning to 80% of normal. Rural and regional nuclear medicine departments have reported a particularly strong and early recovery of patient numbers compared to metropolitan centers which reflects very low penetration of COVID19 cases into regional and rural areas.

Generally speaking, the recovery from the first wave, and indeed navigation through the first wave, has been reactive in nature. There have been significant amounts of effort developing guidelines, albeit as a scramble to adjust, from Society of Nuclear Medicine and Molecular Imaging (SNMMI), International Atomic Energy Agency (IAEA) and other nuclear medicine organizations outside of ANZ that are being used to guide practice during this challenging time. These actions and reactions generally reflect the same responses to COVID19 in the community and across other business structures; reducing risk to staff and patients, and increasing access to services without compromising safety. Notable strategies have included, without being limited to patient triage and screening, hygiene signage and sanitization, social distancing measures, education, changes in workflow, personal protective equipment (PPE), pharmacologic stress only and contactless / paperless service. Reactive solutions may provide some superficial protection but need to be carefully considered in terms of actual risk / benefit to convolve forward thinking and sustainable proactive solutions in the post-COVID19 era. While time did not afford this opportunity for the acute stages and first wave of COVID19, flattening of the curve provides a window to more purposefully assess strategies to navigate the second wave and prepare for the “new normal” that awaits in the post-COVID19 period.

One of the more unique issues in Australia has been associated with high risk patients amongst Indigenous communities. In remote Indigenous communities, Western Australia and Northern Territory particularly, special biosecurity zones were established which essentially prevented movement in or out of these communities. When requests are received from one of these communities, specific more rigorous biosecurity protocols need to be adopted to eliminate contamination risk and allow that person to re-enter their community. This fosters a richer multi-disciplinary team and higher degree of communication. A similar increase in local biosecurity levels for specific patients is also reported in communities with military bases that house recently deployed personnel.

Preparing for the Second Wave and Post COVID19 Practice

COVID19 has produced a number of challenges in ANZ that require careful planning and intervention as we re-emerge. With borders closed and flights grounded ANZ nuclear medicine is vulnerable to radionuclide shortages. A number of radionuclides or radiopharmaceuticals are imported (eg. ^{67}Ga gallium, ^{201}Tl thallium) and transport barriers have created supply issues. Alternative imaging options have been explored and adopted nationally where possible (eg. substitution of $^{99\text{m}}\text{Tc}$ technetium radiopharmaceuticals for ^{201}Tl thallium) or PET procedures have been substituted for unavailable general nuclear medicine radionuclides. There has been a pressing need for the professional bodies in ANZ (Rural Alliance in Nuclear Scintigraphy [RAINS], Australian and New Zealand Society of Nuclear medicine [ANZSNM] and Australasian Association of Nuclear Medicine Specialists [AANMS]) to work with state and federal government departments to convolve solutions for COVID19 related problems. For example, ^{123}I / ^{131}I iodine metaiodobenzylguanidine (mIBG) is supplied from Japan for pediatric neuroblastoma patients and this required Government charter of specific flights on a 3-week cycle to meet domestic requirements. There have also been some limitations associated with cold kit importation that has seen the professional bodies working with regulators to provide temporary approval of alternative suppliers.

The lack of demand for passenger flights produces a significant reduction in freight movements and increase in competition for cargo space. Returning to normal flight patterns may not occur for several years and these kinds of challenges will become the “new normal”. This leaves ANZ nuclear medicine vulnerable in periods where domestic supply of $^{99\text{m}}\text{Tc}$ technetium is compromised (eg. scheduled or unscheduled maintenance). It is also not uncommon for radionuclides to be autonomously offloaded with the weight converting to a larger volume of less urgent cargo (eg. mail); despite being marked as medically urgent. The professional bodies have worked closely with the federal government, airlines and aviation regulator to ensure items marked as medically urgent are prioritized. Unfortunately, at the time of writing a number of routes continue to experience radionuclide offloads that, under pre-COVID conditions would have seen a 1-2 hour delay in delivery but now produces 24 hour delays for deliveries. Delivery

of 18 fluorine fluorodeoxyglucose (FDG) from Melbourne into Tasmania had encountered these types of delays and resulted in departments collectively chartering flights for delivery. At the time of writing, 67 gallium deliveries from Sydney to Brisbane were suffering offloads in consecutive weeks without explanation and road freight from Sydney to Brisbane (900km) had emerged as a more reliable option where half-life permits. Furthermore, the federal government and airlines worked with the professional bodies to open extra government funded commercial flights to increase options for radionuclides, fly in staff and fly in patients; particularly in rural and remote Australia. By way of example, PET in Darwin receives daily 18F FDG supplied via air from Adelaide (3000km south) but flight reductions during COVID19 required the professional bodies to work with the government and airlines to get additional flights to supply Darwin from Brisbane instead. Similarly, additional contracts and routes have been negotiated with road freight companies to overcome shortages in air freight options. Despite these efforts, during the acute phase and continuing through the second wave and recovery phases, widespread delays in deliveries and increased costs have become the “new normal” and this demands attention to patient scheduling (eg. for some rural and regional sites, weekly 99m technetium generators arrive a day or more after expected). Additionally, rural and remote sites that rely on fly-in staff for nuclear medicine services and patients flying into hubs from remote locations remain confronted by scheduling delays and challenges. For example, in remote Western Australia the nuclear medicine technologists made arrangements to fly into the remote site of Kalgoorlie but are required to then drive back to Perth (6.5 hours) due to unavailable flights.

Largely research and clinical trial recruitment had come to a stop due to COVID19. Emerging from the first wave, strategies are being implemented to safely recommence research and patient recruitment. Many of the additional precautions are shared with those for nuclear medicine generally outlined below. Multidisciplinary meetings, continuing professional development and conferences have largely been moved to virtual platforms which, in some cases, provides greater flexibility, engagement and opportunity. The annual scientific meeting of the ANZSNM was cancelled due to COVID19 and has recently been re-engineered into a series of Zoom based seminars for a reduced fee. RAINS teamed up with Siemens Healthineers to create a series of 6

Zoom based seminars offered free to members and this followed the success of 2 previous free Zoom seminars for members during the acute phase of COVID19. RAINS has also teamed up with GE Healthcare and Cyclomedica to produce a Zoom based conference in November; offering an exceptionally rich international program via flexible online delivery. While networking face to face is a valuable aspect of professional conferences, online meetings and conferences will become part of the “new normal” post COVID19 and in doing so, create more flexible options, greater sustainability and networking opportunities that are independent of geography or funding.

The other significant discussion point in Australia is the global concerns that ventilation lung scanning poses a risk to patients and staff as a result of COVID19 and contamination issues. Reactive approaches during the acute phase saw lung scan patients shunted to computed tomography pulmonary angiography (CTPA). It is inadequate longer term to overlook the advantages of the lung scan over CTPA; particularly the radiation dose to the patient and the exceptional positive and negative predictive values. Technegas is in widespread use in Australia and offers a number of clear advantages over aerosols in the COVID19 patient. Technegas reduces the time for performing the ventilation and improves compliance which decreases the risk of room and staff contamination. The patient administration sets are single use, self-contained and without recirculation, eliminating risk between patients. The “new normal” should emphasize the value of the lung scan. Perfusion first protocols and ventilation in separate physical spaces may be part of the mix of modified protocols in the future.

Guidelines from IAEA, SNMMI, departments across the globe and the experiences in responding to the acute first wave of COVID19 afford the opportunity to refine protocols and procedure in a more proactive evidence-based manner. It should be recognized that some protocols or procedures will, or should, be common across all nuclear medicine departments while other strategies are responsive to the unique requirements of individual departments. This will be driven by patient characteristics, political and social characteristics at national and regional levels, and the specific department structure and function. Where possible and where

appropriate for a given department, the following measures have been adopted in some ANZ departments to ensure a nuclear medicine department assimilates into the “new normal” associated with the post-COVID era (figure 1):

1. Triage. Some departments have started contacting patients prior to arriving for their appointments to complete a verbal questionnaire to establish risk. Upon entry to the department, no contact temperature monitoring has been added as standard practice at some sites.
2. Hygiene. Hand sanitizer stations are widely available outside entries to departments, in the waiting room and nearby to all high touch surfaces. Frequent sanitizing of all surfaces, sanitizing of equipment between patients, new bed linen between patients (although some sites have removed all bed linen and clean down the equipment between each patient) (figure 2 and 3), and increased frequency of contract cleaners have all emerged as standard practice in some departments.
3. Waiting room. Seating has been largely minimized and separated appropriately, clear signage for hygiene and hand sanitizing is mostly available, reading material and toys have been removed, and some sites only allow the patient to be admitted (figure 4 and 5). Departments typically remove water facilities and request patients to bring their own water bottles.
4. Signage. Patients and staff in some sites now have access to clear and visual rich infographics that provide immediate direction associated with sanitation stations or requirements, hand wash procedures, and barriers between zones. Color coded floor markings have been used to ensure patients do not accidentally enter staff zones, and to provide social distancing markers (figure 5). Various methods to mark appropriate distance between patients and reception staff have been used including barrier protection, floor markings and spacers (eg. a physical object restricting how close a patient can get to the counter).
5. Paperless. No contact patient registration, electronic referrals and electronic billing has become commonplace.

6. Barrier protection. Where appropriate and possible (eg. between patients and reception), clear barriers have been used to protect staff (figure 4 and 5). The availability of PPE for all staff as required is now standard practice. Unlike many sites in the USA, scrubs are uncommon in Australian nuclear medicine. Some sites have introduced scrubs with staff changing into scrubs at work and out of scrubs before leaving.
7. Zones. Nuclear medicine is familiar with hot (radioactive) and cold zones in department design and designating zones within a department that are low risk helps to protect staff and patients. Color coding zones in some departments have helped provide visual barriers to aid compliance but consideration needs to be given to visually impaired and color blind staff and patients.
8. Education. Many departments have required all staff to undergo credentialing in infection control and, unique to nuclear medicine, the application of radiation safety principles (eg. time, distance and shielding) provide a solid foundation for infection control.
9. Re-engineer. Most departments have evaluated and modified workflow, patient flow and physical spaces to optimize hygiene and infection control. This includes physical design principles associated with air flow and ventilation, contactless opening of doors, contactless water faucet, push release cupboards and other mechanisms to minimize contact of surfaces. Corridors should be free from clutter and equipment, and not used for patient waiting areas (eg. trolley patient) and these established requirements are now being enforced more rigorously to improve social distancing.
10. Limitation. Numerous objects in the nuclear medicine department are mobile (eg. pens) while others are shared high touch objects (eg. keyboard, mouse, camera controller). Departments have implemented practices to minimize mobility of objects to ensure objects to not move between low risk and higher risk zones. Shared objects tend to be frequently sanitized and, if possible (eg. camera controller), be sealed inside clear plastic (eg. zip lock bag).
11. Response planning. Proactively many departments are now preparing procedures and operational manuals to rapidly respond to an infection outbreak, including clear guidelines for managing scheduling / triage, staff and patients.

12. Staff care. The new normal demands regular communication with staff and close attention to the mental health and wellbeing of the workforce. There have been requirements for some departments to redefine job functions to accommodate higher risk staff. In some cases, more staff may be required to deliver the same productivity due to increased time constraints of the precautions outlined above. In some sites, all staff are temperature checked at the start of each day.
13. COVID kits. Nuclear medicine departments are familiar with the need for a radiation spill kit. Introduction of a COVID kit allows a single “bucket” to include all PPE and other items required for a department to manage a COVID19 positive patient. This circumvents essential items of PPE being unavailable when needed and suits departments that are not routinely imaging COVID19 patients. One site reported storing the COVID kit in MRI because it was the most secure location and less likely to be misappropriated (in part or in full).

Conclusion

In the context of ANZ and our responsiveness to the COVID19 crisis, consideration should be given to the interplay associated with the resilience and crisis management skills developed during the multiple 99Mo crises of 2018 and 2019. Particularly with regard to adaptability and responsiveness of individual nuclear medicine departments and the professional bodies, the lessons and connections to resolve issues, including at Government level, were well established. This has enhanced our collective responsiveness to the acute phase of the COVID19 crisis, provided a degree of insulation to more dire circumstances, and armed the professional community with the resilience and nous to implement sustainable practices as we emerge into what will become our “new normal”.

What is unknown at the time of writing was whether post COVID19, life and nuclear medicine practice will return to normal, or, more likely, that COVID19 will define a “new normal” adopted as best practice moving forward. The “new normal” may comprise all, a sub-set of these changes or, indeed, other strategies yet to be convolved. For some nuclear medicine departments, the

“new normal” is exactly the same as the pre-COVID19 normal with the exception of the requirement for caution and cleaning if a COVID19 positive patient were encountered; in many sites, particularly rural areas, no COVID19 patients have been encountered. The ANZ perspective may provide a helpful perspective for the global community.

Acknowledgement

RAINS is the largest professional membership of nuclear medicine technologists in Australia / New Zealand and I wish to recognize the leadership RAINS has provided during the COVID19 crisis and the preceding 99Mo crises. I especially want to thank RAINS members from across Australia and New Zealand for their resilience during this crisis and generosity in sharing their data, experiences and insights for the benefit of national and global colleagues. I would also like to thank PRP Imaging and Queensland Xray for the use of images from their departments.

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Figure 1: Schematic summary of the interplay between strategies for the “new normal” associated with the post-COVID19 era.

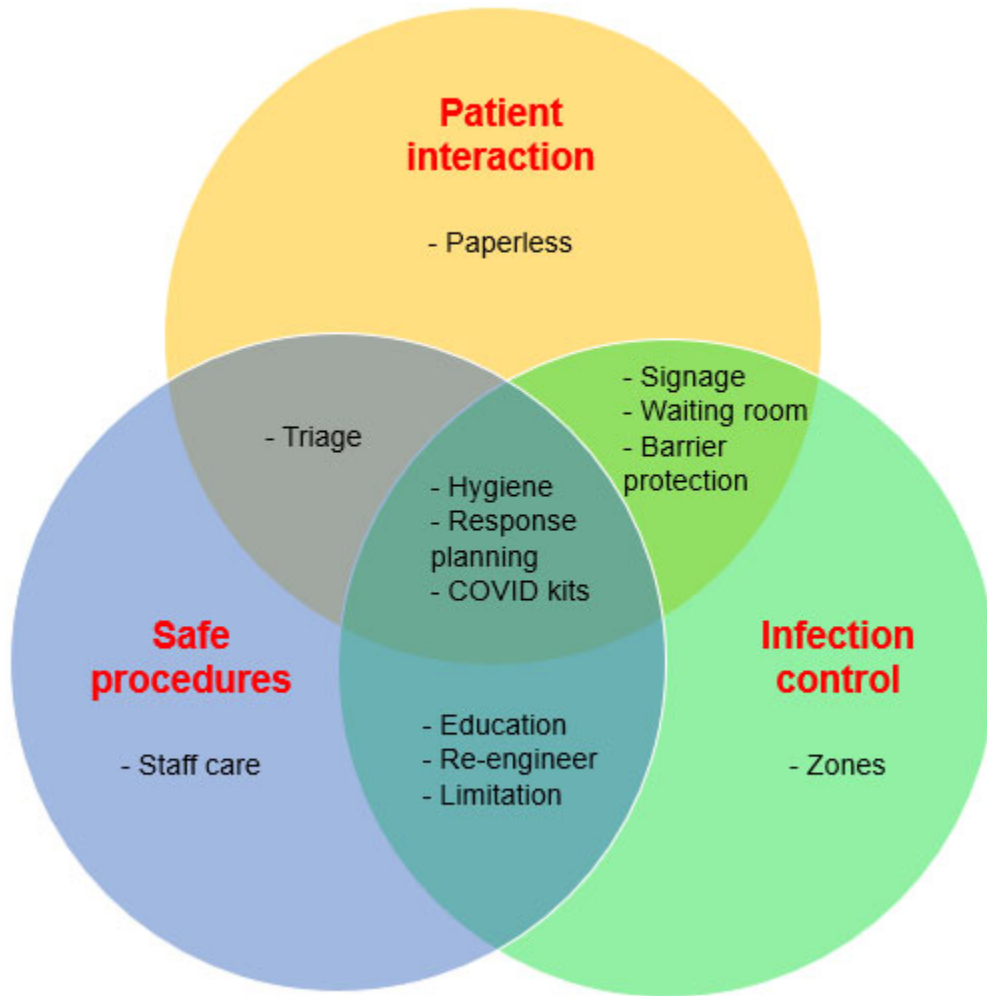


Figure 2: “New normal” for a gamma camera suite with removal of linen and replacement with single use paper roll. The room is de-cluttered for decreased risk and easy cleaning between patients. Image with permission and courtesy of Queensland Xray.



Figure 3: “New normal” for a nuclear medicine injection room with absence of linen (replaced by single use paper roll), decluttered environment and readily sanitized sealed surfaces. Image with permission and courtesy of Queensland Xray.



Figure 4: “New normal” design for a department reception with clear signage providing both instruction and explanation. Readily available hand sanitizer, barrier protection for reception staff, paperless registration (but chained pen to prevent relocation), absence of brochures and non-absorbent easily sanitized surfaces are other key features. Image with permission and courtesy of PRP Imaging.



Figure 5: “New normal” design for a patient waiting room and reception with sparse seating in a well-ventilated expansive space. Social distancing floor markers, readily available hand sanitizer stations, barrier protection for reception staff, paperless registration, absence of brochures and other reading material, and non-absorbent easily sanitized surfaces are other key features. Image with permission and courtesy of PRP Imaging.

