fgi

explore design deliver

*Francis Group International (FGI)*

# *Diagnostic Imaging Medical Physicists (DIMP) Horizons Scanning*

## *Workforce Planning & Development*
## *NSW Ministry of Health*

Brisbane | Melbourne | Sydney | London | Wellington

Level 13
135 King Street
Sydney 2000

www.fgconsult.com

fgi
explore design deliver

## Contents

## Table of Figures

# 1. Executive Summary

The *NSW Health Professionals Workforce Plan 2012-2022* identifies Diagnostic Imaging Medical Physicists (DIMPs) as one of the five 'small but critical' workforces which require attention in order to meet the needs of a changing health care service in NSW. The term DIMP refers to a group of medical physicists that work in the areas of radiology or nuclear medicine, with many physicists working across both areas.

Recent modelling by NSW Ministry of Health and others reveal that the DIMP workforce in NSW is ageing and it is the very low replacement rate which is creating significant concern. The rate of new DIMP accreditations compared to career exits is currently running less than 70%, well below replacement level. Additionally projections are for increased demand for the services provided by medical physicist workforce, driven chiefly by the volume of services required and the increasing complexity of the imaging technology deployed. These trends point to a potential crisis of DIMP supply in the near future if action is not taken.

The strategies within the current Health Professionals Workforce Plan commit the NSW Ministry of Health to develop an action plan for the DIMP workforce. A key part of this is the Horizons Scanning research (this project), which was commissioned to identify the developments and trends in science and technology, as well as generating broader stakeholder involvement in the process of determining the current and future environmental influences and drivers on the DIMP workforce. NSW Ministry of Health was particularly interested in this horizons scanning report to guide and inform the next phase of workforce action planning.

## 1.1 Project Background and Methodology

The consultation approach utilised was designed to canvas a broad and representative range of expert views on the critical risks and opportunities facing the DIMP workforce, whilst also building cumulative insight and consensus on these risks and opportunities to inform future action planning.

The research activity was approached from two complementary perspectives, an 'outside-in' view of the external, expansive view of the DIMPs environment and an 'inside-out' view driven by internal experts.

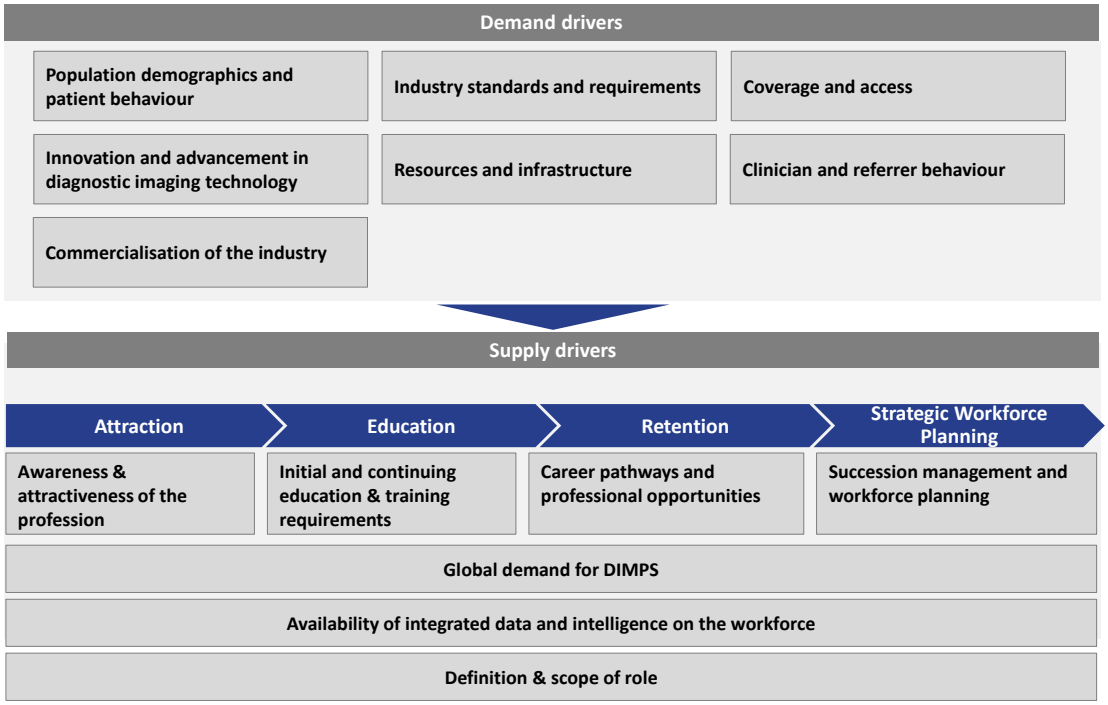
A literature review was conducted to identify and synthesise the available data and literature regarding the DIMPs workforce in NSW, Australia and globally in order to identify key drivers of supply and demand, notable risks and issues anticipated, to identify any gaps and develop high level hypotheses for investigation. A 3 phase Delphi-method survey was employed to engage with stakeholders and obtain and test primary research material in an iterative way.

Finally, a scenario generation workshop explored and compared a range of 'what if' scenarios for the DIMP workforce, guided by the critical drivers and environmental influences identified through the earlier research phases.

## 1.2 Key Findings

Our initial phases of research (literature review and interviews) identified and validated a model of 22 factors which drive the demand and supply of the DIMPs workforce (as summarised in Figure 3 below). This framework provided the basis of the subsequent investigations process via the Delphi email questionnaire, interviews and stakeholder workshop.

### Figure 1 Workforce Drivers




The second round of the Delphi survey process sought to identify which of these drivers (as defined in Table 1 and Table 2 below) were the most significant and to better understand associated issues.

### Table 1 Demand Drivers

| | |
|---|---|
| Patient trends | Patient characteristics e.g. Ageing population, increased acuity of presenting patients |
| | Patient expectations: patient expectations and information requirements. Increase in preventative medicine. |
| Industry standards and requirements | Standards: Radiology and radiation safety requirements and professional standards |
| Coverage and access | Access: Government initiatives to increase coverage of, and access to, diagnostic imaging services |
| | Private sector: Provision and growth of services provided by private sector providers |
| Technological innovation | Advancements in imaging technology: Continued advancement of imaging technology, better imaging quality, introduction of new modalities. |
| | New capacity: Convergence of radiology & nuclear medicine disciplines. Increasing use of diagnostic imaging for therapeutic and interventional purposes |
| Commercial drivers | Vendors: Vendor trends and influences on adoption and purchase of new equipment |
| | Financial drivers: Financial incentives for treating private patients |
| Clinician and referrer behaviour | Referral patterns: Over-referral, or over-reliance on diagnostic imaging |
| | Clinician preferences: Clinician preferences regarding procedures of choice |
| Awareness & recognition | Understanding of the profession: Awareness, understanding and perceived value of the profession by community and key stakeholders |

The three highest rated demand drivers are as follows:

- The impact of new technology was rated by stakeholders as the most significant potential driver of DIMP demand in the years ahead. As new modalities are introduced and imaging performance improves, the required DIMP input will correlate to the increased imaging activity overall
- This is closely followed by the potential of (Federal/State) government initiatives to influence demand for imaging services (e.g. cancer screening initiatives)
- The increasing convergence of radiology and nuclear medicine and the resulting increase in interventional procedures is rated as the third most significant demand driver

The three demand drivers considered to have the lowest significance included:

- The influence of imaging vendors making business-based decisions (as opposed to population-based for example) on the adoption and purchase of new modality equipment in NSW
- Requirements to providers of meeting the safety requirements for Radiology as well as professional standards, no change to these standards is anticipated by stakeholders
- The driver with the lowest assigned rating is the potential impact of financial benefits for treating private (as opposed to public) patients

**Table 2 Supply Drivers**

| | |
|---|---|
| Attracting new professionals | Attraction and awareness: Awareness and attractiveness of the profession to prospective students |
| | Education and certification: Scope and length of initial education and certification pathway |
| Education and training | Educators: Availability and supply of appropriately qualified specialist educators |
| | Training and experience: Availability and capacity for training placements |
| Career opportunities and progression | Career pathways and opportunities: Availability of career pathways and opportunities within the Australian workforce for qualified DIMPs |
| | Remuneration: Remuneration levels for DIMPs in Australia, compared to overseas |
| | Succession management and workforce planning: Strategic, whole-of-workforce approaches to workforce planning and succession |
| | Global mobility: Global demand and opportunity for DIMPs, including potential international accreditation standards |
| | Lifestyle factors: Personal preferences and lifestyle factors influencing DIMPs' career decision-making |
| | Scope of role: How the DIMPs role is scoped and defined, and the day-to-day responsibilities that are delivered in practice |

The three supply drivers given the highest significance ratings include:

- The current lack of availability of career pathways and opportunities for DIMP staff was rated as the most significant negative influence on the supply of DIMPs
- The survey group's perception that there is a lack of a strategic, whole of service approach to workforce planning which is itself a product of system managers' limited understanding of the need for and value of DIMPs services
- The low number of training and qualified positions post-graduation is perceived as a major constraint to recruitment of new DIMP staff

The three factors of least concern as restraints to supply were considered to be:

- Global demand for DIMPs and availability of potential opportunities in NSW, Australia and overseas
- The present scope of DIMP roles as a potential disincentive to prospective DIMPs.
- The influence of lifestyle and personal preferences as constraints to recruitment of potential DIMP candidates

## 1.3 Opportunity Areas

The final phase of the consultation concluded with the stakeholder scenario generation workshop. In this facilitated session the group considered the implications of 3 potential future scenarios on the DIMPs workforce planning in order to validate and identify areas of potential improvement opportunity. Scenarios were designed to address the most commonly cited drivers in the earlier phases of the consultation.

**Scenario 1: Role Configuration**

> *Assuming that next 5-10 years the number of DIMPs remains static or decreases in the face of steadily increasing demand, in what possible ways could the DIMP role be reconfigured, supported or augmented in order to make best use of these scarce resources?*

| Stakeholder Response |
|---|
| ***State-wide Service Framework***<br>One proposed solution was a NSW-wide service model where a few major centres provide services to facilities within appropriate geographical regions, or groupings of LHDs in a 'hub and spoke' configuration. The objective to create a critical mass of expertise and capacity. |
| ***Co-opt Resources from Associated Staff Groups***<br>It is acknowledged that DIMPs share a degree of scope overlap with Administrative staff, Nurses, Radiographers and Nuclear Medicine Technicians and there is potential for these groups to perform some tasks which are currently performed by DIMPs. |
| ***Assistant Medical Physics roles***<br>The establishment of a DIMP Technician (or other assisting) role is one approach to managing low value DIMP and better leveraging current staff capacity as technical roles free up specialised DIMP skills (it is not known if there any assistants working in this field). |
| ***Hybrid ROMP and DIMP role***<br>The possibility of combining the ROMP and DIMP roles was explored in the workshop and was dismissed by consensus as impractical given the divergence and specialisation of the individual roles (on the job). |
| ***Standardisation of DIMP roles***<br>It was felt that there was scope to standardise elements of the DIMP role(s) for which they would need the support of facility/system managers. |

**Scenario 2: Education Models and Pathways**

*Increasing the number of appropriately trained DIMP staff is key to bridging the projected workforce gap. How could the current education model or training pathway be altered to:*

*Increase DIMP numbers? Accelerate qualifications? Ensure course viability for providers?*

| Stakeholder Response |
| --- |
| ***Increase sharing of training infrastructure***<br>One proposal offered was, that whilst public hospital imaging equipment was utilised 24 hours a day and therefore not available for training, that there may be scope to utilise the Private Sector equipment for training. |
| ***Centralised training simulation facilities***<br>The potential of centralised training resources was identified as an opportunity to create the economies of scale required for sustainable education and training programs. |
| ***Public Support for Private sector***<br>The stakeholders promoted the idea that the Public Sector could provide services on a fee for service basis to the private sector. |
| ***Global mobility***<br>If it were possible to leverage a larger pool of international talent than currently, it could be useful to address projected DIMP shortages through overseas recruitment. |
| ***Constraints on Clinical Training***<br>The shortage of paid training positions is having an effect on student choice between careers in ROMP or DIMP as there is more likelihood of permanent employment as a ROMP. Registrar roles are currently the only way for DIMP candidates to access expensive machine time for clinical training to complete certification. |
| ***Partnerships between Health and Education***<br>The potential for enhanced alignment between education providers and health services was raised as an area for improvement. |
| ***Expanded Educator Capacity***<br>Stakeholders also cited the need to increase the number and expand the scope of DIMP TEAP Supervisors roles in the system to support the continued growth of the future DIMPs pipeline (for both initial training and professional development). Current requirements are for a 1:1 Supervisor to Registrar ratio which can prove difficult to achieve with current staffing levels. |

**Scenario 3: Impact of New Technology**

*Introduction of new technologies is an area of potentially disruptive change in the coming years. In what ways do you anticipate that technology could alter the DIMP workload including:*

*Current DIMP activities? Referrer behaviours?*

| Stakeholder Response |
|---|
| ***Impact of new modalities and increasing rates of intervention:*** Imaging uptake is increasing as new technologies enhance it as an interventional, as opposed to a purely diagnostic, modality driving an increasing need for provision of DIMPs 'specialist knowledge and expertise. |
| ***Radiation Safety*** Stakeholders anticipate that technological innovations and adoption of new imaging modalities will ensure that the requirements for DIMP services will grow. |
| ***Activity-based Funding (ABF)*** As the ABF framework reaches maturity, it should drive more efficient use of technology and resources. |
| ***Clinician referrals behaviours*** Referral behaviour will shift as new technologies that are introduced and the use of existing modalities changes. Diagnostic Imaging activity will increase overall and so the demand for DIMP input. |

## 1.4 Recommendations

The final output of this project is set of 15 recommendations for action, based on our assessment of the opportunities highlighted and stakeholder views provided during the research and consultation phases. The recommendations are organised into two categories: to manage demand for and to increase the supply of DIMPs. Recommendations are then prioritised by proposed implementation timeframe.

| Managing Demand – Short Term (next 12 months) |
|---|
| ***Support the development and implementation of clinical risk-based Assessments*** The development of standardised, clinical risk-based assessments / care pathways for Imaging services should be strongly encouraged and supported wherever possible. It is therefore recommended that consideration be given to developing a series of standardised imaging criteria along the lines of the Ottawa Ankle Rule, where clinically appropriate**.** |
| ***Clarify delineation of DIMP scope(s) of practice*** A more pronounced definition of the roles which reside within the overall DIMP scope of practice (e.g. Radiation Safety Officer) is recommended in order to provide clarity of the resourcing needed to meet service requirements. Enhanced delineation of scope and roles would support system managers' ability to consider the potential of all appropriately qualified workforce cohorts to provide support in key areas and to more flexibly plan to meet service need. |
| ***Enhance mentoring framework*** Establish a more formal mentoring program to leverage the expertise of retired DIMP staff (possibly through the DIMPs community of practice network) and provide additional mentoring resources to address the current and pending shortage. |

| |
|---|
| ***Develop a Value Proposition for DIMPs***<br>The critical importance of DIMP services should be better articulated to system stakeholders through the development of a DIMP value proposition summarising DIMPs contributions to patient safety and risk management |
| ***Improve Workforce Data Collection***<br>It is recommended that a NSW workforce dataset for DIMPs comprising both quantitative and qualitative elements (across both public and private sectors) be developed. Data collection to be initiated as soon as possible, in order to provide a valuable evidence base to enhance workforce planning capabilities. |

| **Increasing Supply - Short Term (next 12 months)** |
|---|
| ***Expedite TEAP certification process***<br>It is recommended that the vocational component of DIMP training (managed through ACSPEM) should be re-phased to allow trainees to be certified for independent practice on a by competency basis, accelerating the deployment and utility of new DIMP staff. |
| ***Pursue international DIMP certification***<br>It is recommended that the trend towards international DIMP certification be supported in order to enhance workforce mobility and leverage the global talent pool. |
| ***Establish a DIMP Community of Practice in NSW***<br>A community of practice is a simple, but important way to strengthen the DIMP network in NSW. Its purpose would be to support staff who can feel isolated at times, to share knowledge and facilitate mentoring. |
| ***Explore potential to enhance access to imaging equipment for training purposes***<br>Engage with private health providers to seek agreement to access imaging equipment out of hours for training purposes. |
| ***Establish common approach to workforce modelling and strategic planning***<br>The development of a common understanding of Imaging service requirements for DIMP skills is recommended to enhanced workforce modelling. More accurate (i.e. needs-based) determination of staffing requirements would support strategic workforce planning while also and providing enhanced clarity to system managers of service need. Access to up-to-date workforce intelligence and data about the workforce would also support proactive workforce management efforts. |
| ***Enhance DIMP role in medical education***<br>It is recommended that a greater role for DIMPs in conjunction with Radiologists and Nuclear Medicine Physicians be included in Medical Staff education to promote the benefits of DIMPs to medical practice and enhance patient safety |

| Managing Demand – Longer Term (12-24 months) |
| --- |
| ***Establish state-wide service configuration for DIMPs***<br>A state-wide approach to the provision of DIMP services is required to ensure that LHDs have sufficient and appropriate access to the expertise of this staff group. It is recommended that serious consideration be given to the establishment of a state-wide of DIMP service configuration, with hubs at key facilities radiating service spokes to smaller sites as required. |
| ***Develop Assistant DIMP roles***<br>The development of the DIMP Technician role is recommended as a means to absorb the lower-value activity currently required of fully qualified DIMP staff and free up their time to focus on more complex, higher value activities. |

| Increasing Supply - Longer Term (12-24 months) |
| --- |
| ***Promote the establishment of a fully equipped training simulation centre***<br>Explore and support moves to establish a fully equipped simulation centre for DIMP training. The establishment of a fully equipped simulation centre for DIMP training should be supported and a business case developed. The centre would most likely need to be set up at national-level (or at very least in partnership with another jurisdiction) given the economies of scale to which are required to ensure its viability and value for money. |
| ***Enhanced alignment of education providers' courses with health system needs***<br>Encouragement and support of closer partnerships between education providers and health services is recommended in order to help ensure that the academic modules offered, are fit for purpose and best align with the TEAP and the current requirements of the NSW health system. |

# 2. Introduction

'Small but critical' workforces are defined as those which contribute critical and essential elements of a comprehensive health service and which are currently experiencing threats to meet system needs now and in the future.

Medical physics, as a whole, is the application of physics to medicine, namely medical imaging and radiotherapy. Medical physicists provide expert scientific input into multidisciplinary health teams to deliver clinical services that complies with the standards set out by the Australian Radiation Protection and Nuclear Safety Authority (ARPANSA).

The term Diagnostic Imaging Medical Physicists (DIMP) refers to a group of medical physicists that work in the areas of radiology or nuclear medicine, with many physicists working across both areas[1]. Radiation safety is a core element of both disciplines and mandated by ARPANSA who are the 'recognised experts'[2]. Medical physicists who specialise in radiation oncology are known as Radiation Oncology Medical Physicists (ROMPs). Workforce numbers in NSW are relatively small and within the workforce there is specialisation into three areas: Radiation oncology, Radiology and Nuclear medicine.

When considering the complement of Medical Physicists as a whole (DIMP and ROMP) DIMPs comprise 16% of the total according to figures provided by the Australian College of Medical Scientist and Engineers in Medicine (ACPSEM) in 2012. The NSW figures align to the Australia-wide distribution with 25.5 DIMP FTE being identified to 141.2 ROMP FTE, DIMPs comprising 15.3% of the total Medical Physicist workforce in the state[3].

These low workforce numbers are reflected nationally and have been flagged as an emerging issue previously by a number of State Health Ministries and reflected in a number of reports over recent years.

In 2012 the Australian DIMP workforce comprised 61 people and had an average age of 44 and while not the oldest workforce cohort, as we can see in Figure 2 below, a significant proportion are set to retire in the next 10 years.

In NSW Health, DIMPs will be involved in some of the following activities:

- ***Compliance testing and calibration of imaging equipment*** – this is required when installing new technology, following repair work and for annual audit and regulatory reporting purposes
- ***Patient dose audit*** – advising on appropriate levels of radiation for particular treatment modalities and particularly for some patient cohorts e.g. pregnant women, infants and chronically ill
- ***Radiation safety monitoring*** – for regulatory compliance, assisting the LHDs to meet accreditation and regulatory responsibilities for radiation and nuclear safety, including the design and verification of shielding for new x-ray installations
- ***Case Review*** - working closely with multidisciplinary teams that may include radiologists, radiation oncologists, nuclear medicine physicians, radiographers, radiation therapists and nuclear medicine technologists to provide advice or supervision on radiation safety for patient care, including patient care planning and case review, review and implementation of new or emerging imaging technologies
- ***Research design*** - participation in ethics committees and radiation and nuclear medicine safety (the ARPANSA RPS8 document refers specifically to having a radiation dosimetry report provided by a 'qualified physicist')
- ***Safety standards and protocols*** - participation in local, state and national working groups on radiation and nuclear medicine safety – developing standards, reviewing protocols and incident responses
- ***Clinical Education*** – lecturing on radiation safety and assisting in the induction of new employees into the imaging departments

[1] Round (2013) A 2012 survey of the Australasian clinical medical physics and biomedical engineering workforce. Australasian Australas Phys Eng Sci Med. 2013 Jun;36(2):147-57

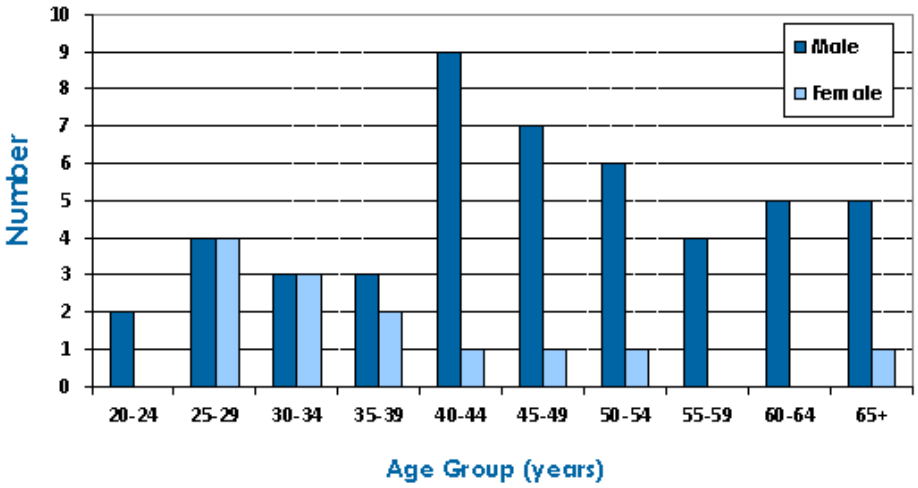
[2] Cormack (2011) Editorial: the ACPSEM diagnostic imaging TEAP project, Australasian Physical and Engineering Sciences in Medicine 34:173–178

[3] Round (2013) A 2012 survey of the Australasian clinical medical physics and biomedical engineering workforce. Australasian Australas Phys Eng Sci Med. 2013 Jun;36(2):149

NSW Ministry of Health data and ABS indicates that in 2011 there were 419 Medical Physicists in NSW, based on the distribution provided by ACPSEM – that 16% of these are DIMPs - this equates to approximately 67 self-identified DIMPs who may be working in the public or private sector.

**Figure 2: Age Distribution of the DIMP Workforce in Australia**

Source: Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM) membership data as cited in Medical Physicist Workforce Study, Health Workforce Australia, Sept. 2012




The replacement rate of DIMPs, i.e. accreditations to career exits, is currently running less than 70%. It is this statistic which is one of the key drivers behind the citing of DIMPs in the *NSW Health Professionals Workforce Plan 2012-2022* as one of the five 'small but critical' workforces. Groups which require enhancement to meet the needs of a changing health care service in NSW.

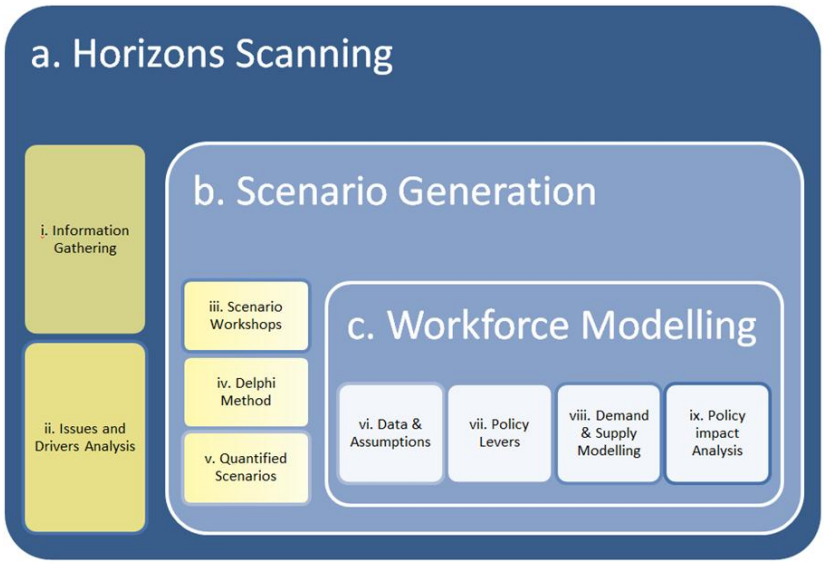
The strategies within the current Health Professionals Workforce Plan commit the NSW Ministry of Health to develop an action plan for the DIMP workforce. This planning activity is to include consultation with the relevant educational providers and professional associations. The objective is to develop a plan which will ensure that the critical elements are in place to support workforce sustainability over time.

While system managers across Australia have recognised this imperative, the majority of additional (State and Commonwealth) investment in the medical physicist workforce has been focused on the larger ROMP workforce as expressed via the establishment of the Radiation Oncology Reform Implementation Committee (RORIC) in 2003. While both DIMP and ROMP workforces experience continued issues as regards training of sufficient numbers to meet service needs, it is the smaller DIMP workforce which appears most vulnerable in NSW at this time.

Prior to the Horizons Scanning survey, data collected in the Ministry's first phase of research on this workforce was reviewed and a quantitative risk assessment of the workforce data was conducted. An initial consultation with key stakeholders was conducted, to review the risk assessments and to consider other relevant information driving and influencing the critical issues for the separate workforces.

As a result of that consultation process, it was identified that further horizons scanning was needed with regards to the DIMP workforce, a decision which resulted in the genesis of this project. The Horizons Scanning research project was to include identification of the developments and trends in science and technology as well as to generate broader stakeholder involvement in the processes of determining the current and future environmental influences and drivers. Horizons Scanning is a process that aims to systematically anticipate, identify and prepare for new or changing risks for the workforce and to consider the implications that new and emerging issues will have on the distribution of resources, existing priorities and delivery for work in the future.

**Figure 3 Components of a comprehensive workforce planning program**




The work undertaken as part of this horizons scanning research (comprising items iii – v in Figure 3 above) aligns with a broader workforce planning and development framework and will contribute to the development of action plan for the DIMP workforce, being completed in the Workforce Development and Planning Branch, NSW Ministry of Health.

This project aimed to answer the following questions with respect to the DIMPs workforce:

- What are the key risks, issues and opportunities currently impacting the NSW DIMPs workforce?
- Of the known or manifested issues and opportunities, what is the current and project impact on the workforce's capacity to meet demand, and quality and safety standard?
- Of the anticipated issues and opportunities, what is the likelihood that these issues and opportunities will be realised and what is their expected impact?
- Based on the above, how can a strategic workforce action plan be developed that identifies:
    - Immediate, short term actions to address
    - Integrated, longer term strategies to support workforce planning and sustainability

In addition to subject-specific objectives outlined above, an additional project aim was to test the Delphi survey methodology as a means of effectively and meaningfully engaging very small workforce cohorts.

# 3. Methodology

The consultation approach utilised was designed to canvas a broad and representative range of expert views on the critical risks and opportunities facing the DIMP workforce, whilst also building cumulative insight and consensus on these risks and opportunities to inform future action planning. These objectives were achieved through a blended research approach comprising:

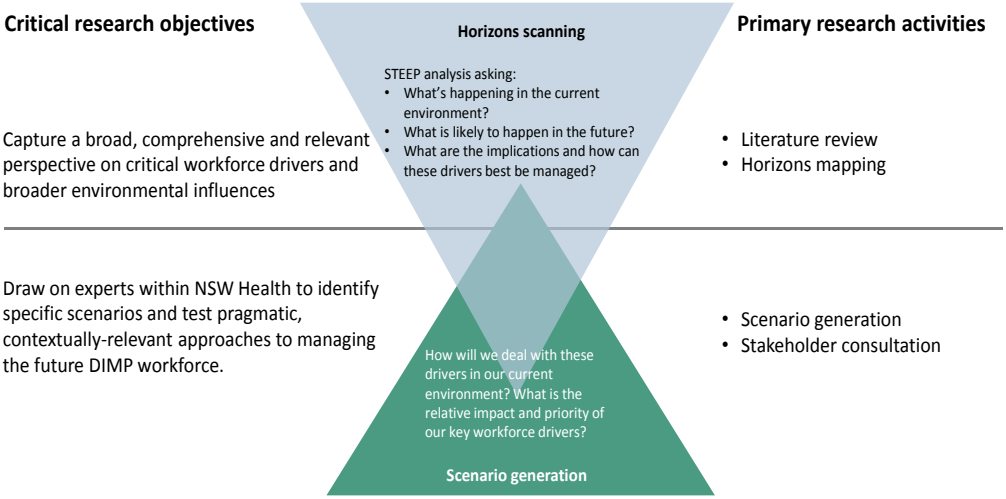
- A baseline review of the international literature
- An iterative survey of key stakeholder groups, via the Delphi methodology, which was implemented via a hybrid method of stakeholder interviews, a two-stage email questionnaire
- A stakeholder workshop

## 3.1 Methodology

The research activity was approached from two complementary perspectives, an 'outside-in' view of the external, expansive view of the DIMPs environment, and an 'inside-out' view driven by internal experts.

A conceptual representation of this approach mapped to the key project activities is provided in Figure 4 below.

**Figure 4 Scope of Research**




(*Explanatory Note. STEEP analysis looks at Social, Technological, Economical, Environmental and Political factors and is a validated tool in trying to gain foresight into an issue).*

### 3.1.1 Literature review

A literature review was conducted to identify and synthesise the available data and literature regarding the DIMPs workforce in NSW, Australia and globally, in order to identify:

- Key drivers of supply and demand in the diagnostic imaging services sector, and the relative influence of these drivers on future trends for the NSW DIMP workforce
- Notable risks and issues anticipated to impact the sector and the implications of these risks and issues for workforce planning

- Identify any gaps in the available data or research literature that should be explored in stakeholder and subject matter expert consultations
- To identify high level hypotheses and research questions for exploration in the next phase of research (stakeholder surveying and consultation)

The results of the literature review were used to determine the consultation questions and focus of the Delphi survey approach, as well as to inform scenario planning.

## 3.2 Expert stakeholder consultation (Delphi survey)

The Delphi method is a structured, iterative process for incorporating expert input in a way that is complementary and ultimately builds a consensus. This approach is particularly suited to soliciting expert input in complex research scenarios, particularly when that group is not able to physically meet. The further advantage of the Delphi method's iterative approach is that it ensures early inputs are not constrained by factors that can impact face-to-face brainstorming scenarios, such as groupthink.

There were three phases to the Delphi method in this project.

- ***Phase 1*** was designed to elicit broad views and test the validity of factors identified in the International literature review regarding critical workforce drivers and influences.

  For the DIMPs stakeholder group, this phase was conducted through an email survey

  For the Senior Clinician and Educator stakeholder groups, this phase was conducted through face-to-face and phone interviews

- ***Phase 2*** was designed to further develop and test the workforce drivers and influences which emerged from Phase 1, providing all respondents with an opportunity to review and comment on the range of factors identified in the first round of interviews. Respondents were asked to review each factor and rate the:
  - Likely impact of each driver on future workforce demand or supply
  - Direction of that impact.
- ***Phase 3*** was conducted as part of the scenario generation workshop. This phase was designed to reach a final group consensus on the most significant and likely factors to impact the DIMPs workforce in the future. The identified factors were then explored in more detail through the scenario planning portion of the workshop.

### 3.2.1 Scenario generation and planning

The scenario planning workshop explored and compared a range of 'what if' scenarios for the DIMP workforce, guided by the critical drivers and environmental influences identified through the earlier research phases.

## 3.3 Stakeholders consulted

A full stakeholder list is provided in Appendix D on page 61 of this document.

# 4. Key findings

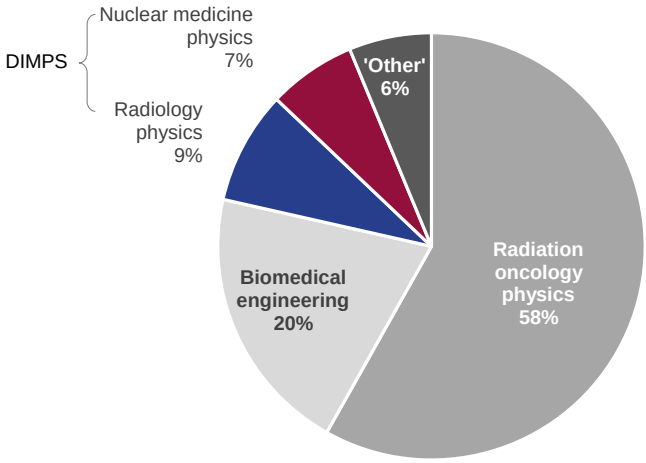
This section provides details of the key findings from the literature review, primary research interviews and stakeholder consultation activities.

## 4.1 Diagnostic Medical Imaging Physicists' (DIMPs) workforce context

As discussed above, the term Diagnostic Imaging Medical Physicist refers to a group of medical physicists that work in the areas of radiology or nuclear medicine, with many physicists working across both areas[4]. A recent study of the medical physics workforce identified the following breakdown of roles within the Australian and New Zealand medical physics and biomedical engineering workforce.

**Figure 5: Distribution of the ANZ Medical Physics and Biomedical Engineering Workforce (2012)**

Source: Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM)




DIMPs work in both public hospitals, private practice, and in research institutions. The exact number of DIMPs employed within the private sector is difficult to ascertain[5], and this in itself represents a risk to understanding the contextual factors that impact the entire workforce (private imaging practices impact overall demand for services, and also offer employment opportunities that influence the public sector's ability to attract and retain staff).

As a potential proxy for employment numbers across the public and private sectors, the Australian Diagnostic Imaging association estimates that 35% to 40% of diagnostic imaging services in Australia are provided by public hospitals, with the remainder conducted by private imaging practices (60-65%)[6] see Figure 6 below.

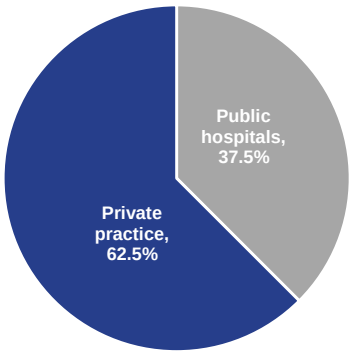
[4] Round (2013) A 2012 survey of the Australasian clinical medical physics and biomedical engineering workforce. Australasian Australas Phys Eng Sci Med. 2013 Jun;36(2):147-57

[5] Round (2013) A 2012 survey of the Australasian clinical medical physics and biomedical engineering workforce. Australasian Australas Phys Eng Sci Med. 2013 Jun;36(2):147-57

[6] http://www.adia.asn.au/

**Figure 6: Estimated proportion of diagnostic imaging services conducted in public and private sites**

Source: Australian Diagnostic Imaging Association



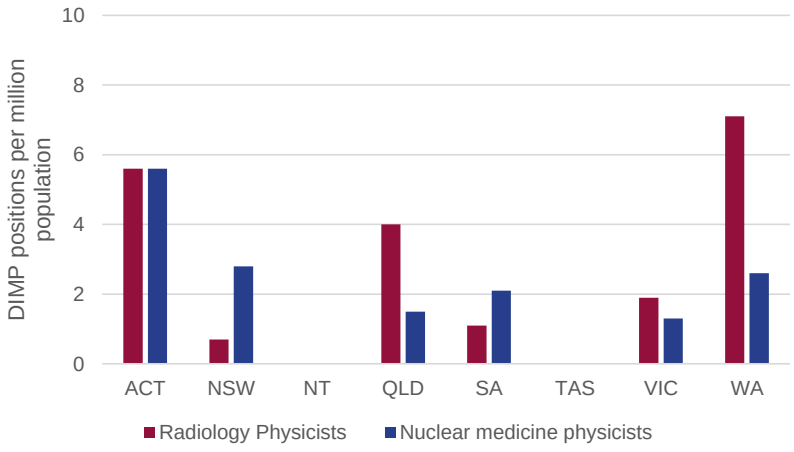

Beyond these high level estimates of workforce distribution, detailed information on the homogeneity of the DIMP role and the specific responsibilities and activities performed is difficult to accurately ascertain and represents an opportunity for further research and analysis.

## 4.2 Projected skills shortages

The DIMP workforce shortages have been widely reported in Australia[7], and globally. Research from Victoria indicates that access to diagnostic imaging and radiation oncology is already being impacted by skills shortages and that even where new diagnostic imaging equipment exists, the rollout and utilisation of this technology is being impacted by a shortage of appropriately skilled physicists[8].

In Australia, there is a reasonable degree of variation in the total number of DIMP positions per million population across the states[9], as summarised below in Figure 7.

**Figure 7 DIMP positions per million population (2012) by state**




[7] Health Workforce Australia (2012) Medical Physicist Workforce Study

[8] Medical Scientists Association of Victoria (2012) Shortage of Medical Physicists in Victoria threatens timely diagnosis and treatment of Cancer

[9] Round (2012) A 2012 survey of the Australasian clinical medical physics and biomedical engineering workforce, Australas Phys Eng Sci Med. 2013 Jun;36(2):147-57

DIMP staff work as Radiology or Nuclear Medicine Physicists the requirements of which are applied variously depending on local service structures and history, as well as the preference and practice of the department and particular staff member.

The Health Workforce Australia Report (2012) highlighted the ratio of newly accredited medical physicists to workforce exits was an area of significant concern for DIMPs, with no DIMP accreditation over the period 2006 to 2011[10]. Due to the lengthy training and education pathway for DIMPs, it is likely that the impact of this drop in new accreditations will impact the Australian DIMP workforce for some time (for example, even with the revised training and education pathway, constant demand, and two intakes of 20 registrars over 2 years, Cormack's projections indicate the supply will not meet demand until 2016). The ability to train and accredit new DIMPs locally is a key imperative, with an Australian DIMP workforce which is skewed towards older, more senior professionals, creating a strong urgency for attracting and retaining DIMPs[11].

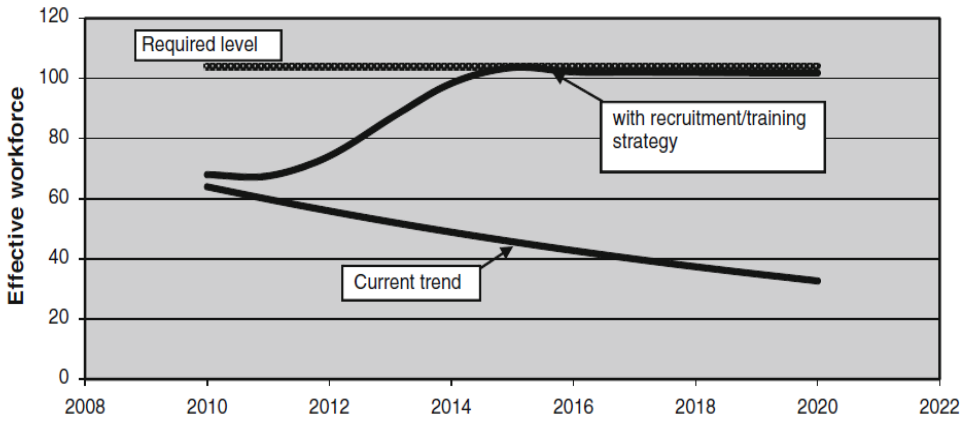
A range of approaches will need to be deployed in order to address this skills gap over time, as a low accreditation rate and lengthy education pathways mean that local attraction and recruitment into the profession will be insufficient to address this gap in the short term.

Workforce projections conducted by in 2011[12] indicated that without significant intervention in recruitment and training for DIMPs, there would be a widening skills gap over time even if demand stayed constant.

The projections are reproduced below in Figure 8. The recruitment and training strategy proposed in the model below encompasses a revised training and education pathway which would make it possible for DIMPs to become accredited in any one speciality within 4 years, or to achieve dual accreditation in 5 years (in recognition of the growing overlap in specialties). The projections take into account an intake of two groups of 20 registrars over 2 years and are based on the requirements of current role and service configurations.

**Figure 8: DIMP workforce projections with and without recruitment and training intervention**

Source: Cormack (2011) Editorial: the ACPSEM diagnostic imaging TEAP project, Australasian Physical and Engineering Sciences in Medicine 34:173–178




## 4.3 Drivers of demand for DIMP services

Current projections for the Australian workforce indicate an increasing gap between workforce supply and demand. A range of factors driving demand for DIMP services have been identified through the literature review and stakeholder consultation activities as follows.

[10] Health Workforce Australia (2012) Medical Physicist Workforce Study

[11] Round (2012) A 2012 survey of the Australasian clinical medical physics and biomedical engineering workforce, Australas Phys Eng Sci Med. 2013 Jun;36(2):147-57

[12] Cormack (2011) Editorial: the ACPSEM diagnostic imaging TEAP project, Australasian Physical and Engineering Sciences in Medicine 34:173–178

### 4.3.1 Population demographics and patient behaviour

One of the key drivers of demand for diagnostic imaging services relate to population growth and longevity, patient and clinician needs and preferences around the use of diagnostic imaging for diagnosis or preventative medicine, and advancements in diagnostic imaging technology which create increased capability[13].

Patient behaviour and expectations also impacts demand for DIMPs in two ways.

- Consumers are increasingly expecting to be more aware and informed about procedures and radiation safety.
- That consumers are placing pressure on medical staff to be referred for more sophisticated imaging

In Australia, referrals for diagnostic medical imaging increased at a rate of 5.6% per annum between 2003 and 2009, driven partly by an increase in emerging presentations[14]. A 2009 global industry outlook reported that demand for diagnostic imaging services was at its highest levels and that this demand was project to increase[15]. The report cites increasing consumerism and preventative medicines (In addition to ageing population and growth in new technologies) as demand drivers[16]. Whilst a centralised and up-to-date international or national data is difficult to source, projections by a range of major institutions in Australia and globally confirm this outlook.[17,18,19,20,21]

### 4.3.2 Coverage and Access

Government (State and/or Federal) initiatives to increase access to diagnostic imaging services (e.g. cancer screening programs) have the potential to increase the need for appropriately skilled professionals. The Australian Government has committed to increasing access to high quality health care services through the Diagnostic Imaging Reform Package. The package is designed to ensure ongoing and affordable access to diagnostic imaging services through staged expansion of access to Medicare-eligible MRI services[22].

### 4.3.3 Innovation and advancement in diagnostic imaging technology

As new technologies are introduced or improved, clinician preferences also evolve. For example, while ventilation-perfusion (VQ) scanning used to be the preferred test of choice for diagnosing pulmonary embolism, CT pulmonary angiography – introduced more recently – has resulted in a significant increase in the use of CT for a range of indications (and a shift away from VQ scanning)[23].

Stakeholders agreed that innovation and advancement in technology would continue and that this was a key driver of demand for diagnostic imaging services. Technological changes are shifting the scope and focus of

---

13 HealthConsult. Radiation Oncology Workforce Planning. Final Report for Department of Health and Ageing. Sydney: HealthConsult, November 2009.

14 Department of Health Victoria (2010) Victorian Medical Radiations Workforce Supply and Demand Projections (2010–2030)

15 Washington G-2 (2009) Diagnostic Imaging Industry Outlook 2009: Market Trends & Analysis, cited in PR Newswire press release, 23 April 2009

16 Mohd-Nor (2011) Medical Imaging Trends and Implementation: Issues and Challenges for Developing Countries, Journal of Health Informatics in Developing Countries

17 Queensland Health Medical Imaging Services projections http://www.health.qld.gov.au/sunshinecoast/docs/govn/hlthsrvpln23.pdf, accessed 18 June 2014

18 Market Wired Press Release, 26 June 2013, Patient Demand for High-Quality Medical Imaging at a Competitive Price Drives Expansion for a Local Provider, http://www.marketwired.com/press-release/Patient-Demand-High-Quality-Medical-Imaging-Competitive-Price-Drives-Expansion-Local-1815006.htm accessed 20 June 2014

19 Deloitte Centre for Health Solutions (2013) Working differently to provide early diagnosis: improving access to diagnostics.

20 Tan (2004) Diagnostic Imaging in Asia, Asian Hospital & Healthcare Management, Issue 9

21 Health Workforce Australia (2012) Medical Physicist Workforce Study

22 Department of Health and Ageing (2012) Fact Sheet: Improving access to Magnetic Resonance Imaging (MRI) services Accessed at http://www.health.gov.au/internet/main/publishing.nsf/Content/D572E27CCF351376CA257BF0001AFD8A/$File/Improving%20Access%20to%20MRI%20Services%20Fact%20Sheet.pdf on 20 June 2014

23 Wiener, Schwartz & Woloshin (2013) When a test is too good: how CT pulmonary angiograms find pulmonary emboli that do not need to be found BMJ 2013;347:f3368

the role particularly the combining of once distinct modalities. Key trends noted by interviewees and confirmed in the stakeholder workshop included:

- A convergence in the radiology & nuclear medicine disciplines, driven largely by innovations in hybrid technologies (e.g. SPECT CT) which has shifted the scope and nature of some DIMPs roles
- The trend towards medical imaging being used increasingly for therapeutic and interventional purposes – not just diagnostic purposes as was primary use historically

Taken together, these trends are requiring an increasing level of specialisation within the profession which has staffing, workforce planning and education and training implications.

This pace of technological innovation directly impacts the DIMP workload. Two particular trends of note are:

- As the ability of imaging technology increases to provide higher quality images, there is a corresponding increase in the DIMP working requirement in monitoring, calibrating and calculating correct dosimetry. There have been a number of instances both around the world where incorrect settings have potentially and actually impacted patient safety.
- The rolling adoption of new technologies has an immediate implementation and training load – some stakeholders reported that new technologies may be implemented every 12 months.

Not all developments in the industry have the impact of driving increased demand, however. In 2012, HealthShare NSW led the implementation of the state-wide Enterprise Imaging Repository, providing centralised, quick and efficient access to patient studies and reducing the need for duplicate or repeat studies[24]. Early results indicate strong uptake in utilisation of the Enterprise Imaging Repository, with over 85 million individual images stored, and LHD patient records for 17 million patients[25], however data on the overall impact of the system on reducing repeat studies could not be sourced.

#### 4.3.4 Clinician and Referrer behaviour

Referral patterns and clinician preferences were cited by a number of stakeholders as being a strong influence on utilisation with anecdotal evidence of an increase in the number, type and complexity of procedures requested by referrers. Of note a pattern of duplicate or inappropriate ordering of imaging procedures was identified. Associate Professor John Heggie, Consultant Medical Physicist at St Vincent's Hospital in Melbourne highlighted the multiple factors driving increased ordering of procedures including: pressure to diagnose conditions quickly, advancement in imaging technology, medico-legal issues, and poor storage and accessibility of patient imaging records resulting in duplicate procedures.

#### 4.3.5 Industry standards and requirements

Evolving industry practice and standards also impact the demands on the workforce. A submission by ACPSEM to the Australian Workforce and Productivity Agency also noted that demand for DIMPs will be increased by new requirements outlined by the Australian Radiation Protection and Nuclear Safety Agency which mandates that a program is established to ensure that "radiation doses administered to a patient for diagnostic purposes are…periodically compared with diagnostic reference levels (DRLs) for diagnostic procedures for which DRLs have been established in Australia"[26].

Radiation safety requirements, as they are implemented within jurisdictions, impact demand for DIMPs. An increasing emphasis on compliance and reporting requirements around radiation protection and safety place increased demand on the role (it is noted however, that there may be opportunities for the administrative requirements related to compliance and reporting to potentially be devolved to other roles).

---

[24] Hughes (2012) NSW public hospitals accessing digital radiology images Cardiovascular Diagnosis and Therapy, 2(4):E14-E15

[25] Enterprise Imaging Repository scoops Premier's Award for developing the first state-wide medical imaging repository in Australia http://www.fujitsu.com/au/about/resources/news/press-releases/2013/20131213-01.html

[26] APCSEM (2013) Submission to Australian Workforce and Productivity Agency for the Skilled Occupation List 2013, accessed at http://www.awpa.gov.au/our-work/labour-market-information/skilled-occupation-list/Documents/2013Submissions/27AustraliasianCollegeofPhysicalScientistsandEngineersinMedicine.pdf on 18 June 2014

### 4.3.6 Commercialisation of the industry

There are also commercial drivers impacting demand leading to over-utilisation and misuse of technology that exceeds the value provided back to patients, creates unnecessary risk to patients or results in over-diagnosis.[27,28,29] Marketing by manufacturers and pharmaceutical companies also drive increased demand by creating awareness of testing procedures and emphasising preventative health[30]. Externally, vendors may influence adoption and purchase of new equipment. From a DIMPs perspective, funding benefits for treating private patients may also influence utilisation patterns.

The impact of the Australian Federal Budget 2014-15 on access and affordability of diagnostic imaging is also still to be seen, particularly with changes to bulk billing. Press releases by the Australian Diagnostic Imaging Association following the release of the 2014-15 budget propose that the governments proposed cuts to Medicare rebates on diagnostic imaging services will have an impact on patients[31] and that some Australians were already delaying diagnostic imaging services due to cost (although it should be noted that their sources or data to support this claim are not published)[32].

## 4.4 Drivers of supply of DIMP staff

The factors influencing (enhancing / constraining) the supply of DIMP staff can be seen within five key focus areas as below.

### 4.4.1 Education and Training Pathways

DIMP workforce shortages are exacerbated by lengthy training and education pathways. Consultations conducted by the Victorian Department of Health found that the profile of the profession was generally low, impacting the ability to attract secondary and tertiary students the discipline[33]. Workforce growth and retention challenges then continue beyond the education stage, with a five year training pathway in Australia to qualify as a Medical Physicist, creating a significant lag in the ability to organically address current skills shortages.

Stakeholders provided varying opinions regarding the appropriateness of the current length and form of the initial education requirements. The NSW Cancer Institute's Chief Cancer Officer, Professor David Currow, noted that for the DIMP workforce, where roles and position descriptions are highly variable, there is a need to ensure the proper alignment of training with the requirements of physicist's actual role, or risk incurring the additional time and cost of providing staff with training which is superfluous to the tasks which they are required to perform.

The availability of senior DIMPs to provide supervision and the availability of internship, traineeship and registrar placements is also a risk to education and training within the profession, creating a bottleneck that would need to be addressed even if the number of enrolments and accreditations could be increased. A number of sites in Victoria already report that they are already at maximum capacity for accepting trainees[34].

---

27 Strategy & Business (2004) Health Care's Technology Cost Crisis, Summer 2004, Issue 5

28 Alexander (2008) Healer or Dealer: Is Entrepreneurialism Ruining Our Diagnostic Imaging Commons? The Internet Journal of Law, Healthcare and Ethics, Vol. 6 (2)

29 Smith-Bindman, Miglioretti & Larson (2008) Rising Use Of Diagnostic Medical Imaging In A Large Integrated Health System, Health Affairs, 27 no.6 :1491-1502

30 Wiener, Schwartz & Woloshin (2013) When a test is too good: how CT pulmonary angiograms find pulmonary emboli that do not need to be found BMJ 2013;347:f3368

31 Australian Diagnostic Imaging Association Press Release, 13 May 2014, Budget goes exactly the wrong way for DI patients http://www.adia.asn.au/sites/default/files/ADIA_Budget%20goes%20exactly%20the%20wrong%20way%20for%20DI%20patients.pdf, accessed 20 June 2014

32 Australian Diagnostic Imaging Association Press Release, 13 May 2014, Health costs already stopping treatment, http://www.adia.asn.au/sites/default/files/ADIA_Press%20Release-Health%20Costs-05-14.pdf, accessed 20 June 2014

33 Department of Funding of Health, Victoria (2013) Medical radiations and imaging technology workforce strategy

34 Ibid

After qualification, the constant pace of technological advancement requires a continued emphasis on professional development and education after qualification. Changing industry standards also have implications for ongoing education, skill development and staffing. For example, ACPSEM has noted that demand for DIMPs will be increased by the requirements of ARPANSA Code of Practice for Radiation Protection in the Medical Applications of Ionizing Radiation[35].

The capacity of the system to train graduates was consistently recognised as a constraint to the supply and flow of future professionals.

This constraint was caused by two prime factors:

1. Lack of suitably qualified mentors in the workforce
2. Difficulty in accessing equipment for training purposes due to availability and high cost

Addressing this bottleneck represents a significant opportunity to mitigate the risks posed by an ageing DIMPs workforce and a high proportion of impending retirements from the profession.

Aside from formal training and education pathways, the opportunity to create a learning and information sharing culture and practice within the profession was noted as a factor which could help to address the anticipated gaps in mid-career professionals following the departure of retirement-age DIMPs from the profession, and would also lessen key person risk.

Mentoring and communities of practice were raised as opportunities to enhance professional practice and development for less experienced DIMPs. Stakeholders also acknowledged however, that possessing a professional qualification does not necessarily equip a DIMP to be an educator, and that as in any profession there are individual differences in the level of interest in training others. With this in mind, it was suggested that a far greater level of support is required for trainers and educators in the system to ensure they were well equipped to drive training and professional development.

### 4.4.2 Workforce Structure and Planning

Stakeholders agreed that succession management and a longer term approach to managing and developing DIMPs was critical to the sustainability of the profession. To support strategic workforce planning, a common framework for workforce modelling and determination of staffing requirements is needed to support planning and consistency across the profession. Access to up-to-date workforce intelligence and data about the workforce would also support proactive workforce management efforts.

In addition to succession management and strategic workforce planning, stakeholders raised the possibility of reviewing the structure and staffing model of the workforce not only to address staffing shortages, but to ensure adequate training and professional development opportunities for junior DIMPs. Potential opportunities raised included locum staffing models which are common for other health roles but less so for DIMPs. Locum staffing may provide additional flexibility and coverage to alleviate some of the constraints associated with a small workforce. From the perspective of DIMPs training and education, it was suggested that conjoint positions between universities and hospitals could provide additional capacity and opportunity within the training system.

There is also a risk of losing DIMPs to other professions due to an actual or perceived lack of career pathways. For example, ACPSEM's submission to the Australian Workforce & Productivity notes that there are a high proportion of entry-level Medical Physicists who are at risk of seeking employment in other fields due to limited growth in more senior level[36]. The Victorian Department of Health medical radiations and imaging technology workforce strategy identified mid-career retention as a particular risk area, citing the need for career path development, leadership opportunities, career flexibility and remuneration as key drivers of

[35] APCSEM (2013) Submission to Australian Workforce and Productivity Agency for the Skilled Occupation List 2013, accessed at http://www.awpa.gov.au/our-work/labour-market-information/skilled-occupation-list/Documents/2013Submissions/27AustraliasianCollegeofPhysicalScientistsandEngineersinMedicine.pdf on 18 June 2014.

[36] Ibid

retention, particularly for professionals with 10-15 years' experience[37]. This report also identified a set of complementary strategies to address education and career development pathways. These include:

- Increasing the availability of funded training placements
- Increasing the capacity of sites accept training placements
- Providing additional supports to clinical educators
- Enhancing strategic partnerships with industry and educational providers
- Raising the profile of the profession

The literature on the drivers and decision factors for students, trainees and qualified medical physicists is notably limited and represents a key area for further understand and analysis in the sector. It is critical to understand not only the distribution and size of the workforce, but the drivers and preferences that affect why people are attracted to the profession, and what the key retention drivers are. Without an ongoing understanding of preferences and decision drivers over time, it will be difficult to develop and implement appropriately targeted strategies to grow and sustain the workforce.

#### 4.4.3 Availability of Integrated Workforce Data

A lack of integrated workforce data sources limits the ability to manage ongoing monitoring and planning efforts. The Heath Workforce Australia review into the medical physicist workforce could not rate DIMPs on all workforce risk indicators due to lack of data (an issue which is compounded by the small size of the workforce)[38]. With the exception of the medical physicist workforce survey conducted every 3 years by the Australasian College of Physical Scientists & Engineers in Medicine, there are few coordinated and ongoing research and monitoring programs in the sector.

Studies that do exist are primarily descriptive in nature, providing valuable data on the shape and characteristics of the workforce, how this has changed over time and how it may be projected to change in the future. However, an effective workforce strategy requires a much more nuanced understanding of the drivers of that workforce – this is particularly critical as the small size of the workforce makes it susceptible to even small changes in demand or supply. Monitoring workforce trends over time also allows builds an evidence base to support prediction or earlier identification of key changes to demand or supply variables and their sustained management.

#### 4.4.4 Global demand for DIMPs

With global demand for DIMPs, any local strategy must also have appropriate reference to the national and international drivers impacting the NSW workforce. Global skills shortages could create a highly competitive and mobile workforce, placing pressure on all employers of DIMPs to maintain competitive attraction, engagement and retention strategies. As well as being listed in the Australian Skilled Occupation List, Diagnostic Imaging Medical Physicists are listed by a number of countries (e.g. New Zealand, Ireland, Canada) as a professional group with long term skills shortages recognised under skilled migrant schemes.

Many stakeholders provided anecdotal reports of DIMPs relocating overseas due to more lucrative remuneration packages, access to emerging technologies, and greater career potential. Equally however, it was noted that Australia is a highly attractive employer and Australian hospitals have also been successful in attracting qualified internationally trained DIMPs.

The possibility of a new International Accreditation for DIMPs is a key change that may significantly impact the Australian and international DIMPs workforce.

[37] Department of Health, Victoria (2013) Medical radiations and imaging technology workforce strategy
[38] Health Workforce Australia (2012) Medical Physicist Workforce Study

Salaries for DIMPs in NSW currently compare favourably to other states[39], positioning NSW well as an employer in the current market, however work across other states to match NSW pay rates has also occurred and NSW must maintain a continued emphasis on attraction, remuneration and retention to ensure that professionals are not lured elsewhere. The demand for DIMPs in both developed and developing countries is also increasing, fuelled by government-led expansion initiatives, as well as increasing consumerism and medical tourism[40]. Combined, these global factors create an interplay of influences that will affect the NSW workforce over time, making the need for an integrated, over-arching workforce strategy imperative to the state's ability to grow and sustain its DIMPs workforce.

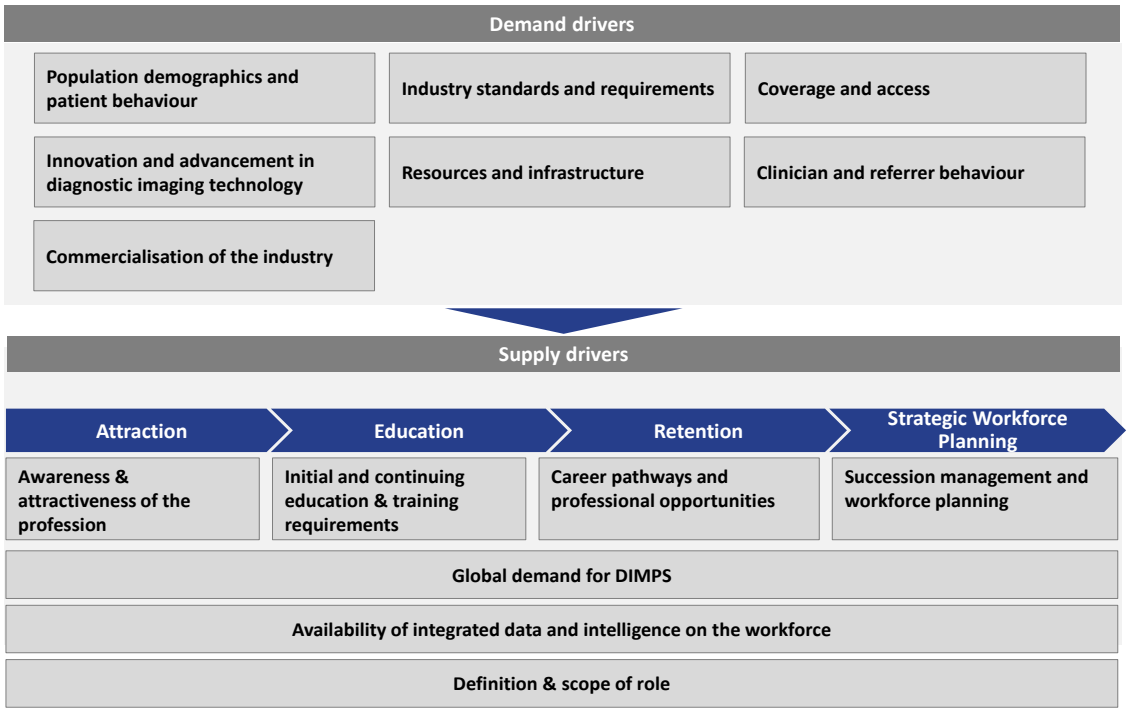
### 4.4.5 Understanding, visibility and profile of the profession

The visibility and profile of the profession was consistently raised by stakeholders as an opportunity for further analysis and improvement. A clear message was relayed by the stakeholders that the value of the DIMP role was not broadly understood, creating ambiguity and variation in the delineation of roles and responsibilities for DIMPs across sites. For example, it was reported that in some areas, there is a view that specialist training or skills was not necessary for the effective operation of medical imaging equipment or conversely, that the role of the DIMP was simply to maintain equipment. It was also noted that within the profession, there are divided views as to whether DIMPs were 'allied health' professionals, or 'health scientists'.

## 4.5 Workforce drivers model – key drivers of workforce demand and supply

The driving factors affecting and supply drivers impacting the DIMPs workforce discussed above are summarised in Figure 9 below. This model formed the basis of the second phase of the research process which was conducted via email questionnaire, interviews and a stakeholder workshop.

**Figure 9 Workforce Drivers**




[39] Round (2012) A 2012 survey of the Australasian clinical medical physics and biomedical engineering workforce, Australas Phys Eng Sci Med. 2013 Jun;36(2):147-57

[40] Mohd-Nor (2011) Medical Imaging Trends and Implementation: Issues and Challenges for Developing Countries, Journal of Health Informatics in Developing Countries

Summary definitions of each of the factors identified in the model above are defined in Table 3 and Table 4 below.

**Table 3: Demand Drivers**

| | |
|---|---|
| Patient trends | Patient characteristics e.g. Ageing population, increased acuity of presenting patients. |
| | Patient expectations: patient expectations and information requirements. Increase in preventative medicine. |
| Industry standards and requirements | Standards: Radiology and radiation safety requirements and professional standards. |
| Coverage and access | Access: Government initiatives to increase coverage of, and access to, diagnostic imaging services.. |
| | Private sector: Provision and growth of services provided by private sector providers. |
| Technological innovation | Advancements in imaging technology: Continued advancement of imaging technology, better imaging quality, introduction of new modalities. |
| | New capacity: Convergence of radiology & nuclear medicine disciplines. Increasing use of diagnostic imaging for therapeutic and interventional purposes. |
| Commercial drivers | Vendors: Vendor trends and influences on adoption and purchase of new equipment. |
| | Financial drivers: Financial incentives for treating private patients. |
| Clinician and referrer behaviour | Referral patterns: Over-referral, or over-reliance on diagnostic imaging. |
| | Clinician preferences: Clinician preferences regarding procedures of choice. |
| Awareness & recognition | Understanding of the profession: Awareness, understanding and perceived value of the profession by community and key stakeholders. |

**Table 4: Supply Drivers**

| | |
|---|---|
| Attracting new professionals | Attraction and awareness: Awareness and attractiveness of the profession to prospective students. |
| | Education and certification: Scope and length of initial education and certification pathway. |
| Education and training | Educators: Availability and supply of appropriately qualified specialist educators. |
| | Training and experience: Availability and capacity for training placements. |
| Career opportunities and progression | Career pathways and opportunities: Availability of career pathways and opportunities within the Australian workforce for qualified DIMPs. |
| | Remuneration: Remuneration levels for DIMPs in Australia, compared to overseas |
| | Succession management and workforce planning: Strategic, whole-of-workforce approaches to workforce planning and succession. |
| | Global mobility: Global demand and opportunity for DIMPs, including potential international accreditation standards. |
| | Lifestyle factors: Personal preferences and lifestyle factors influencing DIMPs' career decision-making. |
| | Scope of role: How the DIMPs role is scoped and defined, and the day-to-day responsibilities that are delivered in practice. |

## 4.6 Notable Drivers

The drivers identified in the workforce model were tested during the remaining consultation phases. In line with the Delphi approach this was an iterative process with factors identified in the initial literature search tested with the respondents and an opportunity given to respondents to add in additional factors they had personally identified. The process then repeated with the responses from the initial consultation phase being tested and ranked utilising a simple scoring methodology. The results of this were further validated with the workshop attendees who were asked to rank and comment on the findings.

As discussed above the first phase of research identified and validated 22 factors driving workforce change, 12 Demand Drivers and 10 Supply Drivers. The second phase of the Delphi survey explored stakeholder perceptions of the significance and direction of influence for each factor. Survey respondents scored each factor on a scale of 1 to 5 for perceived future significance. A score of 1 indicating 'no impact at all' is anticipated, a score of 3 'some impact', and 5 'significant impact' is expected. Respondents also indicated whether they thought the direction of the change driver would: 'Increase', 'Decrease', experience 'No Change' or was too 'Hard to Say'.

Scores were aggregated and drivers assessed on the Supply and Demand sides as below. A complete set of survey responses can be found in Appendix A on page 44 of this document. A total of 9 survey responses were completed and this discrete sample size highlights the qualitative nature of these results.

### 4.6.1 Demand Drivers

The results of the survey are depicted in Figure 10 below and the three highest rated demand drivers are as follows:

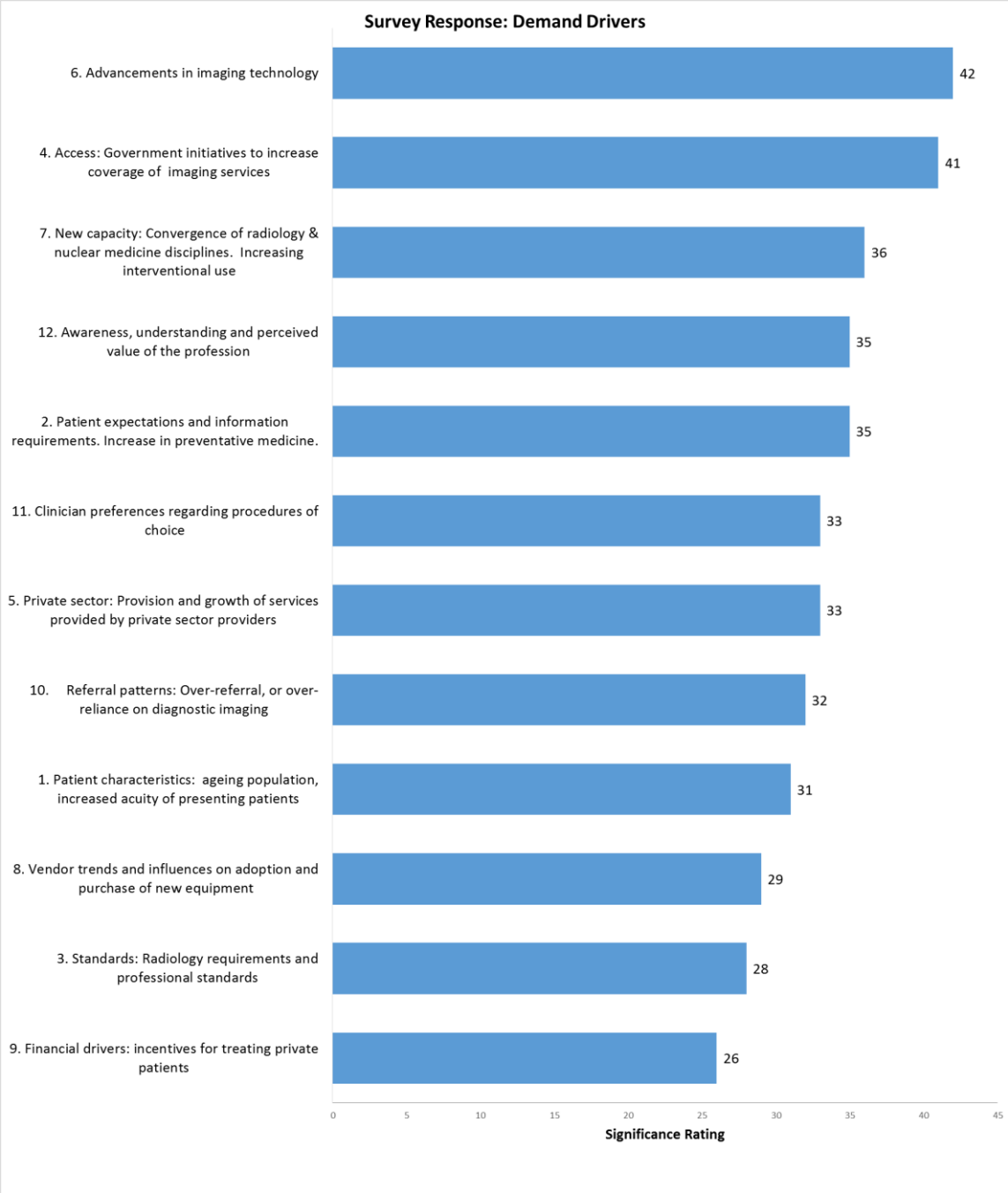
- The impact of new technology was rated by stakeholders as the most significant potential driver of DIMP demand in the years ahead. As new modalities are introduced and imaging performance improves the increased requirement for DIMP input to procedures will correlate
- This is closely followed by the potential of (Federal/State) government initiatives to influence demand for imaging services (e.g. cancer screening initiatives)
- The increasing convergence of radiology and nuclear medicine and the resulting increase in interventional procedures is rated as the third most significant demand driver

The three demand drivers considered to have the lowest significance included:

- The influence of imaging vendors making business-based decisions (as opposed to population-based for example) on the adoption and purchase of new modality equipment in NSW
- Requirements to providers of meeting the safety requirements for Radiology as well as professional standards, no change to these standards is anticipated by stakeholders
- The lowest significance was assigned to the financial incentives of treating private patients and the influence on vendors for the adoption of new modality equipment. Although it is important to recognise the small sample size of this survey, the distribution of these views is of interest. One interpretation could be that this stakeholder group considers the public system to be the main driver of demand (and perhaps Medicare Benefits Schedule compliance) for new equipment/modalities, despite the increase in private provider imaging and vendor involvement in recent years

The consensus of the survey respondents was that the direction of change to demand drivers is increasing. The two exceptions were Radiology Standards, where 'No Change' is expected and Financial Drivers. The potential impact of financial incentives (rated as the least significant demand driver by the group) and the direction of change was rated by most as 'Hard to Say'.

**Figure 10 Expected Influence of Demand Drivers**




### 4.6.2 Supply Drivers

As depicted in Figure 11 below the three supply drivers given the highest significance ratings include:

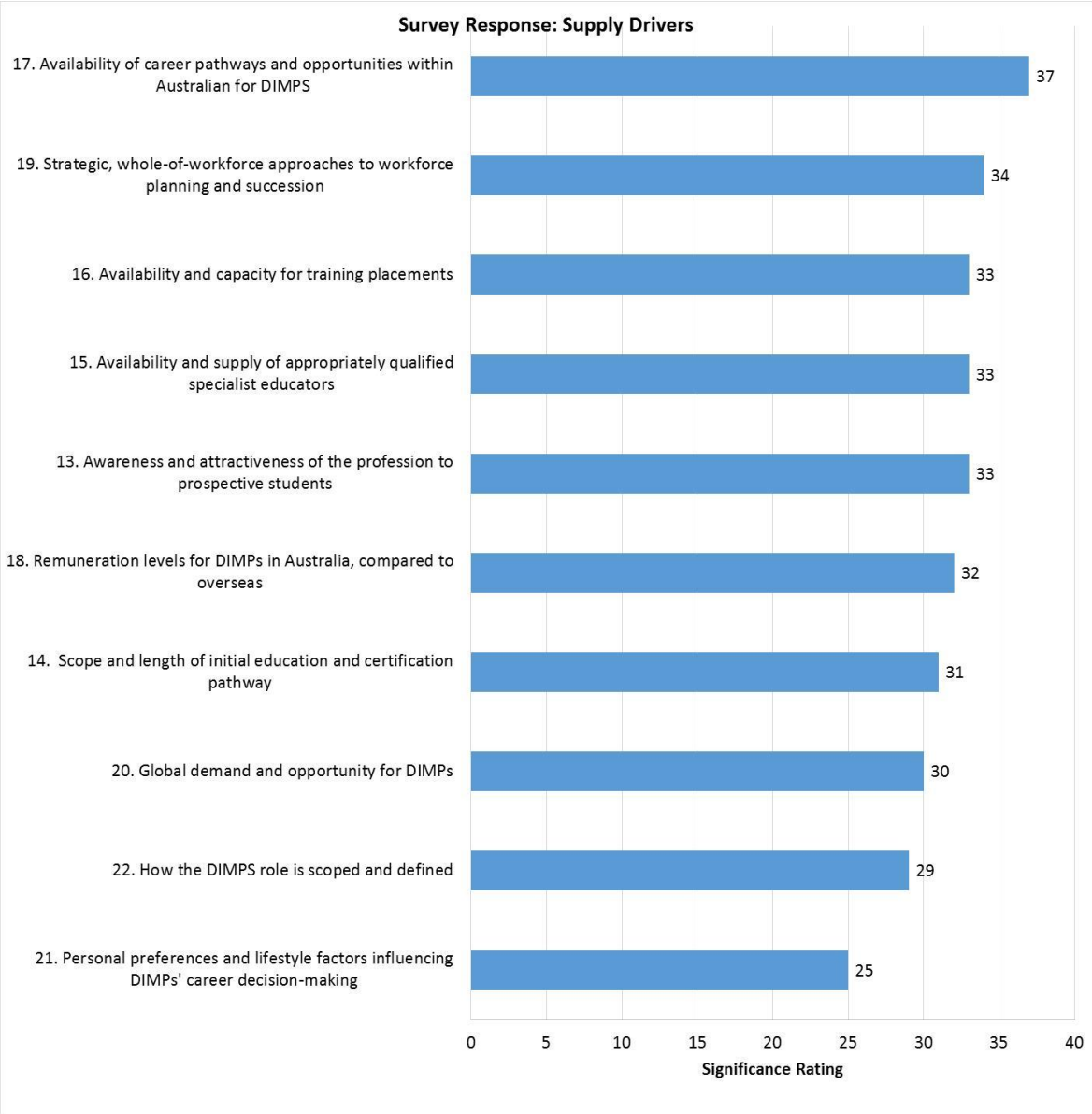
- The current lack of availability of career pathways and opportunities for DIMP staff was rated as the most significant negatively influencing factor on the supply of DIMPs

- The survey group's perception that there is a lack of a strategic, whole of service approach to workforce planning which is itself a product of system managers' limited understanding of the need for and value of DIMPs services
- The low number of training and qualified positions post-graduation (when compared to ROMPs) is perceived as a major constraint to recruitment of new DIMP staff

The three factors of least concern as restraints to supply were considered to be:

- Global demand for DIMPs and availability of potential opportunities in NSW, Australia and overseas
- The present scope of DIMP roles as a potential disincentive to prospective DIMPs.
- The influence of lifestyle and personal preferences as constraints to recruitment of potential DIMP candidates

**Figure 11 Expected Influence of Supply Drivers**



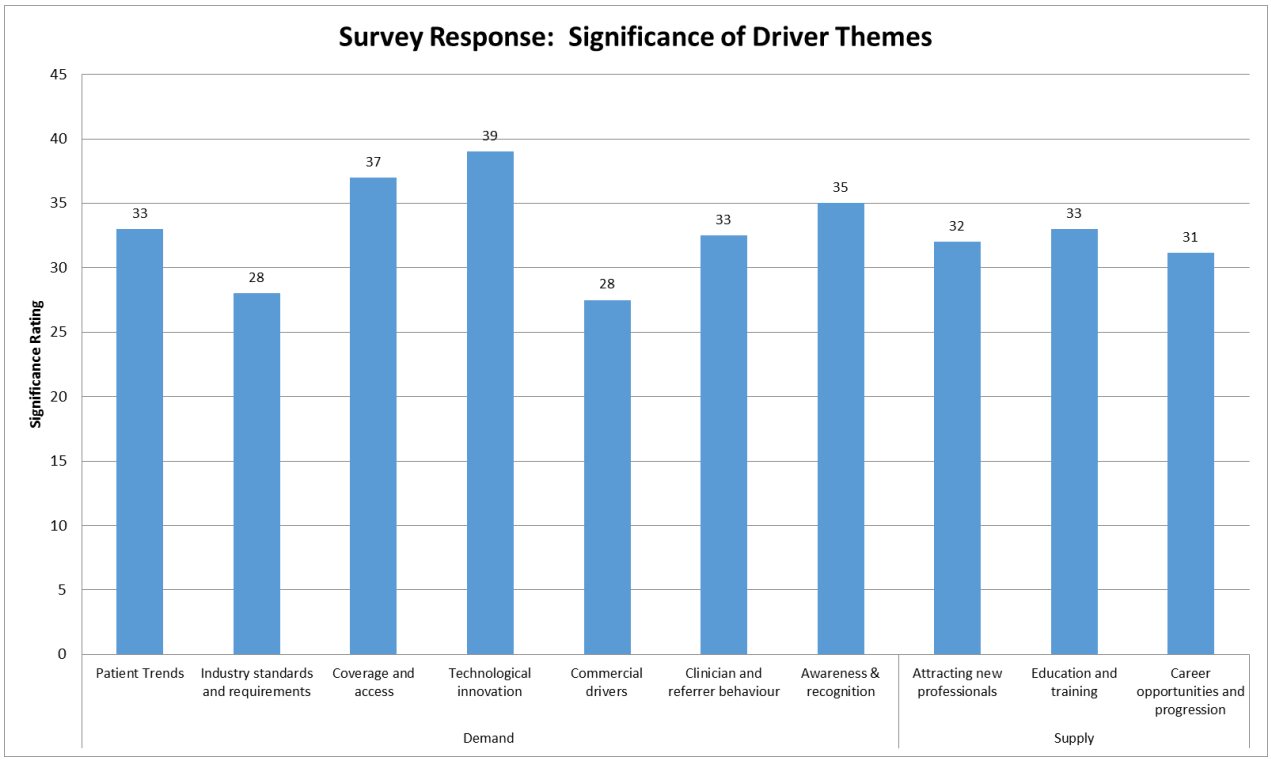
The stakeholder group also described how the sustained lack of training positions has become a self-limiting cycle, as the burden of training others took a disproportionate amount of time because of the low DIMP numbers. The number of available supervisors/educators is also a factor here and is the only driver for which the change direction was considered to be decreasing. Concerns too, are reflected about that the attractiveness of the profession is restricted by a broader lack of awareness of career possibilities.

The direction of change for most supply drivers was considered to be increasing by the survey group (excepting the availability of educators as described above). Response to the potential impact of the scope and practice of DIMP roles was equivocal, with 'Hard to Say' being the majority. 'No Change' was also the most popular response to the expected influence of personal preferences and lifestyle considerations on potential DIMP candidates.

### 4.6.3 Driver Themes

In order to obtain a higher-level view of areas of particular stakeholder emphasis, the 22 drivers surveyed above were grouped into 10 distinct themes, split by Demand and Supply. The scores across each driver within the theme averaged to provide a high level indication of stakeholder emphasis. As we can see in Figure 12 below this view indicates that the themes on the demand side have a slightly higher level of perceived significance than that which is reflected overall on the Demand side, with the impact of technological innovation having the most salience overall. Using this high-level grouping the view of supply factors is evenly spread.

**Figure 12 Expected Influence of Driver Themes**



# 5. Opportunity Areas

The findings detailed in Section 4 above provided the basis for further exploration with stakeholders at the scenario generation workshop (held on September 12, 2014). In this facilitated session stakeholders provided their subject matter expertise to consider the implications of 3 potential future scenarios on the DIMPs workforce planning.

Scenarios were designed to address the most commonly cited drivers in the first phases of the consultation and the results of the Phase 2 of the Delphi survey factored into discussion. In this way the full results of the research were able to be considered by the group. The full scope of stakeholder responses have been included here to illustrate the breadth of thinking across the profession, inclusion of responses in this section of the document should not be confused with endorsement (tacit or otherwise). See Section 6 for the recommendations of this report.

## 5.1 Scenario 1: Role Configuration

The workshop group were asked to consider the following scenario:

> *Assuming that next 5-10 years the number of DIMPs remains static or decreases in the face of steadily increasing demand, **in what possible ways** could the DIMP role be reconfigured, supported or augmented in order to make best use of these scarce resources?*

A number of potential service reconfiguration options were discussed as follows:

| | **Stakeholder Group Response** |
|---|---|
| **5.1.1 A State-wide Service Framework** | All parties acknowledge that the DIMP workforce cohort has a core of specialised skills and statutory responsibilities which is not shared with other Health Professionals. Every Local Health District requires some level of DIMP service provision. The challenge is that these levels vary significantly between LHDs and facilities, depending on the imaging modalities in use and patient flows/workload.<br><br>One proposed solution was a NSW-wide service model where a few major (i.e. key tertiary/quarternary) centres provide services to facilities within appropriate geographical regions, or groupings of LHDs in a 'hub and spoke' configuration. This was approach was highlighted as a potential way to create a critical mass of expertise and capacity to support student training, provide a collegiate environment and improve consistency and quality of care across the state health service.<br><br>Possible risks identified included the upfront cost involved in establishing the service and recognition that that reconfiguring the existing resources would not necessarily address the constraints posed by current staffing levels. |

| | |
|---|---|
| **5.1.2 Co-opt Resources from Associated Staff Groups** | A consistent finding throughout the research process is that a significant proportion of current DIMP activity could be undertaken by other appropriately qualified staff under appropriate supervision. One example cited was the collection and distribution of radiation dosage tags As DIMP roles vary significantly between LHDs then it is expected that the workload passed on to others would be unique to each LHD<br><br>It is acknowledged that DIMPs share a degree of scope overlap with Administrative staff, Nurses, Radiographers and Nuclear Medicine Technicians and there is potential for these groups to perform some tasks which are currently performed by DIMPs. This was considered worthy of exploration, as a means by which to help ensure scarce DIMP resources are deployed on high value activity and more routine administration and compliance tasks were delegated appropriately.<br><br>Concerns were expressed however that knowledge base of Radiographers and Nuclear Medicine Technicians was considerably lower than that of a DIMP in the field of medical physics and safety, and that careful supervision would be required when delegating tasks to associated work roles.<br><br>In some cases this could mean recruitment and training of existing or new staff members. Other points raised for consideration include:<br><br>• What supporting activities (such as portering) can be better supported by but suitably qualified staff?<br><br>• Could the role of radiographer be reconfigured to support DIMPs along the lines of the UK model?<br><br>The group agreed that there was a need for a whole system view for designing future workforce. Planning activities should focus not just on DIMPs, but also the key touch points across the system (referrers, administrative support, patient flow, etc.) to develop a better understanding of where the opportunities lie. |
| **5.1.3 Assistant Medical Physics roles** | The establishment of a DIMP Technician (or other assisting) role is a possible approach to managing low value DIMP and better leveraging current staff capacity as technical roles free up specialised DIMP skills (e.g. label collection). This type of role is not currently used in NSW (Australia) and would need further scoping and review to consider its potential to add value.<br><br>One potential advantage of the DIMP Technician role would be the ability to specifically train staff for the tasks required. However the overhead (training, job design, approvals, funding etc.) of the role establishment process should also be recognised and this would require additional time to implement when compared with leveraging/sharing other Imaging staff groups as discussed above. |
| **5.1.4 Hybrid ROMP and DIMP role** | The possibility of combining the ROMP and DIMP roles was explored in the workshop and was dismissed by broad consensus as impractical given the divergence and specialisation of the individual roles, i.e. that the scope of practice was too broad. Additionally there was a strong expression that the pursuit of such a model would raise significant risks to patient safety as it is considered too difficult to maintain currency of knowledge across both these fields, particularly in this current time of rapid technological change. |

| | |
|---|---|
| **5.1.5 Standardisation of DIMP roles** | The stakeholder group recognised that there was significant disparity between the roles of DIMPs in each of the LHDs. Factors driving this variation include the legacy of historical practice, the limited availability of imaging equipment and the referral patterns of local doctors.<br><br>It was felt that there was scope to standardise elements of the role for which they would need the support of facility/system managers. The risk to quality and consistency, which could be perpetuated without appropriate peer review or support, was raised and would require mitigation. |

## 5.2 Scenario 2: Education and Training Pathways

The workshop group were asked to consider the following scenario:

> *Increasing the number of appropriately trained DIMP staff is key to bridging the projected workforce gap. How could the current education model or training pathway be altered to:*
>
> *Increase DIMP numbers? Accelerate qualifications? Ensure course viability for providers?*

A number of options were discussed as follows.

| | Stakeholder Group Response |
|---|---|
| **5.2.1 Increase sharing of training infrastructure** | The group identified the availability of imaging machinery due to its expense and demand on its utilisation by patients as one of the critical constraints on training provision.<br><br>This is exacerbated when combining with the high costs of training and quality assurance equipment (e.g. Phantoms that mimic human body) that are used infrequently by individual departments<br><br>One proposal offered was that, whilst public hospital imaging equipment was utilised 24 hours a day and therefore not available for training, that there may be scope to utilise the Private Sector equipment which tends to be used 'office hours'. It is accepted within the DIMP community that access to training on equipment occurs 'out of hours' so this was not seen as a barrier. It would also be possible to develop a dedicated training facility with older outdated equipment, but still of course cost dependent |
| **5.2.2 Centralised training simulation facilities** | The potential to centralise training resources was identified as an opportunity to save money but also improve quality of the training. As noted above increased sharing of training facilities would help provide the economies of scale required for sustainable education and training programs. |
| **5.2.3 Private sector contribution to DIMP training** | It was recognised by the Stakeholder group that the Private Imaging Sector benefitted from the services of DIMPs but had little if any involvement in their training. The stakeholders promoted the idea that the Public Sector could provide services on a fee for service basis to the private sector. |
| **5.2.4 Global mobility** | There is a growing global demand for DIMPs and ROMPs. The International Medical Physics certification board was established last year, looking to set up an international accreditation scheme which will create a truly global standard and mobile workforce. If it were possible to leverage a larger pool of international talent than currently, it could be possible to help address projected DIMP shortages through overseas recruitment. Pursuing this course of action assumes that appropriate mechanisms to manage quality will be implemented / observed. |

| | |
|---|---|
| **5.2.5 Constraints on Clinical training** | Currently there are a number of Medical Physicist Registrar training positions within NSW Health. There are not however, a commensurate number of DIMP positions available on completion of training. The shortage of paid training positions is having an effect on student choice between careers in ROMP or DIMP as there is more likelihood of permanent employment as a ROMP.<br><br>The education providers' point of view is that the Clinical training component is the critical constraint. This could be incorporated into the academic courses except that access to machines is prohibitively expensive. This is the rationale for trainee positions as the current mode of delivering clinical training. |
| **5.2.6 Partnership between Health and Education** | The potential for enhanced alignment between education providers and health services was raised as an area for improvement. By strengthening existing (and developing new) partnerships between the universities and the health system/key facilities would help ensure that DIMP training modules are fit for purpose and the skills of the graduates aligned with the requirements of the health system. |
| **5.2.7 Expanded Educator Capacity** | Stakeholders also cited the need to increase the number and expand the scope of DIMP TEAP Supervisor roles in the system to support the continued growth of the future DIMPs pipeline. Current requirements are for a 1:1 Supervisor to Registrar ratio which can prove difficult to achieve with current staffing levels**.** Better supporting educators and training to ensure they have the capacity to support ongoing DIMPs training could accelerate certifications. |

## 5.3 Scenario 3: Impact of new Technology

The workshop group were asked to consider the following scenario:

> *Introduction of new technologies is an area of potentially disruptive change in the coming years. In what ways do you anticipate that technology could alter the DIMP workload including:*
>
> *Current DIMP activities? Referrer behaviours?*

A number of possible changes were discussed as follows.

| | Stakeholder Group Response |
|---|---|
| **5.3.1 Impact of new modalities and increasing rates of intervention** | Imaging uptake is increasing as new technologies enhance it as an interventional, as opposed to a purely diagnostic, modality. Examples include the potential for PET/MRI therapy for hypertension as an alternative to medication. Understanding of new modalities and machines requires deep technical understanding of the relevant engineering, software and data - the increasing need for provision of DIMPs 'specialist knowledge and expertise. |
| **5.3.2 Radiation Safety** | Stakeholders anticipate that technological innovations and adoption of new imaging modalities will ensure that the requirements for DIMP services will grow. They draw a correlation between the trends of growth in technology and the anticipated increase in rates scanning/patient exposure. Increasing the utility and prevalence of imaging creates an increased imperative to better understand the implications of patient radiation exposure. |
| **5.3.3 Activity-based Funding (ABF)** | As the ABF framework reaches maturity, it should drive more efficient use of technology and resources. Transfers of patients between modalities a significant cost factor for LHDs and as awareness of these costs is felt at system level, the logic of economics will drive service efficiency and improvement. |
| **5.3.4 Clinician referrals behaviours** | The group reported that as well as the new technologies that are being introduced the use of existing modalities is shifting clinician referral behaviour too. As improvements to images become available and the prevalence of older modalities (e .g. Fluoroscopy) is in decline. As these referral patterns change, so too does the DIMP workload. |

## 5.4 Other Areas of Opportunity

A range of other areas of potential opportunity were identified outside of the scenario-based exercises as below.

| | Stakeholder Group Response |
|---|---|
| **5.4.1 Clinical risk-based Assessments** | Stakeholders indicate that one way to meet the challenge of increasing demand with limited resources is to make the move to risk-based assessments. The Canadian health system provides an example in this regard, the Ottawa Ankle Rule (OAR).<br><br>This 'rule' is a set of guidelines to help clinicians determine whether x-ray is necessary for ankle injury. Implementation of the OAR resulted in significant change in practice, from 90% of all ankle injuries being x-rayed, with a 10% diagnosis rate. The new impact of the new guidelines transformed this quickly and now 10% of ankle injuries are x-rayed typically, with a 90% diagnosis rate. This provides a far better clinical rationale for additional patient radiation exposure. The OAR is but one example of how risk based assessment can reduce over-ordering and unnecessary patient radiation exposure. |
| **5.4.2 Visibility and awareness** | To address the perceived confusion of the role of the DIMP it was suggested that the profession should have a value statement about why medical physicists are needed by the community (an outside in view, rather than an inside out view) as a key for 'branding' the profession.<br><br>The challenge of raising the profile of the profession was felt to fall on two bodies, the DIMPs professional body (ACPSEM) and the health system at large.<br><br>It was felt the health system could facilitate the raising of the profile of DIMPs whilst at the same time improving medical staff education by incorporating sessions with DIMPs during medical staff orientation. This would be an ideal opportunity (as shown at St Vincent's Sydney) to provide information on the risks and appropriateness of the different imaging modalities available within each hospital, whilst addressing the concern raised within the stakeholder group regarding the lack of knowledge in this area of junior medical staff in particular. |
| **5.4.3 Strategic workforce planning** | There was a consensus view that there is a strong need for an agreed medical physicist workforce model that system planners can use. Current models are provided around the world (e.g. Ireland, the USA etc.) but these do not necessarily apply in Australia. This is because some tasks performed by medical physicists in Europe are performed by technicians here. Once agreed and established this local model would then facilitate accurate projection of staffing requirements, when introducing new equipment for example. |

# 6. Recommendations

This section provides a set of 15 recommendations for future action based on our assessment of the opportunities highlighted and stakeholder views provided during the research and consultation phases. The recommendations made by this report therefore fall broadly into two categories as follows:

a) Managing demand for DIMP services

b) Providing recommendations to increase supply

Recommendations in each category are then further categorised by implementation timeframe, either short or long term.

## 6.1 Managing Demand – Short term (next 12 months)

| | |
|---|---|
| **6.1.1 Support the development and implementation of clinical risk-based assessments** | The development of standardised, clinical risk-based assessments / care pathways for Imaging services should be strongly encouraged and supported wherever possible. During the consultation process a consensus emerged that DIMP workloads have increased due to inappropriate referrals for procedures. It is therefore recommended that consideration be given to developing standardised imaging criteria along the lines of the Ottawa Ankle Rule (OAR), where clinically appropriate.<br><br>It is acknowledged that the variations in imaging practice across NSW are very significant (in some instances up by 100%). The OAR is just one example of standardisation of practice which has shown successfully how to reduce workload and improve the consistency and safety of care<br><br>Successful implementation of standardised practice pathways will, over time, assist in the management of DIMP workload. By making relevant safety information more readily available, routine/low value enquiries to DIMPs should reduce, while the more complex cases will be more appropriately be referred to them. |

| | |
|---|---|
| **6.1.2 Clarify delineation of DIMP roles and scopes of practice** | A more pronounced definition of the roles which reside within the overall DIMP scope of practice (e.g. Radiation Safety Officer) is recommended in order to provide clarity to all stakeholders of the resourcing (types and levels) needed to meet appropriately meet health service requirements for DIMPs. Comparative analysis and assessment of a range of current DIMP position descriptions across NSW would be the first step in this process.<br><br>DIMPs are currently spread thinly and unevenly around the state. The roles are not clearly defined and appear to be a result of historical custom and practice within individual hospitals. This potentially has implications in the quality and reliability of the service provided.<br><br>Increasing role clarity and standardisation would support better understanding of DIMP services, enabling managers to factor in the ability of other staff groups (i.e. Nursing, Administration, other Technician groups) to perform certain tasks which traditionally have been conducted by and /or to assist DIMP staff via the uptake of related (lower value) activity. Radiation Safety roles are often filled by DIMPs in most centres for example, but other workforce cohorts may also be appropriately qualified to perform this function and enable the DIMP post holder to perform more complex activity.<br><br>Development along these lines would also support closer alignment of education and training levels with roles / scopes of practice as appropriate.<br><br>There is a gap in the understanding and standard delineation of DIMP roles which has led to marked variation in the tasks and scope of these positions across NSW. This remains an issue despite the work by ACPSEM in the defining the scope of practice for Qualified Medical Imaging Physicists (June 2014). This document provides a useful starting point for more detailed (i.e. to activity level) workforce planning, aligned either with the requirements of an LHD, or a state-wide DIMP service configuration. |
| **6.1.3 Enhance mentoring Framework** | The increasing scarcity of suitably experienced DIMP staff to act as mentors for junior DIMPs (both during and post TEAP) has been acknowledged as a key risk for sustaining the transfer of knowledge across the profession. It is recommended that a more formal mentoring program be established to leverage the expertise of retired DIMP staff (possibly through the DIMPs community of practice network, see 6.2.3 below) and provide additional mentoring resources to address the current and pending shortage. |
| **6.1.4 Develop a Value Proposition for DIMPs** | It is recommended that the critical importance of the services that DIMPs provide be better articulated to system managers (and other key stakeholders) through the development of a DIMP value proposition. This to be a concise statement which provides a summary expression of the benefits of DIMP services. A simple way help to provide better understanding about the role and to highlight the DIMPs vital contribution to patient safety and the quality of care.<br><br>At present there is considerable ambiguity surrounding the role, there is very limited understanding of the difference between a DIMP and a ROMP for example. A DIMP value proposition would be a simple way to differentiate and highlight the importance of the profession, not just to system managers but to potential candidates and the public at large. |

| | |
|---|---|
| **6.1.5 Improve Workforce Data Collection** | It is recommended that a NSW workforce dataset for DIMPs (comprising both quantitative and qualitative elements) for DIMPs be developed and that data collection is initiated as soon as possible. The absence of a clear, consistent and integrated set of workforce data is restricting the ability of system managers to monitor and plan accurately as regards the demand and supply of DIMPs. It is anticipated that this data set could also incorporate DIMPs working in the private sector. Development and maintenance of a concise and well-defined data set would provide a valuable evidence base to enhance workforce planning and a resource to support the activities of DIMP professional bodies (e.g. a DIMP Community of Practice, ACPSEM). |

## 6.2 Increasing Supply - Short Term (next 12 months)

| | |
|---|---|
| **6.2.1 Expedite TEAP certification process** | A re-phasing of the vocational component of DIMP training is recommended in order to allow trainees to be certified for independent clinical practice on a by competency basis. At present graduates are not able to practice without supervision (in any competency area) until the full TEAP process has been completed and certified – a process which typically takes 3-5 years (post-graduation).<br><br>If trainees were able to practice each competency as soon as they completed the relevant training module, this would accelerate the deployment and utility of new DIMP staff. Given the small size of the DIMP cohort and the duration of the current TEAP pathway, the potential additional DIMP resource which could be brought online is potentially significant. |
| **6.2.2 Pursue international DIMP certification** | It is recommended that the move towards international DIMP certification (managed through ACPSEM) be supported in order to enhance workforce mobility and leverage the global talent pool. Effectively bridging the pending DIMP workforce gap in NSW is unlikely to be achieved in the short term via increases in training and education alone (i.e. locally-developed DIMPs) and recruitment from overseas provides a short term solution which can augment moves to train more Australian staff, more quickly.<br><br>At present only the qualifications of DIMPs from the UK and Canada are recognised here, the move to a broader international certification would increase the potential talent pool from which NSW could draw and also offer the prospect of greater global mobility to those students considering a career in medical physics. |
| **6.2.3 Establish a DIMP Community of Practice in NSW** | A community of practice is a simple, but important way to strengthen the DIMP network (at present largely informal) in NSW. Its purpose would be to support staff who can feel isolated at times, given the DIMPs distributed nature as a very small workforce and also provide a forum by which members can share learnings, facilitate training and mentoring as well as experiences and opportunities.<br><br>A community of practice is differentiated from a college as it specifically a peer-group, with a flat structure and little hierarchy. Membership could easily include retired staff as well, in order to increase the ranks of potential mentors and provide the benefit of their experiences to the broader group. |

| | |
|---|---|
| **6.2.4 Explore potential to enhance access to imaging equipment for training purposes** | Engagement with private health providers is recommended to seek agreement to access imaging equipment out of hours for training purposes. Access to machine time has been identified throughout the research process as one of the key constraints on the DIMPs education and training pathway. Modality equipment at private facilities hospitals is often in use only during business hours (i.e. circa 8am – 5pm) and this is in contrast to machines at public hospitals, which are generally reserved for patient use between 7am and 11pm.<br><br>Given the low numbers of trainees involved it would likely not require more than one or two facilities to participate in order to greatly benefit students and expedite the training process. This could be a trialled as an interim measure until a longer term solution was implemented. |
| **6.2.5 Enhance DIMP role in medical education** | It is recommended that a greater role for DIMPs in conjunction with Radiologists and Nuclear Medicine Physicians be included in Medical Staff education. During the consultation process it emerged that DIMPs considered the radiation risk inherent to current imaging practices was not given sufficient consideration when referring patients.<br><br>This was felt to be due to a number of factors including systemic pressure to diagnose conditions quickly particularly in the Emergency Department, consumer pressure, medico-legal factors, traditional practice and a lack of knowledge particularly among junior medical staff. |
| **6.2.6 Establish common approach to workforce modelling and strategic planning** | The increasing pace of technological development is highlighted in the pending introduction of new modalities (e.g. proton beam therapy) and the increasing prevalence of interventional radiology (e.g. PET/MRI therapy for hypertension). Along with the new technologies and techniques comes a potential increase in demand for DIMP expertise, to assess the patient safety implications of increased exposure, to understand and calibrate new equipment and related systems.<br><br>Stakeholders agreed that succession management and a longer term approach to managing and developing DIMPs was critical to the sustainability of the profession. The development of a common understanding of Imaging service requirements for DIMP skills is recommended to enhance workforce modelling. More accurate (i.e. needs based) determination of staffing requirements would support strategic workforce planning while also and providing enhanced clarity to system managers of service need<br><br>Access to up-to-date workforce intelligence and data about the workforce would also support proactive workforce management efforts. |

## 6.3 Managing Demand – Longer Term (12-24 months)

| | |
|---|---|
| **6.3.1 Establish hub and spoke service configuration for NSW DIMPs** | The establishment of state-wide approach to the provision of DIMP services is recommended to ensure that all LHDs have sufficient and appropriate access to the expertise of this staff group. Even with improvements in other areas the present scarcity of DIMP resources in NSW is unlikely to be remediated in the short term. The establishment of a formal clinical network of DIMP staff is recommended, with hubs at key facilities (e.g. at Westmead, John Hunter Hospitals) radiating service spokes to smaller sites as required. Workflows could then be managed centrally to ensure appropriate coverage across LHD clusters. Planning on a state-wide basis would provide greater visibility of DIMP activity and value, and could also support cost sharing between LHDs.<br><br>The potential of this model is likely to be enhanced if implemented along with the standardisation redesign of DIMP roles and introduction of assisting medical physics positions and/or task reassignment to other Imaging staff groups. |
| **6.3.2 Develop Assistant DIMP roles** | The development of the DIMP Technician role (assuming a current model is not in practice/previously implemented) is recommended as a means to absorb the lower value activity currently required of fully qualified DIMP staff and free up their time to focus on more complex, higher value activities. There is a range of miscellaneous activities (collection of radiation dosing tags, portering etc.) which presently comprise part of the DIMP role and that represent questionable value considering the qualifications and specialist expertise required of DIMP staff.<br><br>The technician role could also play an important role in a state-wide service configuration, providing crucial resource on site as DIMPs flex across sites as required. Additionally this type of auxiliary roles has potential to provide an additional vocational pathway into the profession for interested candidates. |

## 6.4 Increasing Supply - Longer Term (12 -24 months)

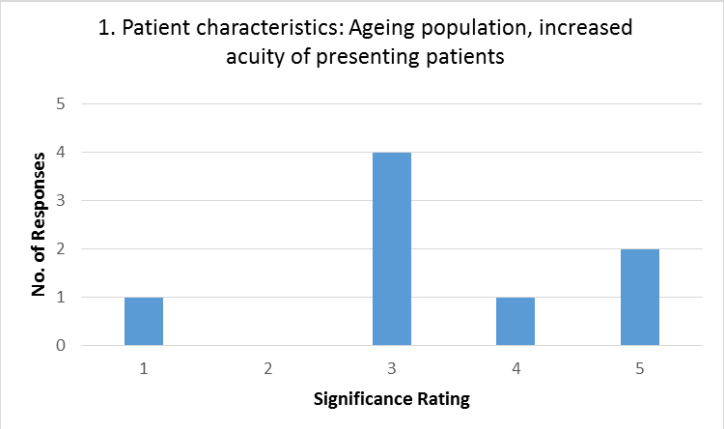
| | |
|---|---|
| **6.4.1 Enhance alignment of education providers' courses with health system needs** | It is recommended that partnerships between education providers and health services be encouraged, supported and enhanced. Closer relationships are one way to help ensure that the academic modules offered are fit for purpose and best align with the TEAP and the current requirements of the NSW health system. The stronger the relationships between the two sectors the better the education and training process will likely perform. Planning a sustainable future workforce requires that course offerings are fit for purpose and that there suitable employment prospects for graduates are available. Establishment of more formal partnerships between key universities and hospitals could offer a range of benefits, for example the potential to better integrate clinical training into the academic modules, possible truncating the training time requirements. |
| **6.4.2 Promote the establishment of a fully equipped training simulation centre** | The establishment of a fully equipped simulation centre for DIMP training is a longer term objective which is deserving of support and the exploration and promotion of the concept is recommended. The centre would most likely need to be set up at national-level (or at very least in partnership with another jurisdiction) given the economies of scale to which are required to ensure its viability and value for money.<br><br>Successful development of the simulation centre would offer a more permanent solution to the challenge of providing machine infrastructure for modality training. Inclusion of all the branches of Medical Physics and other Radiologist workforces would also strengthen the business case for the centre and offer cross training potential should that considered desirable in the future. |

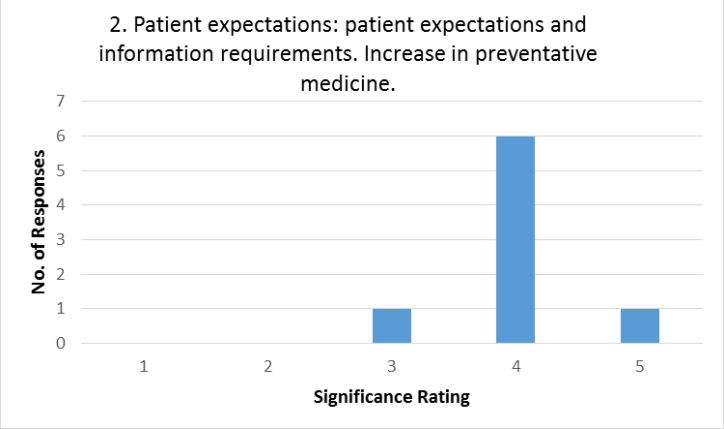
# 7. Appendix A: Stakeholder Survey Results

This section provides the detailed results of the stakeholder survey. Each driver was rated by expected significance on a scale of 1-5 where 1=no impact at all, 3 = some impact, 5= significant impact

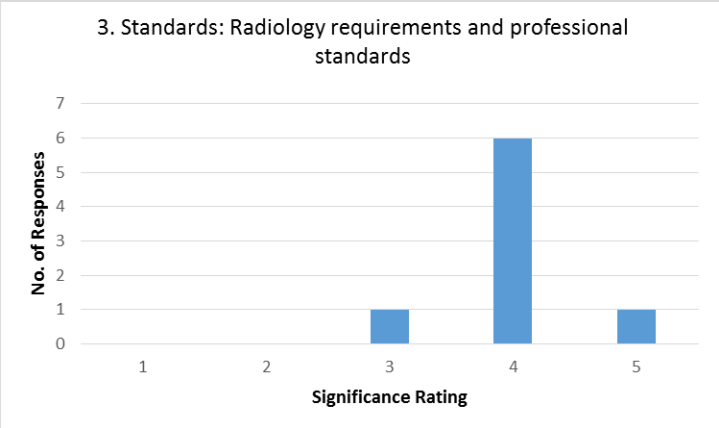
## 7.1 Demand Drivers

### 7.1.1 Patient Trends

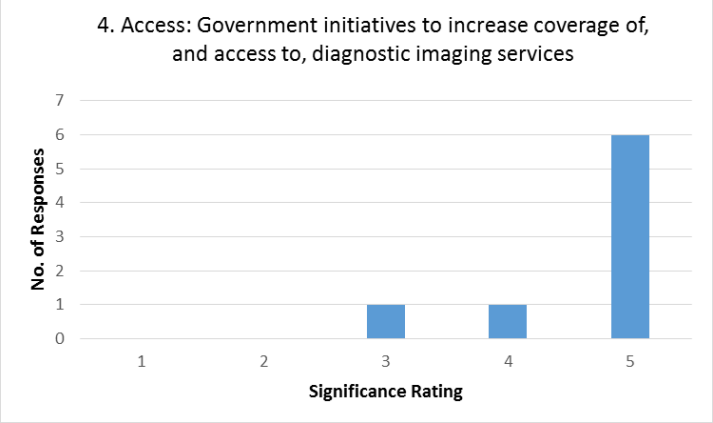


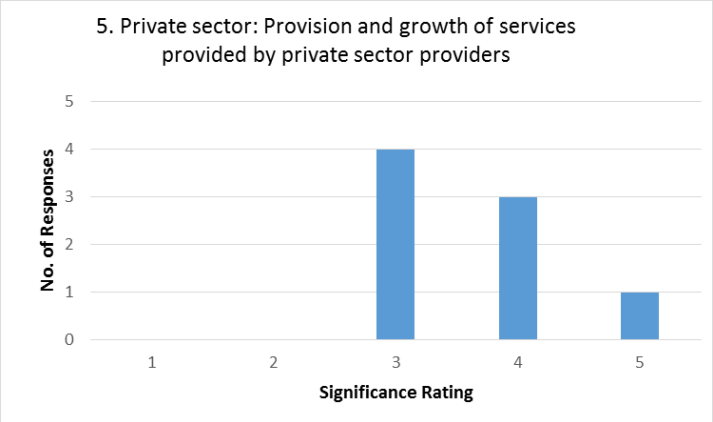



### 7.1.2 Industry Standards and Requirements

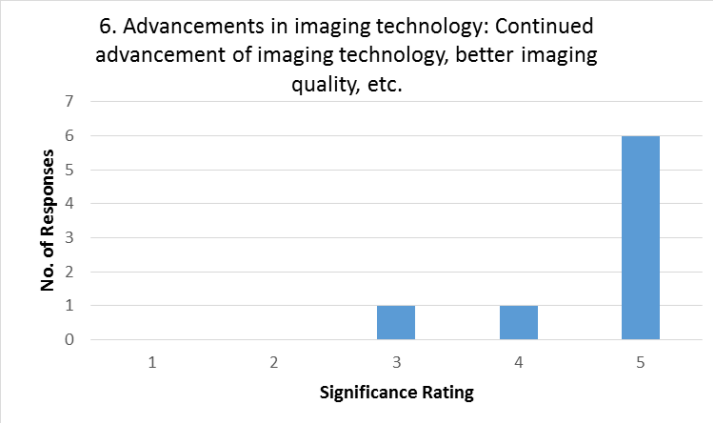


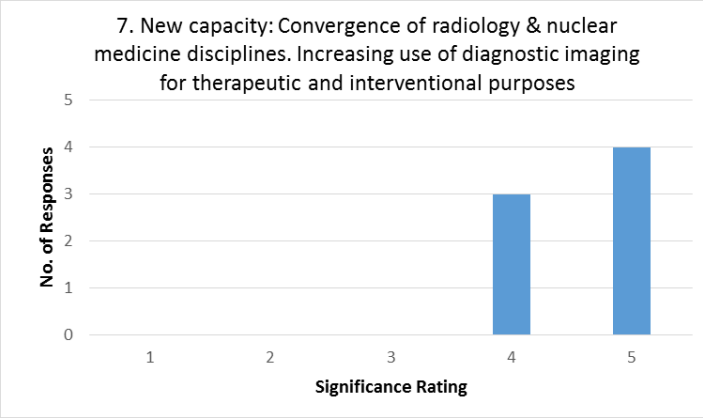

### 7.1.3 Coverage and access



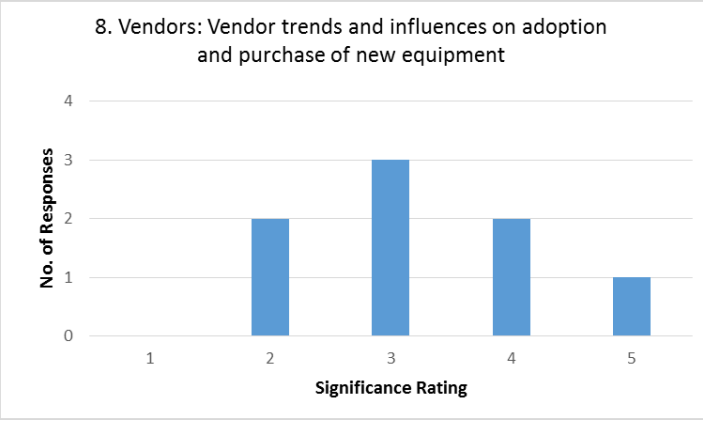



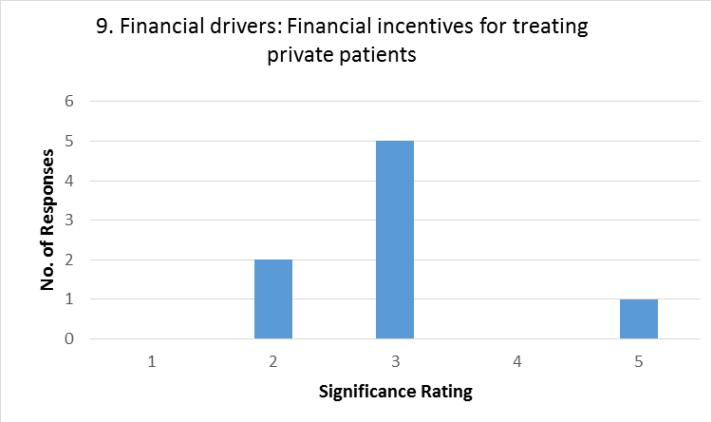
### 7.1.4 Technological innovation



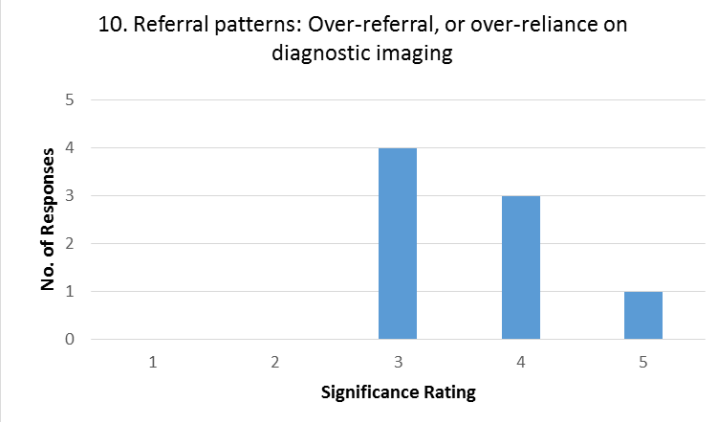



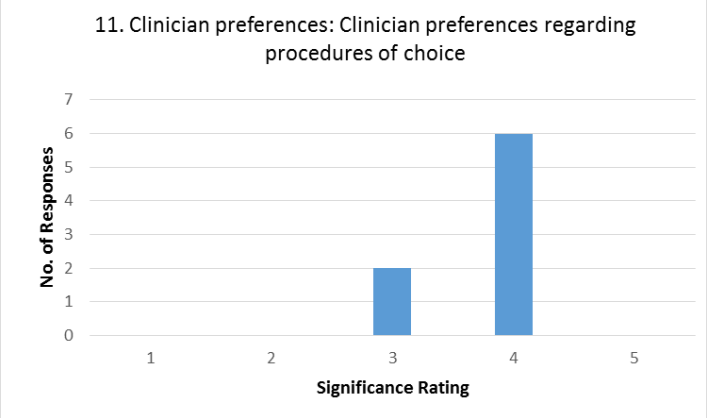

### 7.1.5 Commercial drivers



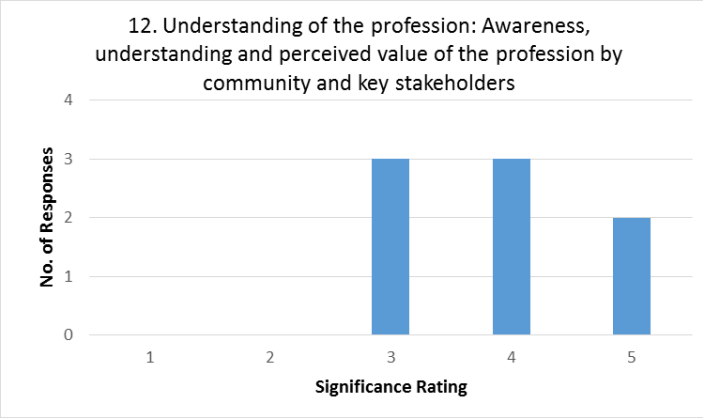



### 7.1.6 Clinician and referrer behaviour



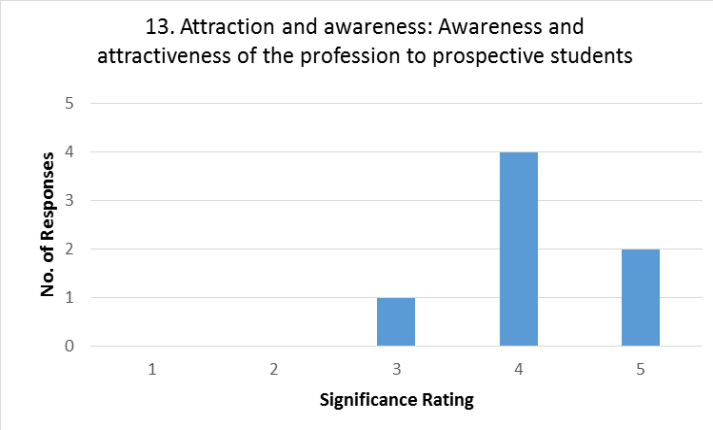
### 7.1.7 Awareness & recognition

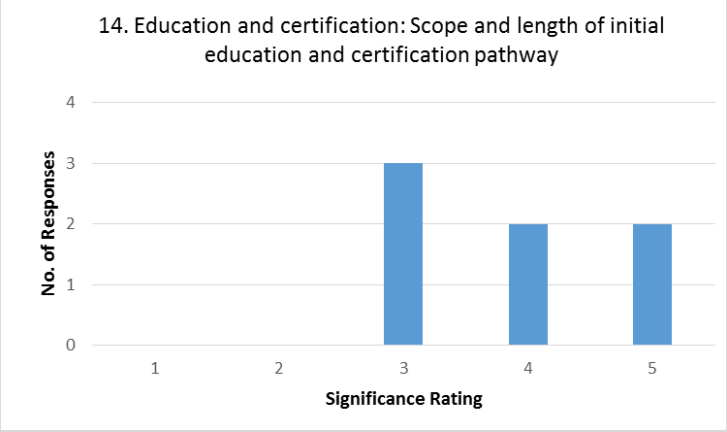



## 7.2 Supply Drivers

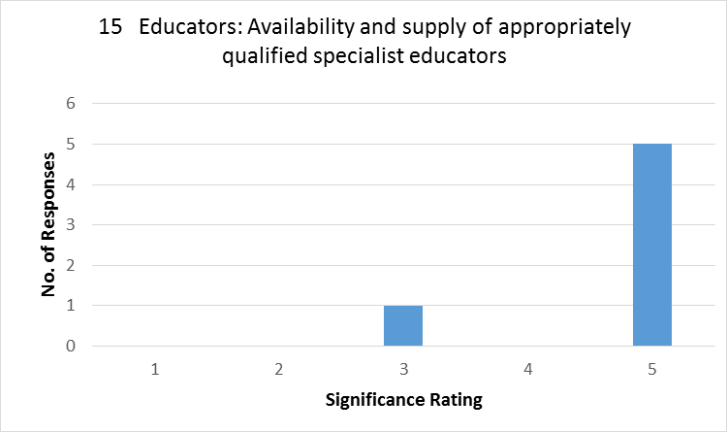
Responses to the supply driver questionnaire are grouped into 3 key themes as follows:

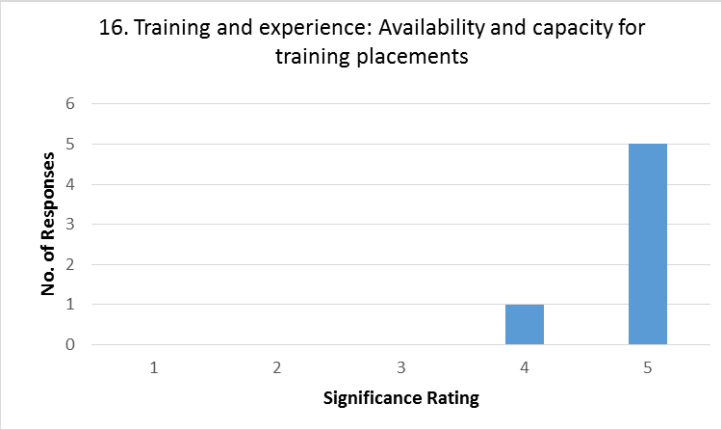
### 7.2.1 Attracting new professionals



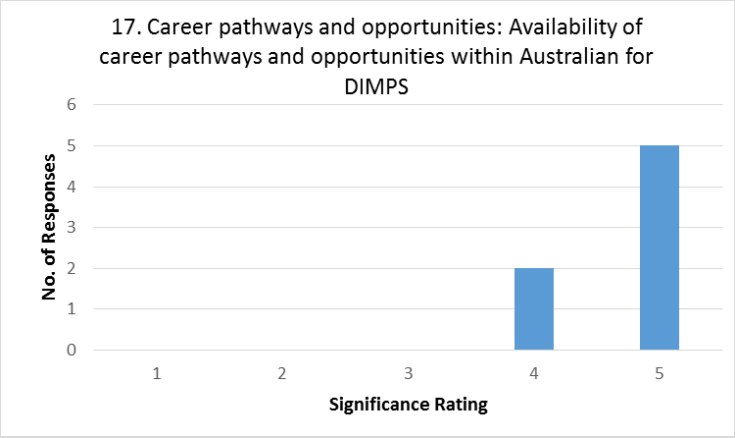



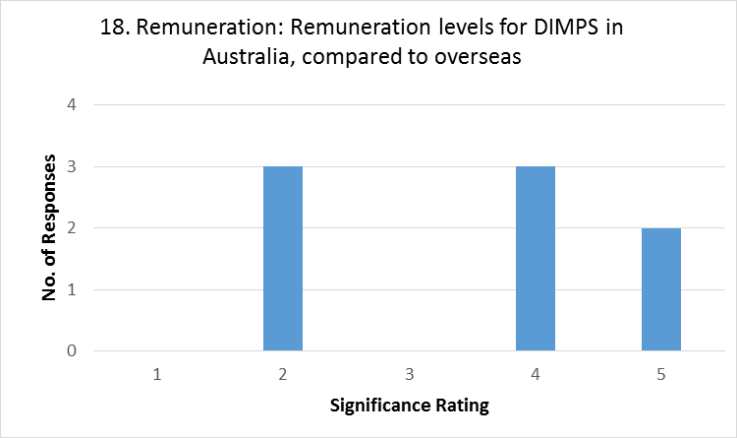
### 7.2.2 Education and training



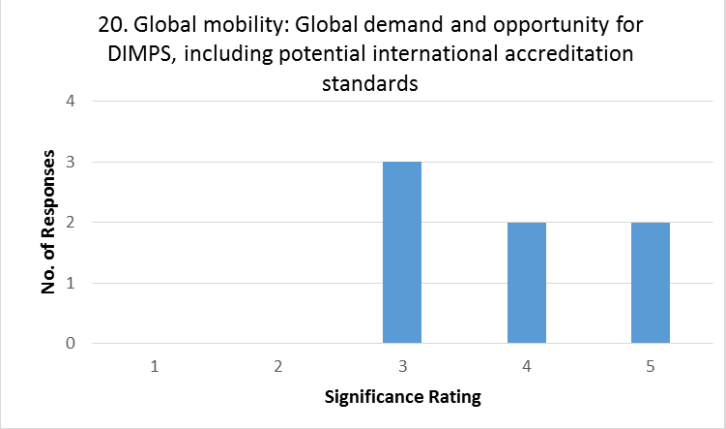



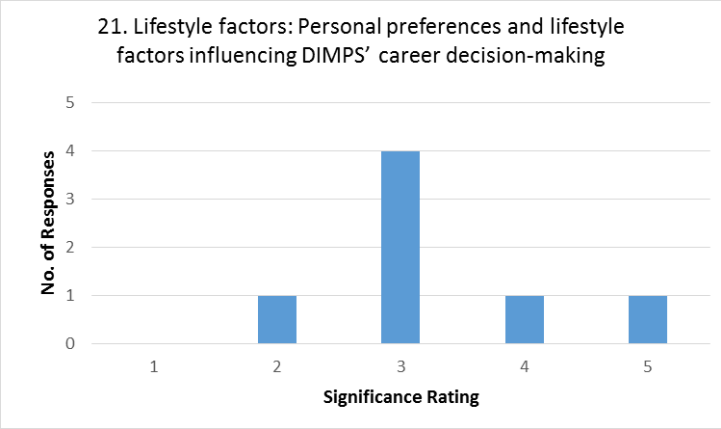

### 7.2.3 Career opportunities and progression

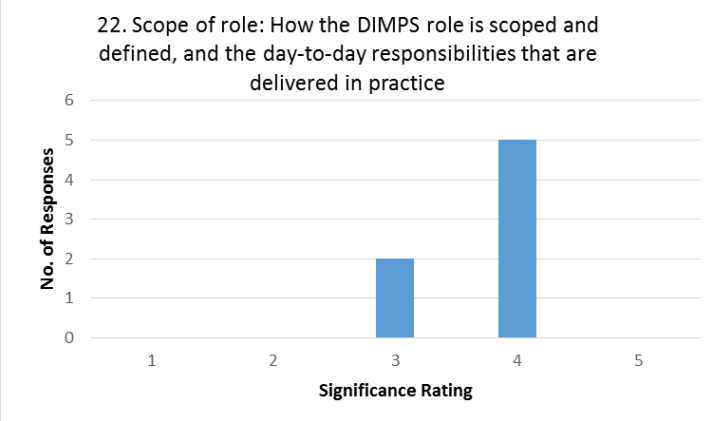



18. Remuneration: Remuneration levels for DIMPS in Australia, compared to overseas
No. of Responses
0
1
2
3
4
1
2
3
4
5
Significance Rating


19. Succession management and workforce planning: Strategic, whole-of-workforce approaches to workforce planning and succession
No. of Responses
0
1
2
3
4
1
2
3
4
5
Significance Rating


20. Global mobility: Global demand and opportunity for DIMPS, including potential international accreditation standards
No. of Responses
0
1
2
3
4
1
2
3
4
5
Significance Rating


21. Lifestyle factors: Personal preferences and lifestyle factors influencing DIMPS' career decision-making
No. of Responses
0
1
2
3
4
5
1
2
3
4
5
Significance Rating


22. Scope of role: How the DIMPS role is scoped and defined, and the day-to-day responsibilities that are delivered in practice
No. of Responses
0
1
2
3
4
5
6
1
2
3
4
5
Significance Rating

# 8. Appendix B: Stakeholder Survey

This section provides copies of the survey forms as issued to stakeholders in July and August 2014

## Diagnostic Imaging Medical Physicists (DIMPs) Horizon Scanning Survey

### Background

As you may be aware, the NSW Health Professionals Workforce Plan 2012-2022 identifies 5 small but critical workforces that require enhancement to meet the needs of a changing health care service in NSW. Diagnostic Imaging Medical Physicists are one of the 'small but critical' workforces identified. A workforce action plan will be developed to ensure the sustainability and capacity of the profession to meet need.

### About this survey

This survey is designed to ensure that all relevant risks, issues and opportunities relating to the workforce are identified and considered as part of the horizons scanning process and resulting action plan.

It is expected that this survey will take 20-30 minutes to complete.

### Completing this survey

***Please complete this survey by 16 August 2014 and return it via email or mail to:***
Ms Tamara Lee
Principal Allied Health Advisor
Workforce Planning & Development Branch
NSW Ministry of Health
Email: talee@doh.health.nsw.gov.au
Phone (02) 9391 9803

# Diagnostic Imaging Medical Physicists (DIMPs) Horizon Scanning Survey

## Part 1: About you

This information helps us to understand the representation of different stakeholder groups in the research process, and how the key issues, risks and opportunities identified may impact stakeholder group differently.

Your responses will be anonymous and reported only in aggregate form, such that no respondent is individually identifiable.

| Question | Response |
|---|---|
| • **Your name** | |
| • **Your role** | |
| • **Your LHD, institution or organisation** | |
| • **Your tenure in your current role** | |

## Part 2: The profession – now and in the future

In this section, we also explore your views regarding the challenges and opportunities for the profession as a whole.

This section is designed to explore the dynamics and drivers of the profession that may not necessarily be apparent from a review of workforce data alone. We are interested in understanding your experience in the profession so that any future workforce action plan is appropriately cognisant of the needs, interests and drivers of current and future DIMPs.

*These survey questions are intentionally broad, so that the scope of your response is not limited.*

| Question | Response |
|---|---|
| • **What attracted you to your profession?** | |
| • **What motivates you to remain in your profession?** | |
| • **What are some of the key challenges you face in your day-to-day role? How do you address them? What possible solutions exist?** | |
| • **What do you see as the most critical challenges facing your profession today?** | |
| • **What do you anticipate as the most critical challenges facing your profession over the next 5-10 years?** | |

| |
|---|
| • **What opportunities do you see to support the growth and enhancement of your profession?** |
| • **Do you have any suggestions for adapting the initial and ongoing training and education pathways for your profession?** |
| • **Do you foresee any risks to the growth and sustainability of the DIMPs workforce now, or in the future? Please describe.** |

## Part 3: Open response

Is there anything else we should have asked you in this survey, or which we should include in the next survey? What is it and why?

| |
|---|
| |

**Thank you for your feedback. Your responses will help us ensure that we have captured and considered a comprehensive range of factors in our review.**

# Diagnostic Imaging Medical Physicists (DIMPs) Horizons Scanning Project

## Introduction

Thank you for your participation in the DIMPs Horizons Scanning project to date. Your input has been extremely valuable in informing and refining our view of the key drivers that are likely to impact this small but critical workforce in the future.

A range of demand and supply drivers were identified through our first round interviews. We would like to provide this opportunity for you to review and comment on the range of factors that were identified by your colleagues.

We understand your time is limited, but we greatly value your input in this exercise as it allows us to validate and ensure the comprehensiveness of the model we have developed, as an input to the DIMPs workforce action plan to be developed by the Ministry of Health. We have endeavoured to keep this survey as short, yet comprehensive, as possible.

Following this survey will be a final, optional workshop, intended to explore these factors in a range of scenario planning discussions. If you would like to participate in this workshop, please indicate your interest to Tamara Lee. The workshop will be held at the end of August/early September.

## Completing this survey

It would be appreciated if you could complete and return this survey by Friday 29th August. We anticipate this survey will take approximately 15-20 minutes to complete.

Surveys can be returned to Nina Dejmanee via email.

**Nina Dejmanee**
**Senior Associate, Francis Group International**
Email: nina.dejmanee@fgconsult.com

*Thank you for your input.*

fgi
explore design deliver

## Factors likely to influence future demand for DIMPs.

**In early round interviews for the horizons scanning process, a range of <u>demand</u> factors were raised. These are summarised below**. We invite you to review these factors and to provide your views regarding:

- The level of **significance** of each factor in influencing
- The direction of that impact (that is, is the driver expected to decrease or increase demand in the future?)

| How *significantly* is this factor expected to influence demand? *On a 1-5 scale where 1=* no impact at all, 3= some impact, and 5=significant impact | | | | | | In which *direction* is it likely to influence demand (compared to today)? | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | |
| Patient trends | | | | | | | |
| 1. **Patient characteristics:** E.g.,: Ageing population, increased acuity of presenting patients | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| 2. **Patient expectations:** patient expectations and information requirements. Increase in preventative medicine. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| Industry standards and requirements | | | | | | | |
| 3. **Standards:** Radiology requirements and **professional** standards | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| Coverage and access | | | | | | | |
| 4. **Access:** Government initiatives to increase coverage of, and access to, diagnostic imaging services | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| 5. **Private sector:** Provision and growth of services provided by private sector providers | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| Technological innovation | | | | | | | |
| 6. **Advancements in imaging technology:** Continued advancement of imaging technology, better imaging quality, etc. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| 7. **New capacity:** Convergence of radiology & nuclear medicine disciplines. Increasing use of diagnostic imaging for therapeutic and interventional purposes | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| Commercial drivers | | | | | | | |
| 8. **Vendors:** Vendor trends and influences on adoption and purchase of new equipment | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| 9. **Financial drivers:** Financial incentives for treating private patients | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **Clinician and referrer behaviour** | | | | | | | |
| 10. **Referral patterns:** Over-referral, or over-reliance on diagnostic imaging | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| 11. **Clinician preferences:** Clinician preferences regarding procedures of choice | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| Awareness & recognition | | | | | | | |
| 12. **Understanding of the profession:** Awareness, understanding and perceived value of the profession by community and key stakeholders | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |

## Factors likely to influence future supply of DIMPs.

**In early round interviews for the horizons scanning process, a range of <u>supply</u> factors were raised. These are summarised below**. We invite you to review these factors and to provide your views regarding:

- The level of **significance** of each factor in influencing future supply of DIMPs
- The **direction** of that impact (that is, is the driver expected to positive or negative impact on supply in the future?)

| How *significantly* is this factor expected to influence supply?<br>*On a 1-5 scale where 1*= no impact at all, 3= some impact, and 5=significant impact | | | | | | In which *direction* is it likely to influence supply (compared to today)? | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | |
| **Attracting new professionals** | | | | | | | |
| **13. Attraction and awareness:** Awareness and attractiveness of the profession to prospective students | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **14. Education and certification:** Scope and length of initial education and certification pathway | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **Education and training** | | | | | | | |
| **15. Educators:** Availability and supply of appropriately qualified specialist educators | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **16. Training and experience:** Availability and capacity for training placements | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **Career opportunities and progression** | | | | | | | |
| **17. Career pathways and opportunities:** Availability of career pathways and opportunities within Australian for DIMPs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **18. Remuneration:** Remuneration levels for DIMPs in Australia, compared to overseas | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **19. Succession management and workforce planning:** Strategic, whole-of-workforce approaches to workforce planning and succession | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **20. Global mobility:** Global demand and opportunity for DIMPs, including potential international accreditation standards | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **21. Lifestyle factors:** Personal preferences and lifestyle factors influencing DIMPs' career decision-making | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |
| **22. Scope of role:** How the DIMPs role is scoped and defined, and the day-to-day responsibilities that are delivered in practice | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ Decrease<br>☐ Increase | ☐ No change<br>☐ Hard to say |

## Opportunities

A range of opportunities to support the growth and sustainability of the DIMPs workforce have been identified by interviewees as areas for possible exploration. We invite you to review and comment on these early opportunities, as well as provide any additional ideas for consideration.

| Opportunity area | Your comment (optional) |
|---|---|
| Knowledge sharing and transfer across the profession. In particular, this relates to the sharing of experience and knowledge from more experienced DIMPs to junior DIMPs channels such as mentoring. It also includes ongoing communities of practice to support continued professional development and knowledge sharing | Click here to enter text. |
| Capacity of the education and training system: Increasing the number and scope of educator roles in the system to support the continued growth of the future DIMPs pipeline. Better supporting educators and training to ensure they have the capacity to support DIMPs training. | Click here to enter text. |
| Workforce structure. This includes reviewing the structure and pattern of employment of DIMPs, including but not limited to: locum positions, conjoint positions | Click here to enter text. |
| Role definition and scope: This refers to defining the scope and boundaries of the DIMPs role, and supporting or adjacent roles, to achieve better utilisation of core skills for all professional groups | Click here to enter text. |
| Profile and branding of the profession: Efforts to increase the profile and brand of the profession, for example, the creation of a community 'value statement for the role and value of DIMPs in the health sector | Click here to enter text. |
| **Other?**<br>Click here to enter text. | Click here to enter text. |

## Additional comments

Do you have any additional comments regarding the factors addressed in this survey, or would you like to raise any additional factors for consideration?

Click here to enter text.

# 9. Appendix C: List of References


- Alexander (2008) *Healer or Dealer: Is Entrepreneurialism Ruining Our Diagnostic Imaging Commons?* The Internet Journal of Law, Healthcare and Ethics, Vol. 6 (2)
- APCSEM (2013) *Submission to Australian Workforce and Productivity Agency for the Skilled Occupation List 2013*, accessed at http://www.awpa.gov.au/our-work/labour-market-information/skilledoccupationlist/Documents/2013Submissions/27AustraliasianCollegeofPhysicalScientistsandEngineersinMedicine.pdf on 18 June 2014
- Australian Diagnostic Imaging Association Press Release, 13 May 2014, *Budget goes exactly the wrong way for DI patients.* *h*ttp://www.adia.asn.au/sites/default/files/ADIA_Budget%20goes%20exactly%20the%20wrong%20way%20for%20DI%20patients.pdf, accessed 20 June 2014
- Cormack (2011) *Editorial: the ACPSEM diagnostic imaging TEAP project*, Australasian Physical and Engineering Sciences in Medicine 34:173–178
- Deloitte Centre for Health Solutions (2013) *Working differently to provide early diagnosis: improving access to diagnostics.*
- Department of Funding of Health, Victoria (2013) *Medical radiations and imaging technology workforce strategy*
- Department of Health and Ageing (2012) *Fact Sheet: Improving access to Magnetic Resonance Imaging (MRI) services*. http://www.health.gov.au/internet/main/publishing.nsf/Content/D572E27CCF351376CA257BF0001AFD8A/$File/Improving%20Access%20to%20MRI%20Services%20Fact%20Sheet.pdf on 20 June 2014
- Department of Health Victoria (2010) *Victorian Medical Radiations Workforce Supply and Demand Projections (2010–2030)*
- Department of Health, Victoria (2013) *Medical radiations and imaging technology workforce strategy*
- *Enterprise Imaging Repository scoops Premier's Award for developing the first state-wide medical imaging repository in Australia* http://www.fujitsu.com/au/about/resources/news/press-releases/2013/20131213-01.html
- Health Workforce Australia (2012) *Medical Physicist Workforce Study*
- HealthConsult. *Radiation Oncology Workforce Planning. Final Report for Department of Health and Ageing*. Sydney: HealthConsult, November 2009.
- http://www.adia.asn.au/
- Hughes (2012) *NSW public hospitals accessing digital radiology images Cardiovascular Diagnosis and Therapy*, 2(4):E14-E15
- Market Wired Press Release, 26 June 2013, *Patient Demand for High-Quality Medical Imaging at a Competitive Price Drives Expansion for a Local Provider*,
- http://www.marketwired.com/press-release/Patient-Demand-High-Quality-Medical-Imaging-Competitive-Price-Drives-Expansion-Local-1815006.htm accessed 20 June 2014
- Medical Scientists Association of Victoria (2012) *Shortage of Medical Physicists in Victoria threatens timely diagnosis and treatment of Cancer*

- Mohd-Nor (2011) *Medical Imaging Trends and Implementation: Issues and Challenges for Developing Countries*, Journal of Health Informatics in Developing Countries
- Queensland Health Medical Imaging Services projections http://www.health.qld.gov.au/sunshinecoast/docs/govn/hlthsrvpln23.pdf, accessed 18 June 2014
- Round (2013) *A 2012 survey of the Australasian clinical medical physics and biomedical engineering workforce.* Australasian Australas Phys Eng Sci Med. 2013 Jun; 36 (2):147-57
- Smith-Bindman, Miglioretti & Larson (2008) *Rising Use Of Diagnostic Medical Imaging In A Large Integrated Health System*, Health Affairs, 27 no.6 :1491-1502
- Strategy & Business (2004) *Health Care's Technology Cost Crisis*, Summer 2004, Issue 5
- Tan (2004) *Diagnostic Imaging in Asia*, Asian Hospital & Healthcare Management, Issue 9
- Washington G-2 (2009) *Diagnostic Imaging Industry Outlook 2009: Market Trends & Analysis*, cited in PR Newswire press release, 23 April 2009
- Wiener, Schwartz & Woloshin (2013) *When a test is too good: how CT pulmonary angiograms find pulmonary emboli that do not need to be found* BMJ 2013;347:f3368

# 10. Appendix D: Stakeholders consulted

| | |
|---|---|
| **Annie Hutton** | Network Manager Radiology and Nuclear Medicine , Agency for Clinical Innovation |
| **Dr Charlotte Salt** | RMIT |
| **Assoc. Prof. John Heggie** | Consultant Medical Physicist, St Vincent's Hospital, Melbourne |
| **Dr. Alessandra Malaroda** | Lecturer, School of Physics, University of Wollongong |
| **Dr. Charles Young** | Registrar Radiology / Emergency Medicine, Royal Free Hospital, NHS (UK) |
| **Dr. Leigh Collins** | Professor Nuclear Physics, Westmead Hospital |
| **Ingrid Egan** | Chair, LHD MRPs Network, Chief Radiographer, Northern Beaches Hospital |
| **Jenny Diffey** | DIMP, Hunter New England, LHD |
| **Nick Ellie** | DIMP, Hunter New England, LHD |
| **Paul Cardew** | ACPSEM DIMP Certification Panel Chair |
| **Prof. Anatoly Rozenfeld** | Director, Centre for Medical Radiation Physics, University of Wollongong |
| **Prof. Peter Metcalfe** | Professor at Centre for Medical Radiation Physics, University of Wollongong; Cancer Institute NSW Chair in Radiation Oncology Physics |
| **Prof.David Currow** | Chief Cancer Officer, Cancer Institute NSW |
| **Sean Geohegan** | President, ACPSEM, Medical Physics and Radiation Engineering , Canberra Hospital |
| **Sue McAlpine** | Radiation Safety Officer, Northern Sydney LHD |