

Establish Roles and Standards for Non-Medical Diagnostic Imaging Staff

Quality Use of Diagnostic Imaging Program
Sub Project QS3

Literature Review

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1. Background

The challenge confronting healthcare practitioners and workforce planners is to ensure that healthcare services of high quality are consistently delivered. This requires the use of planning and change processes that critically examine, evaluate, and address a complex and changing array of environmental issues. These include a need to analyse the health workforce and its capacities. Other issues requiring consideration include how to: meet the demands of a changing demographic, respond to the impact of new technology and information systems, meet increasing consumer expectations and address variable economic imperatives.

Limiting the usefulness of strategies that might address the above issues are disparate systems in federal and state licensing and regulation requirements. These systems contain the accreditation, regulation and legislative provisions that dictate policy approaches to service funding and provision.

As noted above, quality healthcare remains the key deliverable for health professionals. Regarding quality measures in healthcare Schilp and Gilbreath note that the value of healthcare is best measured by the following: the clinical quality of a service provided, the customers' satisfaction with the service, taking into consideration the cost of the service provided (Schilp & Gilbreath, 2000). This equation provides a framework against which strategies and change processes designed to address healthcare issues, can be evaluated.

The Royal Australian and New Zealand College of Radiologists (RANZCR) recognises the role that it has to play in ensuring the quality of radiology services. As such, it is a party to the Quality and Outlays Memorandum of Understanding (MoU) under Medicare funding arrangements and manages the Quality Use of Diagnostic Imaging Program (QUDI) under contract, with the Department of Health and Ageing (RANZCR, 2005).

Recent changes in the radiology and radiation oncology fields arising from new technology have resulted in increased diagnostic and interventional expertise. This increased expertise provides cost benefits in terms of health expenditure, and quality of life improvements for patients (RANZCR, 2005). Better patient outcomes are attributable to expert medical diagnosis and treatment using new and evolving modalities in radiology such as Magnetic Resonance Imaging (MRI), Computerised Tomography (CT), Positron Emission Tomography (PET), and new interventional radiological procedures as well as teleradiology.

These factors, however, work to accelerate the pressure on roles within radiology practice and generally in healthcare provision. It has been stated by Bolman and Deal (1991) that: 'Restructuring, recruiting and retraining are powerful levers of change. But creating new roles and developing new skills need to be done in concert' (Bolman & Deal, 1991). As part of the QUDI program managed by RANZCR, the "Role Evolution and the Attraction and Retention of Non-medical Diagnostic Imaging Staff to the Radiological field" project aims to identify and recommend pathways for extending the clinical role of non-medical imaging practitioners and enhancing patient care by extending the capacity of the radiologist.

A project brief has been drawn up by RANZCR and greater detail about the QUDI program is available from the RANZCR website at: (<http://www.ranzcr.org.au/qudi>). As part of this project the RANZCR has asked that literature regarding role evolution for non medical diagnostic imaging staff working in the radiological field be reviewed.

This review focuses on non medical diagnostic imaging staff (i.e. radiographers and sonographers) and the standards that have been established around individual roles, education standards, standards relating to accreditation, registration, and medico legal issues. The review also includes an analysis of the available literature that relates to role evolution within radiological and other medical settings.

This review does not however, cover role evolution or task substitution by nurses, nurse practitioners or other groups in Australia that have begun undertaking work usually considered to be tasks for medically qualified personnel. The issue of task

substitution, delegation and role evolution in other groups of allied health and 'para' medical workers will be discussed in detail in a Discussion Paper, which will be distributed in draft form for stakeholder comment in February 2006.

1.1 Health Workforce Issues and this review

The global challenges facing healthcare practice and specifically the medical workforce are beyond the scope of this literature review. However, role extension issues are raised in the Health Workforce Productivity Commission Issues Paper (2005) as subsets of an examination of supply and demand issues. Therefore, to ensure that this review is conducted in an informed manner, references to role and role 'extension' (as it is referred to in the Productivity Commission Issues Paper and radiology stakeholder submissions in response to the Issues paper), are considered below.

1.2 Putting role evolution in the context of workforce issues

The pressures on the healthcare workforce have become the focus of government in recent years. This is demonstrated by the publication of the National Health Workforce Strategic Framework in May 2004, within which it is presaged that:

"To make optimal use of workforce skills and ensure best health outcomes ... a complementary realignment of existing workforce roles or the creation of new roles may be necessary. Any workplace redesign will address health needs, the provision of sustainable quality care and the required competencies to meet service needs".
(Australian Health Ministers' Conference, 2004)

A number of Medicare funding initiatives have already extended the role of general practitioners to that of team leaders managing chronic disease. General practitioners are now able to manage chronically ill patients in a multidisciplinary setting retaining overall responsibility for the management and leadership of care. At the general practitioner's discretion and under certain conditions, the general practitioner may delegate care to nurses and other allied health practitioners. These 'other'

practitioners must be working in multidisciplinary teams within the general practice setting. The general practitioner retains a leadership role. That is, they continue to be responsible for overall planning and coordination of care provided to patients (Department of Health and Ageing, 2005).

State and Federal Governments are aware of the pressures being created by the shortage of skilled medical personnel. Having tasked the Productivity Commission with the responsibility of reviewing health workforce issues, stakeholder opinion and solutions are now in the process of being considered, and recommendations will follow. The United States (US) and the United Kingdom (UK) have attempted to address workforce shortages by restructuring the patient care model, creating new position profiles and creating training programs for new roles (American Society of Radiologic Technologists a; Department of Health, 2003). These models are discussed in depth later in this review.

1.3 Workforce issues that impact specifically on traditional radiology practice

Growth in medical imaging arising from an ageing population, increased consumer expectations and technological advances especially in interventional radiology, has lead to increased pressure on radiological services (Jones, 2003). This has meant that some radiologists have come under increasing pressure from increased workloads, resulting in a corollary increased risk of litigation against radiologists (Jones, 2003).

In terms of workforce capacity and workforce reserves, radiologists are reported as choosing to work fewer hours on the basis of choices to improve work/lifestyle balance (Jones, 2003). The continued reduction in hours worked by qualified radiologists increases the likelihood that radiology team roles and work practices will continue to change. Practice managers will have to look for practice efficiencies that free up radiologists to enable radiologists to preserve the quality management of diagnosis. As noted above, there has been a growth in demand for medical imaging services. Therefore, the reduction in hours worked by some radiologists has not reduced the overall demand or workload for the entire radiological workforce. In

2004, a survey conducted by the RANZCR showed that 45% of working radiologists believed their workload was too heavy (RANZCR Workforce Advisory Board, 2005).

Other factors affecting the supply of radiologists are the recertification requirements for radiologists. At present these requirements are linked to professional development. Regulatory requirements impacting on supply include stipulations that sites and equipment need to be accredited (RANZCR, 2005). Also impacting supply is the increasing complexity of procedures being performed in the radiological setting which are therefore more time consuming.

The increased rate of female participation in radiology is also reported to have an impact on the radiology workforce (Jones, 2003) with female radiologists justifiably concerned to minimize radiation exposure during their child bearing years. A further follow on effect of the increased rate of female participation in the radiological workforce is the preference for many female radiologists to work part time in order to care for young children, although the number of radiologists who now undertake part time work has increased across the entire radiologist workforce (Workforce Advisory Board, 2005). Further results of the survey of radiologists conducted in 2004 by the RANZCR indicated that a higher proportion of the workforce is working less than 40 hours per week with 28% reported to work less than 40 hours per week compared to 21% in 2002 (RANZCR Workforce Advisory Board, 2005).

Consumers' have increased expectations, and this coupled with a shift in community attitudes about access to medical services and outcomes information, sees medical practice coming under increasing public pressure and scrutiny (Health Issues Centre, 2004). The result of this is that standards and processes that validate the currency of qualifications, knowledge and competency in professional roles are under review.

As the population ages, predictions suggest that the demand for diagnostic and interventional radiological procedures will increase exponentially (Jones, 2003). Other factors influencing increasing demand are the increased affluence of Australians. Forty three per cent of Australians have private health insurance and

their expectations of access to these services are commensurate with their level of insurance cover (AHIA, 2005).

There are many pressures on radiologists to ensure that patient care is of the highest quality possible in the context of increased productivity. Radiologists are required to manage these pressures. Jones writes: "Radiologists and practices should recognize that although some of their remuneration may be linked to productivity, productivity is far less an important factor in income determination than optimal patient care"(Jones, 2003).

2. Methodology

A number of methods were used to conduct this review. These included a search of electronic journals using the following search terms: role evolution, role extension, role delineation, sonographer reporting, radiographer reporting, sonographer training, radiographer training, image interpretation, ultrasound standards, radiography standards, advanced practitioner, radiographer education, sonographer education, accreditation and other related terms. No geographic limits were imposed on any of the search terms used.

Other methods included reviewing the bibliographies of identified articles and obtaining copies of hard copy journals of listed in those bibliographies. A review of relevant websites for documents relating to standards, education and registration requirements was also conducted. Information was also obtained directly from stakeholders during discussions held in preparation for the second phase of this project. All articles obtained are referenced in the bibliography attached to this review.

Other areas searched for articles on role evolution and related topics included clinical subspecialties in ultrasound namely cardiovascular, mammography, obstetrics and gynaecology. The literature in the area of role evolution and diagnostic imaging is limited, with most research studies being conducted in either the United States or the United Kingdom. The subspecialty areas also were not well covered in the literature, and discussion of these areas is limited to the studies found during the review phase.

In relation to establishing roles for radiographers and sonographers, the literature revealed little in relation to day to day protocols although overarching protocol and policy documents are published by the Australian Institute of Radiography (AIR), the Australian Sonographers Association (ASA) and the Australasian Society for Ultrasound in Medicine (ASUM). Anecdotal evidence is that procedural protocols are provided by practices and are used by staff to guide their work on a daily basis. The literature did reveal that Government at the state and federal level seeks to regulate

the practicing credentials of radiographers and sonographers to a certain extent. There is significant variance in registration requirements at the state level for radiographers and further variance between the requirements for radiographers and sonographers.

Education standards for radiographers are based on the AIR accrediting institutions to provide undergraduate degrees in medical imaging. Qualifications in ultrasound are assessed and accredited by the Australian Sonographers Accreditation Registry (ASAR), all of which occur at the graduate or post graduate level. These issues are discussed in greater detail, later in this review.



3. Role Evolution – a definition

Throughout the literature examined there are a number of terms that are used, sometimes interchangeably, to describe role evolution (Magennis, Slevin and Cunningham, 1999). Role extension, role delineation and role expansion appear throughout the literature as well as role evolution. This project is focused on role evolution, and hence this term will be used throughout this paper and the issues paper to be produced. Role extension and expansion in the nursing setting have been discussed by Magennis et al... and described in the following way:

*“- expanded role implies any enlargement of the nurse’s role within the boundaries of nurse education, theory and practice;
- extended role implies the performance of any activities by the nurse that were previously undertaken by medical doctors or other healthcare professionals.”*
(Magennis et al., 1999 p. 2).

While these terms are in some way applicable, role evolution has been identified as the preferred term for this project because it imparts a sense of the organic nature of the process of workplace practice changing in the face of new demands. Also, the term ‘evolution’ indicates the boundaries of roles are not fixed – as can be implied by the terms extension or expansion - but rather are changing and being shaped on a continual basis as influenced by the environment (Australian Institute of Radiography, 2004a). Role delineation is not considered an appropriate overall term for this project as this term relates to the process of matching job profiles with job activities (MAF New Zealand, 1994). This technical process will occur during the consultation phase of this project, however it constitutes one element of the project rather than the project in its entirety. Therefore, it is not considered to adequately capture the complexity of the issues that result in changed roles.

3.1 Radiographers

This review has focused on the evolution of roles and literature relating to the roles of radiographers and sonographers. A radiographer within this paper is considered to be – in Australia - a person who has undertaken a relevant degree course, and completed any preceptorship or intern year requirements. The person is then issued with a statement of accreditation issued by the AIR (or its equivalent) (Australian Institute of Radiography 2004a). This definition therefore includes graduates of programs who may not be practicing in the field, but may be considering returning to the field. It also includes those who are qualified but not registered to work as a radiographer within the state in which they reside because they have not applied for the appropriate license or practice certificate. It is noted that in some states in Australia, registration with a State Practising Board is not required (Department of Health, 2004).

3.2 Sonographers

A sonographer in Australia is considered to be a person who has undertaken a relevant graduate or post graduate course as accredited by the ASAR, fulfilled any preceptorship or other requirements, enabling their listing as a Sonographer on the register maintained by the ASAR (Australian Sonographer Accreditation Registry, 2005). This group does not include graduates of medical degrees who have completed post graduate ultrasound qualifications. For the purposes of this paper, medical graduates who are able to seek a Medicare rebate for services provided in ultrasound are termed 'sonologists', if they are not classified as a Radiologist and have completed an accredited course in Ultrasound for Medical Practitioners (Australasian Society for Ultrasound Medicine, 2005).

3.3 Radiologists

An Australian radiologist for the purposes of this review, is a graduate of an accredited university holding a basic medical degree and has then specialized in radiology having been assessed as eligible to receive a Fellowship of the RANZCR,

and is able to be registered as a radiologist with the Health Insurance Commission (HIC). Doctors who have trained overseas and studied radiology are considered to be radiologists for the purposes of this paper, if they have complied with the requirements of assessment for overseas trained doctors and met the RANZCR requirements for recognition (RANZCR, (n.d) c).

3.4 Regulatory Environment

Australia has an established history of ensuring that healthcare providers in most sectors are appropriately qualified and registered. The Australian Medical Council assesses and accredits training programs for medical practitioners. The RANZCR training program has been accredited by the Australian Medical Council. This means that the RANZCR is 'responsible for setting the standards of training and examination required to allow recognition and registration as a specialist in Radiology (RANZCR, (n.d) a). The College seeks to build on established collaborative relationships with the Australian Institute of Radiography and Australian Sonographers Association and other stakeholders through regular consultation and discussion of key issues.

Practitioner boards for medical practitioners exist in each State, as do registering bodies for nurses, physiotherapists, dentists and other personnel entrusted with delivering medical or allied health care (Department of Human Services Victoria, 2003a). There are a number of components to the regulatory environment which contribute to the 'accreditation' process. These components are: education leading to certification and thereafter, annual registration on the basis of ongoing requirements being met such as continuing professional development (American Registry of Radiologic Technologists, 2001).

The education requirements to enable registration/accreditation and practice as a radiographer or sonographer in Australia, are discussed below.

3.5 Standards Relating to Education Requirements

At present, in order to be issued with a provisional Statement of Accreditation as a radiographer by the AIR, a person must have completed an undergraduate degree in Medical Imaging or Medical Imaging Sciences (Australian Institute of Radiography, 2005a). Most degrees conducted by universities which have been approved by the AIR are of three years duration, with a minority of courses four years in length (Smith and Lewis, 2003). Thereafter in order to gain full AIR accreditation, the graduate is required to undertake a year of training which is referred to as the intern or professional development year (Australian Institute of Radiography, 2005a). During this year, the graduate is accredited to practice as a 'graduate practitioner'.

If the requirements of this professional development year are considered to be met following assessment, then the AIR will issue full accreditation of the practitioner (Australian Institute of Radiography, 2005a). This Statement is valid for a period of three years, during which the Radiographer is required to complete 36 points of AIR recognized CPD in order to be issued with a Certificate of Compliance in CPD. This Certificate of Compliance enables the Radiographer to continue to practice as a fully accredited radiographer. Should a radiographer not meet the CPD requirements, the AIR will not issue a Certificate of Compliance with CPD, and the Statement of Accreditation will expire (Australian Institute of Radiography, 2004b and 2005b).

Radiographers may choose to sub-specialise in particular modalities – such as MR, and the AIR has educational policies and guidelines in place for the recognition of appropriately qualified and experienced radiographers (Australian Institute of Radiography, 2004a).

Sonographers may have completed an initial undergraduate degree in medical imaging sciences and then proceed to graduate or post-graduate level studies in Ultrasound. Graduates of other health related disciplines such as nursing, can also complete an ASAR recognized graduate diploma or post graduate diploma in either general ultrasound or one of the specialty areas – such as vascular ultrasound - enabling their recognition by the ASAR as a sonographer (GetAccess, 2005).

Sonographers working in private practice need to be listed on the ASAR in order to attract a Medicare rebate for services that they provide on behalf of certain types of medical practitioners (ASAR, (n.d) a). Sonographers listed on the ASAR are required to accrue 40 Continuing Professional Development credits in each three year period, following their listing on the Registry (ASAR, (n.d) b).

3.6 Standards Relating to Registration Requirements - Radiographers

As with medical practitioners, the ability to practice as a radiographer is not based on a Federal system of recognition. Rather, radiographers working in each of State or Territory are required to fulfill different requirements. As noted by Smith and Lewis:

“Currently Australian radiographers are either licensed or registered, depending on in which State they work. Licenses are linked to the use of irradiating apparatus and substances whereas registration acknowledges the broader responsibility radiographers have in the health care system.” (Smith and Lewis, 2003).

By way of example, in Victoria, the Medical Radiation Technologists Board has been established within the Department of Human Services. Radiographers are required to register with the Board in order to be able to practice as a radiographer (Department of Human Services, 2003b). In Western Australia, there is no requirement for radiographers to register with any board or regulatory authority, so long as they are employed within the office of a recognised radiologist (Department of Health, 2004).

It is widely acknowledged that registration requirements for radiographers are complex and convoluted as: “every...jurisdiction in Australia has separate radiation safety legislation” (Department of Human Services, 2003b). Radiographers are therefore required to comply with a variety of registration and/or licensing requirements in order to practice legally, across each State and Territory.

The table on the following page provides an outline of the different requirements each State currently has in relation to registration and licensing for radiographers.

Table 1 - State and Territory Licensing and Registration Requirements for Radiographers

State/Territory	Registration requirements	License requirements
ACT	Not required to be registered	Not required to hold a license if working under the direction of a licensee (i.e radiologist)
New South Wales	Not required to be registered	License required to operate certain types of equipment under the <i>Radiation Control Act, 1990</i>
Northern Territory	Required to be registered	Not required to hold a license if radiographers comply with conditions stipulated in the <i>Radiation (Safety Control) Act</i>
Queensland	Required to be registered with the Medical Radiation Technologists Board of Queensland	License required to 'use radiation' under the <i>Radiation Safety Act</i> and associated Regulations
South Australia	Not required to be registered	License required to operate certain types of equipment under the <i>Radiation Protection and Control Act 1982</i>
Tasmania	Required to be registered under the <i>Medical Radiation Science Professionals Registration Act 2000</i>	License required to operate certain types of equipment under the <i>Radiation Control Act 1977</i>
Victoria	Required to be registered	Exempt from obtaining a license if registered as a medical imaging technologist, radiation therapy technologist or medical imaging technologist as provided for by the <i>Health Act 1958</i> and <i>Health (Medical Radiation Technologists) Regulations 1997</i>
Western Australia	Not required to be registered	Not required to hold a license if employed by a radiologist.

Sources: (refer Bibliography for full references)

Review of Victorian Radiation Safety Legislation – Discussion Paper, Public Health Group, Department of Human Services, State Government of Victoria, 2003; *Licenses to Use (Radiation)*, Environment Protection Authority, Department of Environment and Conservation New South Wales, 2005.

Radiation Protection, Environment Protection Authority, South Australia, 2005.

This lack of uniformity has been the focus of a National Competition Policy review and resulted in the establishment of the National Directory for Radiation Protection (Australian Radiation Protection and Nuclear Safety Agency, 2004).

It is expected that in coming years this directory will provide greater uniformity of requirements for radiographers however, at present, the current edition of the directory contains basic criteria as to what is required to enable recognition as a radiographer. State governments are, however in various stages of review and amendment of legislation in order to achieve consistency in registration and licensing arrangements outlined by the National Competition Policy Review.

3.7 Standards Relating to Accreditation - Sonographers

The Australian Sonographers' Accreditation Registry (ASAR) has been established to: "accredit and re-accredit...ultrasound programs offered by various institutions" in both Australia and New Zealand (Australian Sonographer Accreditation Registry, (n.d) a). The ASAR also maintains a register of accredited and student sonographers as well as maintaining records regarding the continuing professional development activities of those sonographers on the registry. Sonographers must be listed with the ASAR so that where a medical practitioner has a sonographer perform an ultrasound examination on their behalf, they are able to receive a Medicare benefit for that service (Australian Sonographer Accreditation Registry, (n.d) a). Sonographers listed on the ASAR are required to participate in a continuing professional development program that has been put in place by the ASAR (Australian Sonographer Accreditation Registry,(n.d) b).

At present, sonographers are not required to be registered in order to practice. As noted above, in order to work as a sonographer, a prospective sonographer would need to complete a course recognized by the Australian Sonographers Accreditation Registry and apply for listing on the Registry maintained by the ASAR. Some sonographers will have initially qualified as radiographers, and then completed further education enabling them to practice as sonographers. It could therefore be argued that the regulatory environment for radiographers/sonographers is more

complex than that of radiographers, if they seek to practice as both a radiographer and sonographer. This is because they would need to maintain their license and registration requirements as a radiographer as well as concurrently complying with the listing requirements of the ASAR.



4. Delivery of Care in the Radiology Setting

The literature reviewed indicated that workforce pressures can lead to role evolution and result in the emergence of different service delivery models. In their design, such models aim principally to address workforce issues. New models which are variants on the traditional service models of practice, have been developed and implemented in the US and the UK.

An analysis of the available literature showed that the radiology practice model appears to vary from country to country. For instance, the American College of Radiologists in the US has worked closely with the American Society of Radiologic Technologists and created a new position entitled: “Radiologist Assistant” (American Society of Radiologic Technologists, (n.d) d). This has meant that the Radiologist is assisted in the more technical aspects of their work, whilst still retaining full responsibility for reporting on images.

The workforce shortage in the UK is reported as being the driving force behind reworking of job profiles in the National Health System, and specifically the introduction of a four tiered radiology practice model with differing professional responsibilities for each level (Department of Health, 2003). The UK model has differed to that of the US in that the Royal College of Radiologists has allowed for delegation of some tasks previously being performed by radiologists, to radiographers and sonographers. Delegated tasks include the ability of trained radiographers to provide reports on some images, so long as certain conditions have been met¹(The College of Radiographers, 2005).

These two models will be discussed later in this review, however it is interesting to contrast Australia’s training and registration model for non medical diagnostic

¹ The College of Radiographers has written that: “Reporting radiographers must be provided with a full written scheme of work approved by the employing authority and must be made aware that they are legally responsible for their acts or omissions” (The College of Radiographers 2005; and Department of Health, 2003). This authority generally comes in the form of a patient group directive within the Trust in which they are employed. This directive indicates the level to which a Consultant or Advanced practitioner may work.

imaging staff with that of the four tiered system registration arrangements in the UK. There is no documented evidence to date to suggest that non medical diagnostic imaging staff in Australia report on images in a formal manner. At present, Australian practices fall into two broad categories – public practices and private practices. Private practice can be further broken down to corporate groups or independent practitioners (RANZCR, 2005). A search on the ‘non report rate’ of images in Australia indicates that at present, there is no data available on the ‘non’ report rate of films in either the public or private sectors. This does not mean however, that some images may not be reported or are reported later than is clinically useful.

4.1 Policy perspectives

Healthcare in the US is delivered in a different manner to Australia with practitioners being able to self refer for some services. Some Health Management Organizations (HMO’s) have introduced guidelines which have sought to restrict the delivery of radiological services to only being provided by radiologists. Prior to the guidelines’ introduction, Specialist Practitioners could have self referred for some radiology services. It was reported that as a result of the guidelines and the restriction they imposed on self-referrals, the number of x-rays ordered and performed by non-radiologists fell from a total of 39% of all x-rays to 15% after the guideline was introduced (Moskowitz, Sunshine, Grossman et al., 2000). The study suggests that self referrers tend to over service.

The UK funding arrangements for the public sector are governed by the National Health Service. A four tiered model has been introduced in the UK which recognizes four different skills levels for radiographers and sonographers (Department of Health, 2003).

The situation in Australia is that Medicare and the Public hospital system provides universal health cover for all eligible Australians. In addition, Australians can choose to be privately insured or alternatively, they can self insure. A number of compensable schemes also provide private and public health cover for injured workers, veterans, and road accident victims.

In considering the models of role evolution that have been implemented in the US and UK, it should be noted that the funding and referral arrangements for health care providers in Australia are not the same as either the US or the UK. For instance, in Australia traditionally radiologists have owned their practice. More recently many private practices have been corporatised with corporate ownership accounting for more than half of all radiology practice. Corporate ownership includes the provision and management of radiology services in both private and public hospitals. Private practice in the UK is a relatively small part of the health care system.

In Australia, there are unique principles that apply under Medicare and other government legislation impact on how radiology is provided and funded. These include rules regarding referrals and self referrals, and access to some imaging modalities. RANZCR's Diagnostic Economic Committee is primarily responsible for supporting the management of the Radiology, Obstetric & Gynaecological Ultrasound and Nuclear Medicine Quality and Outlays Memoranda of Understanding (MoUs) 2003-2008 and for developing policies to inform and influence governments and other decision makers about the importance of a viable and sustainable radiology profession in Australia (Diagnostic Imaging Referral Arrangements Review Committee, 2000).

On the issue of private medical practice and the health workforce, the Productivity Commission (March 2005) Issues Paper reports: "Greater provision of acute care within the private hospital system is reducing the time that specialist practitioners can devote to clinical training within the Public hospital system" (Productivity Commission, 2005).

In discussing the distribution of healthcare resources, Richardson notes that: "notwithstanding regional differences in health care needs, variations in servicing levels across Australia point to scope for better use of the available workforce. In other words, 'more health' could be obtained with a redistribution of existing resources" (Richardson 2004, p. 13). That is, more services could be provided to the community if existing resources were used or distributed differently.



This idea has been considered by the Productivity Commission in their Issues Paper which states that “widespread rigidities in job descriptions and allowable duties - often underpinned by regulatory, industrial and funding arrangements - reduce the scope to substitute or reallocate staff and detracts from productivity” (Productivity Commission, 2005). The paper also states that: “Quality can be...difficult to measure, however indicators such as the incidence of ‘adverse events’ suggest that there are likely to be significant benefits for patients, as well as possible cost savings, from improvements to service quality” (Productivity Commission, 2005).

Adding a layer of complexity to role evolution in radiology practice, State governments are responsible for funding training places through public hospitals. Suitable candidates are selected through an application process conducted at individual hospitals. Successful applicants are required to sit the RANZCR Part I examination and if successful proceed through the training program provided by the Hospital (auspiced by RANZCR) and then sit the final examination. If successful in this examination, the candidate is eligible to be awarded a Fellowship of the RANZCR.

Recently however, the RANZCR has determined “that certain overseas departments, private hospitals and private radiology practices may be accredited for training provided the guidelines laid down by the education board are met” (RANZCR, (n.d) b). Historically, the majority of training places have been in public hospitals. As noted above, individual States are responsible for funding training places in public hospitals. Issues of funding for training within the public hospitals system therefore impact on the numbers of radiologists exiting education and training programs. If training places are not offered because of funding restrictions by State (or Federal) Governments, this then affects total workforce numbers over time and the capacity of the workforce to train further radiologists whilst meeting increasing service demands.

5. Research Conducted on Role Evolution

As a result of increasing pressure on all members of the radiological team, anecdotal evidence suggests that radiographers and sonographers are sometimes involved in procedures for which they have not been formally trained or accredited. Smith and Lewis write: "...it has always been part of the unacknowledged role of some senior radiographers to perform barium studies. Similarly, intravenous cannulation and the administration of IV contrasts is now commonplace in busy CT and MRI units in Australia" (Smith and Lewis, 2002)

Literature from the UK and US settings revealed numerous studies have been conducted comparing the ability of radiographers and sonographers to interpret images, perform certain tasks such as barium enemas, estimate the weight of babies by ultrasound examination and other studies which aim to compare the radiographers or sonographers performance to that of the radiologist. Reporting on images is one of the major issues to have been researched in role evolution related studies.

Studies from the UK and US are discussed below. It is important to note that a number of weaknesses in the design of various studies in the UK and US have been identified Brealey, Scally and Thomas (2002) have noted the various forms of bias that can occur in the design of any study aiming to compare radiographer or sonographer performance with that of radiologists. They contest that in studies that use the radiologists' diagnosis as the correct diagnosis, what is being measured is: "[the] radiographers' ability to predict the radiologist's diagnosis which may be wrong, rather than the patient's true disease status" (Brealey, Scally & Thomas, 2002). When considering the results of studies which rely on a radiologist's interpretation of an image as the gold standard, the bias is that there is an assumption made that the radiologist's diagnosis is correct in the first instance.

Robinson states that the variance in the reading of images means that: "image interpretation is considered the weakest area of clinical imaging" (Robinson in Brealey and Scally, 2001). If image interpretation may be considered the most difficult and complex component of the radiology field then the quality of services is

likely to be highest when image interpretation is in the domain of the most experienced and highly trained personnel.

5.1 Image interpretation studies - Radiographers and radiologists

The ability of some radiographers to report on images has been examined in a study conducted in the UK (Loughran, 1994). This particular study aimed to examine the impact that a training program could have on increasing the ability of radiographers to report images more accurately (Loughran, 1994). The results from this study suggested that education and training improved the ability of radiographers to detect fractures. It is reported that detection rates improved from 81% at the commencement of the trial to 95.9% at its completion. The performance of some radiographers with extra training may be comparable with that of junior radiologists. The author notes though that it may 'be considered preferable' to confine certain examinations to radiologists, while suggesting that 'extremity radiology' could be delegated safely (Loughran, 1994). Other studies conducted looking at radiographer training and the reporting of films by radiographers have concluded that there is value in training programs, as well as other self directed learning strategies (McConnell and Webster, 2000).

Robinson (1997) has written that image interpretation is one of the most difficult elements of radiology. Observers may often agree on the cases where disease is advanced, or easily seen, but may not agree so often in difficult cases. The definition of difficult, in this instance, was where disease was not advanced. In this article Robinson notes that if specialist doctors restrict their reading of images to the area of specialty in which they are trained, then there is little difference in their reading performance compared with that of radiologists (Robinson 1997). The article reports that when mammograms were looked at twice by 'experienced observers', the number of lesions detected increased by 10-15%. This paper suggests that when considering the efficacy or new techniques: "it may be more effective and cheaper to employ extra observers than to buy new technology" (Robinson, 1997).

Following on from this, Robinson and his colleagues published a further study in 1999 comparing radiologist and radiographer image interpretation where two specially trained radiographers reported on over 11,000 images (Robinson, Gulpan and Wiggins, 1999). It should be noted that this study required the radiographers to report only on suspected fractures on patients presenting through the Accident and Emergency Department rather than the hospital population as a whole. Therefore, a limitation of the study is that while subtle or occult fractures were included, people who were very ill or had complex co-existing conditions, were excluded from the study. A further limitation of this study is that it compares the interpretative ability of two radiographers. This limits the ability of these results being considered representative of the abilities of the wider radiographer population.

The results revealed that of the 10% of patients who re-attended (i.e. 1,103), 29 had a discrepancy noted between the first and second image report, with 13 of these being occult fractures. This study concludes that with appropriate training, motivated radiographers can successfully report on a limited range of images. As well as having the limitations noted above, the authors query the ability to extrapolate these results onto a broader, unselected set of images being read to an appropriate standard by trained radiographers (Robinson, Gulpan and Wiggins, 1999).

Sonnex, Tasker and Coulden conducted a study in which over 8,000 chest radiographs were read by radiographers. They found that in 38 examinations, the radiographers did not detect potentially important changes. The report notes that the: "most commonly missed abnormality was a small apical pneumothorax or a new post-operative effusion. In none of these cases was a chest drain inserted" (Sonnex, Tasker and Coulden, 2001).

A more recent study conducted by Brealey, King and Crowe et. al (2003), found that the reporting performance of two specially trained radiographers was not statistically different from that of radiologists when looking at a selected random sample of 400 x-rays. The results of this study raise questions about additional training and skills improving the aptitude of image interpretation by radiographers.

5.2 Radiologists and other specialist staff

While the ability of radiographers to read images has been compared with that of radiologists in a number of research articles, recent studies have also looked at the skills of other specialist staff when interpreting images relevant to their specialty field. For example, some studies have compared the image interpretation skills of emergency physicians with the skills of radiologists (Eng, Musko, Weller, et al. 2000). The design of this particular study meant that the ability of physicians to read images was compared with that of radiologists on different modalities including digital technology, as well as conventional film format. They found “significant differences between the interpretation of radiographs on films and on digital monitors” (Eng, Musko, Weller et. al 2000). They also found that when considering differences between observer performance: “differences of equal or greater magnitude associated with the observer’s training level and physician speciality” (Eng, Musko, Weller et. al 2000). The results were interpreted as indicating that radiologists were better able to interpret images with the most important factor impacting on image interpretation skills being the training level and specialty of the observer.

Robinson (1999) has also aimed to compare observer performance in a study. This study examined the variation found between three experienced observers when looking at three major types of plain film X-ray – skeletal, chest and abdominal. Robinson found that the incidence of errors per observer was in the magnitude of 3-6% and that interobserver variation in plain film reporting was ‘considerable’ (Robinson, 1999).

Given the large number of unreported films generated in Accident and Emergency Departments in the UK, Simon, Khan, & Nordenberg et al. (1996) examined the necessity of radiologist review of plain radiographs which had been initially interpreted by a paediatric emergency physician. The authors reported that the interpretation of films by emergency physicians was accurate, with no adverse outcomes arising from incorrect reading of images. The authors found that in 96.9% of cases, the clinical management of the patient was unchanged. Of the 69 discordant interpretations, 48 were clinically significant, but this was contributed to

largely by extremity fractures being reported at a high false positive rate by emergency physicians, which they suggested might be the result of medico legal concerns (Simon, Khan, and Nordenberg et. al, 1996).

An article published in Britain in 2005 discussing the implementation of the Four Tiered model, argues that while radiographers may be able to report with similar accuracy to that of radiologists, the context in which they place their findings limits their ability to report on images (Donovan and Manning, 2005). The authors also note that a radiological report has a number of functions and these are: to advise the referring clinician of the presence of any abnormalities and link these findings to: “a large knowledge base of diagnostic meaning and pathological features. The radiological and anatomical patterns... need to be translated into diagnostic and management decisions” (Donovan and Manning, 2005). The article contends that because radiographers do not have medical training in their background, they have a ‘knowledge gap’ when it comes to either arriving at a diagnosis or providing a report that can be used in a meaningful way for future management of the patient. The authors then cite a number of legal cases that arose as the result the way reports were written indicating that a ‘diagnostically accurate’ report is not necessarily an adequate one. In summary, Donovan and Manning write that as a result of not having medical training: “Radiographers...may lack the expertise to fully engage with the context of the diagnostic examination, especially where patients have been inappropriately referred for some examinations.” (Donovan and Manning, 2005).

5.3 Radiologist/Sonologist and Sonographer comparisons

Some studies have sought to measure sonographers' performance against that of radiologists/sonologists. In a study conducted by Bates, Conlon and Irving (1994) it was found that in 94% of 1046 scans performed, the sonographer’s report “gave an accurate account of the findings and provided a correct answer to the clinical problem”. This study also found, however, that a number of changes were made by radiologists to the sonographer’s reports on the basis of style and argued for comprehensive audit processes to ensure continuous professional development and quality in reporting.

In contrast to this, Ramsay and Fracchia (1999) examined the role of a sonologist in a practice predominantly staffed by sonographers. This study found that 10 per cent of cases required the patient to be scanned by a sonologist as well as a sonographer to clarify visual findings. The study also reports that 34.5% of all patients had some contact with a doctor that was not scheduled. The authors conclude that: “an on site doctor should improve the diagnosis in difficult cases, reduce the number of patients recalled to be seen by a doctor and expedite subsequent investigations and management” (Ramsay and Fracchia, 1999).

Some studies have found however, that non medical diagnostic imaging staff are more proficient at reading certain components of an image. Humphries, Reynolds and Bell-Scarborough et al. (2002) found significant difference between the performance of maternal fetal medicine specialists and sonographers at predicting birth weight by using biometric parameters. They found that: “prediction of birth weight is significantly more accurate when sonographers rather than maternal fetal medicine specialists perform the ultrasonographic examination” (Humphries, Reynolds and Dell-Scarborough et. al, 2002).

Shirley, Bottomley and Robinson (1992) conducted a study where 6183 babies were examined by ultrasound, which was undertaken by a radiographer with a Diploma of Medical Ultrasound – i.e a sonographer. When an abnormality was detected, the patient was recalled and the scan then repeated by a radiologist. In this study it was reported that routine ultrasound by sonographers at 19 weeks gestation, in women of normal risk of fetal abnormality has a sensitivity of 60.7% in detecting abnormal fetuses, this includes abnormalities at the more minor end. When looking at the more significant abnormalities or lethal abnormalities, the sensitivity increased to 73% with a specificity of 99.8% (Shirley, Bottomley and Robinson, 1992).

A more recent study by Leslie, Lockyer and Virjee (2000) examined 100 cases where both the non medical staff member performing the ultrasound (referred to as a radiographer in the study) and radiologist had provided a report on the film. The study does not indicate if the radiographer had further or specialized training in

ultrasound. They found that: “three of the disagreements were considered minor and four major. In three of the seven cases, the radiographer was correct, and in four, the radiologist correct (Leslie, Lockyer and Virjee, 2000). The small sample size in this study limits any conclusions being extrapolated to a wider population.

A similar study audited the ultrasound reports prepared by non medical diagnostic imaging staff (referred to once again as radiographers with no indication if further ultrasound training had been undertaken) and an auditor. In the 100 reviewed it was found that 42 of 100 were agreed to be normal, and the remaining 58 resulted in 75 diagnoses being made. The importance of clinical information and the ability to interpret the entirety of an image is one finding of the study where the authors report: “The service made two errors that were relevant to clinical history... The service made a significant error of diagnosis that was incidental to the clinical indication, namely, missing an abdominal aortic aneurysm of 4.4cm in diameter” (Weston, Morse and Slack, 1994). Once again, the small sample size limits the usefulness of the results.

5.4 Technical expertise

Other studies have examined the ability of radiographers and sonographers to perform technical tasks to the same level of expertise as radiologists. Studies have included examining whether technologists could perform gastrointestinal fluoroscopy to the same level of expertise as radiologists (Davidson, Einstein and Baker, et al... 2000), the complication rate of barium enemas by technologists (Stevenson, 2000), and the comparison of radiation dose given by a radiographer versus a radiologist when undertaking barium enema examinations (Crawley, Shine and Booth, 1998).

In these studies it is argued that radiologists are trained for the more complex parts of medical practice and radiological work, and therefore they are overqualified for the less complex parts of the job. Davidson et al.. state: “residents seem less interested in traditional gastrointestinal radiology than high tech modalities such as CT, MR imaging and radiography (Davidson et al., 2000). Stevenson notes that of the 70,000 barium enema examinations conducted by technologists there was no

significant difference in the complication rate when compared with that of radiologists (Stevenson, 2000). Stevenson also notes that the study design has some weaknesses in that radiologists were allocated the patients with complex co-existing disease with the more straightforward patient allocated to radiographers. This is not an uncommon flaw in studies comparing radiologists and radiographers, where the more complex patients with chronic illness or co-existing disease are allocated to radiologists and radiographers are allocated the less complex patients (Brealey and Scally, 2001).

In a study conducted by Crawley, Shine and Booth (1998), radiographers were found to be able to conduct barium enema examinations with the same diagnostic yield as radiologists. However a protocol put in place at the hospital required that radiographers take two extra films for radiologists to review. According to the authors this represented an unacceptable increase in dose except for those patients over 65 and the process of radiographers conducting such examinations was being reviewed (Crawley, Shine and Booth, 1998).

6. Examples of Role Evolution in Practice

The United States has attempted to engineer a number of solutions to their workforce issues. The Radiologist Assistant (RA) will soon enter the workforce in the US as a number of tertiary institutions in the US are now training RAs (Reid, 2004). Preceding the introduction of the RA, was the practice model employing the Radiology Practitioner Assistant (RPA). The RPA role was conceptualized after the US military perceived a need for a mid level technologist, however funding priorities saw Federal monies withdrawn (American Society of Radiologic Technologists, (n.d) c). Regardless of this, the program was implemented and continues to be offered at one university in the US. A lack of funding from the Federal Government coupled with the American College of Radiology clearly stating that they do not support RPAs has resulted in a somewhat limited uptake of RPA service (American College of Radiology, 2004).

A non radiology specific example of role evolution in the US is that of Physician Assistants (PA), whereby graduates of PA courses are considered to be mid level health professionals who have prescribing rights in a majority of US states and once qualified, may seek to sub-specialise in radiology (American Academy of Physician Assistants, 2002). All three groups of assistants are required to have their work either directly or indirectly supervised or have tasks formally delegated to them. None of these physician or radiology 'extenders' as they are sometimes known, is able to provide a final report on images.

In contrast to this, the National Health Service in the UK has introduced a four tiered system of non medical diagnostic imaging staff in order to address its workforce shortage. Two levels within this model have a wide reaching role that includes reporting on images as well as undertaking some medical procedures. The Advanced and Consultant Practitioner are able to report on images – both plain film and ultrasound at certain sites - as well as conduct tests such as barium enemas, fluoroscopy of the gastrointestinal tract and establish intravenous access and administer intravenous fluids during imaging procedures (Department of Health,

2003). In spite of the procedural component of their roles, they are employed as diagnostic imaging staff rather than medical staff. While it is too early to assess the effectiveness or otherwise of these models, they are discussed in more detail later in this paper.

6.1 US Model and Training Requirements – Regulatory Background

The regulation of medical professions in US is complicated because of the size and nature of the individual states and the litigious environment. The American Board of Radiology manages the national accreditation of Radiologists, however training of non medical diagnostic imaging staff and their accreditation, registration and licensing needs are not so streamlined. There are three organizations that have been closely involved with the process of role evolution that has occurred in America for radiographers and sonographers. These bodies are the American Registry of Radiologic Technologists (ARRT), the American Society of Radiologic Technologists (ASRT) and the American College of Radiology (ACR).

The ARRT is responsible for the accreditation of technologists and provides examinations and certification enabling relevant state authorities to issue practice licenses or certificates. The ASRT is the professional interest group for technologists, that is non-medical diagnostic imaging staff - with a focus on ensuring quality in practice. The ACR is the professional interest and research body for doctors who specialize in Radiology (American College of Radiology, 2005). The ACR is not involved in the training and accreditation of radiologists as it is in Australia and the UK, but rather, seeks to represent Radiologists' interest to government through lobbying for legislative change and providing funding for research projects. The ACR has worked closely with both the ARRT and ASRT to develop the role of the RA.

6.2 Radiologist Assistants- RAs

The RA is generally a tertiary qualified radiographer who has completed an ARRT accredited training course and is employed as an RA (American Society of Radiologic Technologists, c). RA's are required to undertake a clinical preceptorship

with a supervising radiologist, where they are 'mentored' and supervised (American Society of Radiologic Technologists, c). The training for a Radiologist Assistant is focused on advanced level practice within the radiology setting. The Physician Assistant Program (also discussed later in this paper) provides a more generalist training experience designed to support Generalist Medical Practice.

The activities and duties that the RA can be involved in are summarised in Appendix II. By way of summary: "A radiologist assistant is an advanced level radiologic technologist who enhances patient care by extending the capacity of the radiologist in the diagnostic imaging environment" (American Society of Radiologic Technologists, c). That is, the RA provides technical assistance with tests, procedures and other work practices, and does so under the supervision of a radiologist. In other documentation issued by the ASRT it is noted that the following duties are not within the roles and responsibilities of the RA:

1. *The radiologist assistant does not interpret images. The supervising radiologist retains responsibility for final image interpretation.*
2. *The radiologist assistant does not make diagnoses. The supervising radiologist retains responsibility for preparing a final written report.*
3. *The radiologist assistant does not prescribe medications or therapies."*

(American Society of Radiologic Technologists, (n.d) d)

The RA is a technical expert in the procedural component of some parts of radiological practice but always works under the supervision of a radiologist who may provide different levels of supervision depending on the nature of the procedure being undertaken at the time. The radiologist is responsible for the radiology team. The interpretation of images and diagnosis, medical management, treatment, follow up and outcome remains the responsibility of radiologists.

While the ARRT offers the credentialing of courses for RAs, the state licensing requirements vary from state to state. In order to practice as RAs, all graduates will have to: "pass the national registry certification examination" which is overseen by the ARRT before they are able to work (Radiological Society of North America,

2004). While requirements for registration will vary from state to state, all states will require that RAs have passed the ARRT certified examination.

At present, RAs are not able to bill directly for the entirety of their services. RAs are, however, able to bill for the technical component of their services when they are fulfilling the duties of a Radiologic Technologist and when they comply with the relevant funding body guidelines (Strickland, 2005).

6.3 Radiology Practitioner and Radiology Physician Assistants – RPAs

A radiology practitioner assistant (RPA) is different from a Radiologist Assistant in that they have undertaken a different course of study to that of RAs and have sat a different certification examination to RAs. RPAs are currently only able to qualify as such having completed a course which is offered at one university in the United States. The course currently offered in the United States is a two year program which results in a Bachelor of Science being awarded. Most of the individual states in the United States do not differentiate – in terms of legislative recognition - between RPAs and Radiologic Technologists (American Academy of Physician Assistants, 2005) and conceptually, the RPA program is an extension of the Radiologic Technologist's training.

RPAs are said to differ from RA's because of a difference in philosophy in relation to the training provided to RPAs (Certification Board for Radiology Practitioner Assistants, 2005). While both RAs and RPAs do not do final image interpretation, the Certification Board for RPAs states that:

“The scope of practice for the RPA is more broad and leaves the limitations to the radiologists discretion...Levels of supervision are also left to the radiologists discretion...The RPA can conduct a preliminary evaluation of images and provide a technical report to the radiologist, perform invasive imaging procedures under the supervision of a radiologist and participate in all phases of patient assessment and management.” (Certification Board for Radiology Practitioner Assistants, 2005).

By way of comparison, the Certification Board for RPAs writes: “the RA does not have a scope of practice, but follows a role delineation developed by the ARRT, that was guided by a joint statement from the ASRT and ACR on the functions of the RA.” (Certification Board for Radiology Practitioner Assistants, 2005). The main difference therefore between RAs and RPAs is that RAs have completed a different course of study and their day to day practice is governed by the agreed delineation by the ACR, ASRT and the ARRT.

The ACR has not endorsed RPAs and their involvement in radiological practice. The ACR has stated that: “The ACR does not recognize either the scope of practice or designation of an RPA” (American College of Radiology, 2004). The ACR does however recognize the RA and their capacity to perform certain tasks or procedures in a radiological practice.

While the supervisory requirements for RPAs are less clearly stated than those required for RAs, when an RPA is involved in patient treatment and care, there is an expectation in the funding arrangements however that the radiologist will remain closely involved in the patient’s ongoing management. That is, services provided by an RPA are able to be claimed by the supervising Radiologist from Medicare/Medicaid, so long as certain conditions are met and they are charged at the appropriate rate, which is lower than the rate able to be billed by Radiologists when they provide the service themselves (Certification Board for Radiology Practitioner Assistants, 2005).

The RPA program has been limited in terms of producing graduates because it is not Federally funded and only available at one University in the US. Data indicates that approximately 59 graduates had completed the RPA course as at the end of 2002 (American Academy of Physician Assistants, 2005). Another limitation of this model is that while an RPA may be credentialed appropriately by the National Certification Board for RPAs, individual state legislation: “must be modified to allow RPAs to be licensed to perform procedures expected in a radiology department or practice” (Strickland, 2005). In States where this amendment to relevant laws has not occurred, and the supervising physician

allows the RPA to perform a task which the physician knows they are not licensed to perform, then the physician can be considered to have 'aided and abetted the unauthorized practice of medicine' (Delman in Strickland, 2005).

Prior to this, in the 1970's 'advanced practice' programs were available from three universities in the United States for Radiologic Technologist seeking to work at an advanced level. Graduates from these programs were called Radiology Physician Assistants. It is reported that owing to a lack of funding and support from the medical community, the programs that offered Radiology Physician Assistant Training closed in the late 1970's (Certification Board for Radiology Practitioner Assistants, 2005; American Academy of Physician Assistants, 2002).

6.4 Physician Assistants – PAs

Physician Assistants differ from Radiologist Assistants and Radiology Practitioner Assistants in that their education program provides a more generalist training experience than that of RPAs or RAs (American Academy of Physician Assistants, 2005). On the basis of this generalist background, Physician Assistants can, however, choose to work in Radiological Practice, or some other specialist area such as cardiology, gastroenterology and others. PA students are generally selected on the basis of previous work experience and training and in about three quarters of each intake, undertake the course as a graduate of another often related course. By way of example, students enrolled in a PA Program in 2006 are reported to have had as previous occupations: certified nursing assistant, paramedic, lactation consultant and medical assistant amongst others (Jefferson College of Health Sciences, 2005).

Physician Assistant Programs are widely available in the United States with a reported 137 accredited programs available, with the course averaging 111 weeks and can be taken as either a full time or part time course (Association of Physician Assistant Programs, n.d). Graduates of accredited programs are the only applicants eligible to sit the examination at the completion of a course, enabling recognition as a PA which is administered by the National Commission on Certification of Physician

Assistants. Once certified PAs are required to complete 100 hours of continuing medical education every two years and must sit a re-certification examination every six years (American Academy of Physician Assistants, 2005).

Physician Assistants are able to order tests, prescribe medications (in 47 of the States) and work with physicians in all medical and surgical specialities (American Academy of Physician Assistants, 2005). Radiology Practitioner Assistants on the other hand, practice only within radiology, “do not diagnose or order tests or procedures or prescribe medications. Radiology Practitioner Assistants practice under their Radiologic technologist licenses” – with the exception of the State of New York (American Academy of Physician Assistants, 2005)

Physician Assistants do not work to a prescribed scope of practice, but rather work ‘within the scope of their supervising physician, taking into account any specific limitations in state law’ (American Academy of Physician Assistants, 2005). This model appears to provide some flexibility in relation to determining the day to day duties of PAs. Some PAs may choose to work in Radiology Practice which is interesting when contrasted with RAs and RPAs who also work in the Radiology field. While RAs and RPAs are able to take films and undertake certain procedures, PAs may be able to do the same tasks. However, some States do not allow PAs to take X-rays under State Radiologic Technology laws (American Academy of Physician Assistants, 2005).

In relation to funding for these models, reimbursement arrangements differ depending on whether the service is provided in a hospital or non hospital setting. In non-hospital settings there are designated levels of supervision required by the physician to enable reimbursement by Medicare. In a hospital setting, if the supervising physician is present, then the services provided by the PA can be billed in the supervising physicians name and are reimbursed at the full Physician fee rate. If the supervising physician is not present (in the hospital setting) then the service can be billed in the PAs name and will be reimbursed at 85% of the Physician’s fee (Strickland, 2005). Importantly, PAs can train staff, but services which are provided by trainees and overseen by PAs are not able to be charged to Medicare (Strickland,

2005). PAs are not paid directly by Medicare, but rather payment is made to the practice at which they are employed (American Academy of Physician Assistants, 2005).

6.5 UK Model and Training Requirements

The model introduced in the United Kingdom (UK) National Health Service (NHS) is based on four levels of recognition as outlined in job descriptions (Department of Health, UK, 2003). These are: Assistant Practitioner, Practitioner, Advanced Practitioner and Consultant Practitioner. The definitions of the four tiers are contained in Appendix III. Rather than a prescriptive examination or course of education, it is expected that Consultant Practitioners either hold or are working towards a Masters Degree or Doctorate in a relevant area. Advanced practitioners hold a relevant undergraduate degree and may be working towards a Masters degree with significant practical experience. Practitioners are required to hold a relevant undergraduate degree in medical imaging.

For registration and accreditation purposes, all practitioners with the exception of Assistant Practitioners, are required to be registered with the Health Professions Council (Department of Health, UK, 2003). In order to be registered with the Health Professions Council, a practitioner, advanced practitioner or consultant practitioner must have satisfied the educational requirements of a course accredited by the College of Radiographers (Department of Health, UK, 2003).

The model in the UK is based on a flexible approach with job descriptors providing the boundaries between different job levels. As such, there is no specific course of study offered for Consultant Practitioners or Advanced Practitioners. Rather, the position description for each level, which is authored by individual area health services known as 'Trusts', provides the clearest insight into what is required of the different levels of staff. In order to regulate the actual practice of staff working in the radiological field, there has been a set of occupational standards drawn up which provide guidance as to the types of tasks that can be undertaken (see Appendix IV).

It is noted that there are significant differences between the UK and US role evolution models as reported in the literature. One difference is that in the UK the four tier system does not formally specify the education standards required for practitioners in each tier in the new structure. Conversely, the US model is defined in terms of extra education and training competencies that are required and is linked to a formal accreditation and certification system. In the UK, Advanced Practitioners and Consultant Practitioners can report on certain images, including those which are considered to be more complex such as those of the chest and abdomen (Department of Health, UK 2003) whereas in the US, RAs, RPAs, or PAs do not report on images but rather focus on increasing practice efficiency through undertaking some tasks that were traditionally performed by radiologists.

The limited literature that is available suggests that certain environmental conditions influence structure, training and education components of roles in radiology practice. As both the US and UK Role Evolution models for Radiological Practice are relatively new, there is scant literature on the efficacy of these models to date.

7. Professional Indemnity

A search of the literature indicated that RAs in the US would be required to maintain their own professional indemnity or 'medical malpractice' insurance once qualified (The Division of Radiologic Science – UNC, (n.d)). Insurance during training is required, but may be provided by the educational institution in some states, whilst the student participates in the accredited course (The Division of Radiologic Science – UNC, (n.d)). The educational institution does not provide cover for a student when they are working for pay. Because of the predominance of a fee for service system in the US, it is likely that most RA's will obtain their own insurance coverage.

In the UK, literature regarding professional indemnity insurance for advanced and consultant practitioners showed that membership of the Society and College of Radiographers included a professional indemnity policy with a limit of two million pounds (Society of Radiographers, n.d). Radiographers employed within the NHS are generally covered by their employer – the NHS (Department of Health, n.d.).

At present in Australia, radiographers and sonographers who are members of the AIR and ASA are covered by insurance that has been obtained by these organizations and is contributed to by premiums paid by members (Australian Institute of Radiography, 2004; Australian Sonographers Association, 2006). The AIR policy provides coverage for covered persons up to \$5 million dollars, whilst the ASA policy has a limit of \$2 million dollars. Both policies provide for a limited amount of coverage for legal fees. Individual practices are likely to have different insurance requirements of non medical diagnostic imaging staff to larger public hospitals, with public hospitals historically offering legal protection to their staff against litigation (Insurance Council of Australia, 2001).

The litigious environment in the US may have contributed to the design of the 'extender' model of role evolution in that it consists of training and education standards that must be met, prior to the implementation of structural changes to practice. It is noteworthy - from a legal perspective - that the evolved roles do not

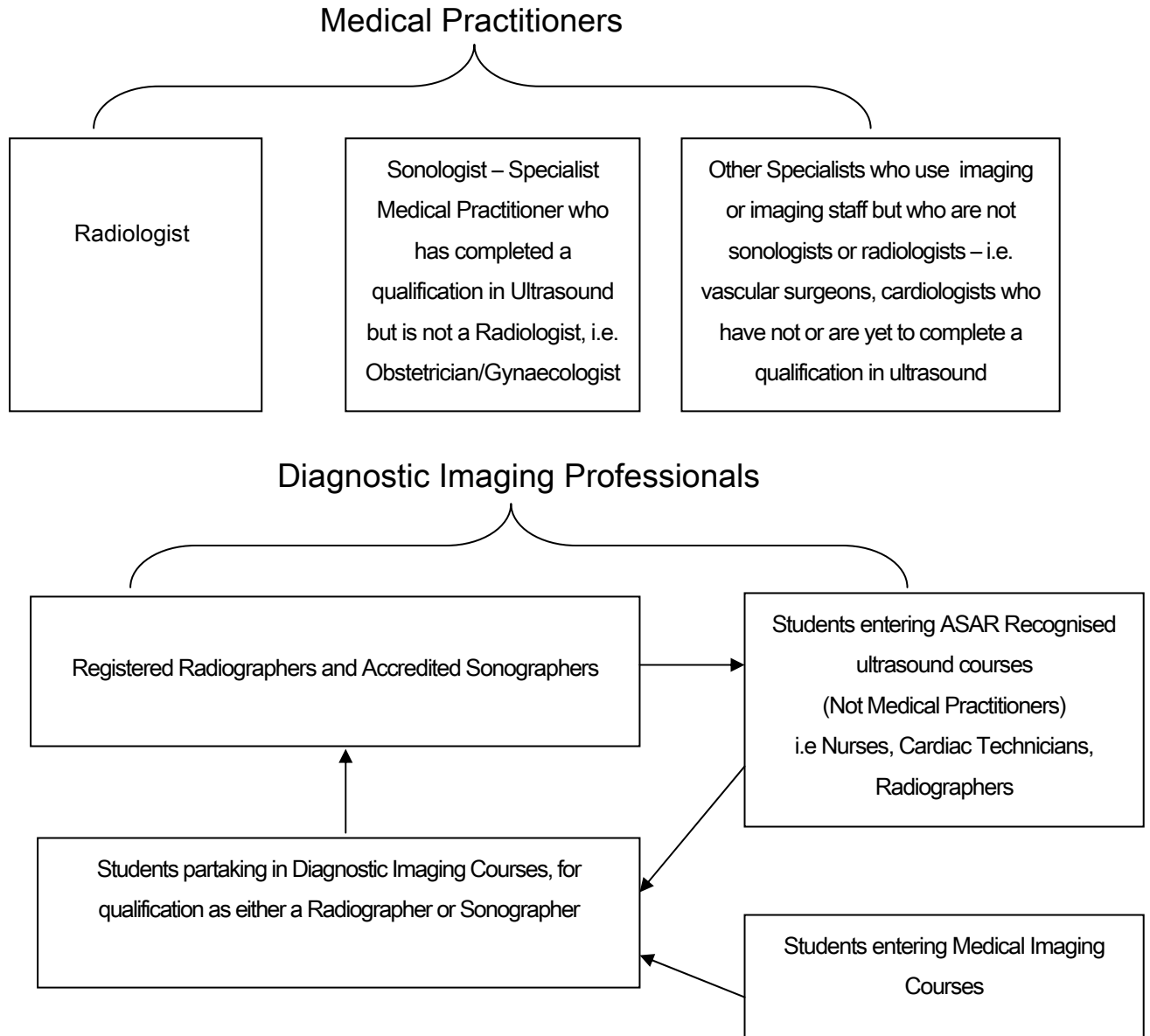
include reporting responsibilities. By comparison, the UK model appears to have provided the structure that allows reporting, but has not yet formalised a training and education program to support the practice and role changes. While there is an expectation that Advanced and Consultant Practitioners (in the UK) will have post graduate qualifications, their ability to practice at these levels is dictated by the position at which they are employed, rather than a formal accreditation or registration process. Long term follow up studies in the UK examining the reporting success of non medical diagnostic imaging staff reporting on films, when available, may provide a better evaluation of the quality of the service provided by such staff.

Training, education and structural change are key elements to role evolution and its success or otherwise. At present, there is little empirical evidence available to assess the usefulness of role evolution as a strategy aimed at addressing workforce shortage within radiological practice.



Appendix I

Professional Groupings of Imaging Personnel



Appendix II

Clinical Activities and Levels of Supervision Required for Radiologist Assistants

Definitions of Levels of Supervision:

Personal Supervision means the radiologist must be in attendance in the room with the R.A. during the performance of the procedure.

Direct Supervision means the radiologist must be present in the office suite and immediately available to furnish assistance and direction throughout the performance of the procedure. The radiologist is not required to be present in the room when the procedure is performed.

General Supervision means the procedure is furnished under the radiologist's overall direction and control, but the radiologist's presence is not required during the performance of the procedure.

Clinical Activities	Levels of Supervision
1. Review the patient's medical record to verify the appropriateness of a specific exam or procedure and report significant findings to radiologist.	General
2. Interview patient to obtain, verify, or update medical history.	General
3. Explain procedure to patient or significant others, including a description of risks, benefits, alternatives, and follow-up. Patient must be able to communicate with the radiologist if he/she requests or if any questions arise that cannot be appropriately answered by R.A.	General
4. Obtain informed consent. Patient must be able to communicate with the radiologist if he/she requests or if any questions arise that cannot be appropriately answered by R.A.	General
5. Determine if patient has followed instructions in preparation for the exam (e.g., diet, pre-medications).	General

Clinical Activities	Levels of Supervision
6. Assess risk factors that may contraindicate the procedure (e.g., health history, medications, pregnancy, psychological indicators, alternative medicines). (Note: Must be reviewed by radiologist.)	General
7. Obtain and evaluate vital signs.	General
8. Perform physical examination and analysis of data (e.g., signs and symptoms, laboratory values, and significant abnormalities) and report findings to the supervising radiologist for the following:	
a. abdomen	General
b. thorax, lung, and respiratory function	General
c. cardiovascular function	General
d. musculoskeletal (muscles, bones, and joints of extremities)	General
e. spine	General
f. peripheral vascular system	General
g. neurological function	General
h. breasts and axillae (clinical breast exam)	General
9. Apply ECG leads and recognize life threatening abnormalities.	General
10. Perform urinary catheterization. Catheterization can be performed by appropriately trained R.A. under general supervision. If the patient is known to have an anatomic anomaly, recent surgery in the area, etc. direct supervision would be needed.	General
11. Perform venipuncture.	General
12. Monitor IV for flow rate and complications in compliance with facility and regulatory rules.	General
13. Monitor IV therapy for flow rate and complications in compliance with facility and regulatory rules.	Direct
14. Position patient to perform required procedure, using immobilization devices and modifying technique as necessary. Application of restraints should be in compliance with departmental rules and regulations.	General
15. Administer moderate (conscious) sedation in compliance with facility and regulatory rules.	Personal
16. Observe and assess patient who has received moderate (conscious) sedation in compliance with facility and regulatory rules.	Direct

Clinical Activities	Levels of Supervision
17. Assess patient's vital signs and level of anxiety/pain and inform radiologist when appropriate.	General
18. Recognize and respond to medical emergencies (e.g., drug reactions, cardiac arrest, hypoglycaemia) and activate emergency response systems, including notification of the radiologist.	General
19. Administer oxygen as prescribed.	General
20. Operate a fixed/mobile fluoroscopic unit.	General
21. Assure documentation of fluoroscopy time.	General
22. Explain effects and potential side effects to the patient of the pharmaceutical required for the examination	General
23. Administer contrast agents and radiopharmaceuticals as prescribed by the radiologist	Direct
24. Administer general medications as prescribed by the radiologist. (Note: for purposes of this document, the term medications excludes contrast media and radiopharmaceuticals.)	
a. Medications administered parenterally always:	Personal
b. Medications administered orally usually:	Direct
25. Monitor patient for side effects or complications of the pharmaceutical depending on medication administered.	General or Direct
26. Perform the following fluoroscopic examinations and procedures including contrast media administration and operation of fluoroscopic unit:	
a. upper GI	Direct
b. oesophagus	Direct
c. small bowel studies	Direct
d. barium enema	Direct
e. cystogram	Direct
f. t-tube cholangiogram	Direct
g. hysterosalpingogram (imaging only) - Personal by radiologist if obstetrician/gynaecologist not in the room; Direct by radiologist if obstetrician/gynaecologist present in room.	Personal or Direct
h. retrograde urethrogram	Direct

Clinical Activities	Levels of Supervision
i. nasoenteric and oroenteric feeding tube placement	Direct
j. port injection	Direct
k. fistulogram/sonogram	Direct
l. loopogram	Direct
m. swallowing study	Direct
27. Perform the following procedures including contrast media administration and needle or catheter placement:	
a. lumbar puncture under fluoroscopic guidance	Personal
b. lumbar myelogram	Personal
c. thoracic or cervical myelogram	Personal
d. joint injection and aspiration	Direct
e. arthrogram (conventional, CT, and MR)	Direct
f. PICC placement (Level of supervision dependent upon complexity of examination).	Direct or General
g. non-tunnelled venous central line placement	Personal
h. paracentesis with appropriate image guidance	Direct
i. thoracentesis with appropriate image guidance	Direct
j. venous catheter placement for dialysis	Personal
k. lower extremity venography	Direct
l. breast needle localization	Personal
m. ductogram (galactogram)	Personal
28. Perform additional procedures the radiologist deems appropriate.	Personal
29. Perform routine CT post-processing (e.g., 3D reconstruction, modifications to FOV, slice spacing, algorithm).	General
30. Perform specialized CT post-processing (e.g., cardiac scoring, shunt graft measurements).	General
31. Perform MR post processing data analysis: (e.g., 3D reconstructions, MIP, 3D surface rendering, volume rendering).	General
32. Evaluate images for completeness and diagnostic quality, and recommend additional images as required (general radiography, CT, and MR). (Note: Additional images only in the same modality such as additional CT cuts.)	General

Clinical Activities	Levels of Supervision
33. Evaluate images for diagnostic utility and report clinical observations to the radiologist. (Note: Applies to general radiography, CT, and MR).	General
34. Review imaging procedures, make initial observations, and communicate observations only to the radiologist.	General
35. Record previously communicated initial observations of imaging procedures according to approved protocols.	General
36. Communicate radiologist's report to referring physician consistent with ACR Communication Guideline.	General
37. Provide physician-prescribed post care instructions to patients.	General
38. Perform follow-up patient evaluation and communicate findings to the radiologist.	General
39. Document procedure in appropriate record and document exceptions from established protocol or procedure.	General
40. Write patient discharge summary for review and co-signature by radiologist.	General
41. Participate in quality improvement activities within radiology practice (e.g., quality of care, patient flow, reject-repeat analysis, patient satisfaction).	General
42. Assist with data collection and review for clinical trials or other research.	General

Reference-taken from: American Registry of Radiologic Technologists 2005a, *Radiologist Assistant Role Delineation – Information paper*, American Registry of Radiologic Technologists, Available from:

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Appendix III

Summary of UK Four Tiered Model

Four Tiers of the UK Model of Skills Mix for Non Medical Diagnostic Imaging Staff

Assistant Practitioner

An assistant practitioner performs protocol limited clinical tasks under the direction and supervision of a State-registered practitioner.

Practitioner (State Registered)

A practitioner autonomously performs a wide-ranging and complex clinical role; is accountable for his or her own actions and for the actions of those they direct.

Advanced Practitioner (State Registered)

An Advanced Practitioner, autonomous in clinical practice, defines the scope of practice of others and continuously develops clinical practice within a defined field.

Consultant Practitioner (State Registered)

A consultant practitioner provides clinical leadership within a specialism, bringing strategic direction, innovation and influence through practice, research and education.

Reference: Department of Health (UK) 2003, *Radiography Skills Mix: A Report on the four tier service delivery model*, Department of Health, London.

Appendix IV

List of New Occupational Standards for the Four Tiered Model

List of new occupational standards

Breast Screening

- Position woman and produce basic radiographic images of the breast
- Examine screening mammography images for presence of abnormalities
- Perform ultrasound examination of the breast and associated structures
- Undertake X-ray guided interventional breast procedures
- Direct and interpret mammographic examination of the breast

Radiotherapy

- Mark up treatment area for a patient without the use of imaging
- Mark up a treatment area for a patient using a simulator
- Undertake treatment verification using a simulator
- Undertake treatment verification using mega-voltage equipment
- Define radiation treatment volumes for isodose planning
- Perform simple treatment calculations
- Produce an isodose treatment plan
- Check and approve an isodose treatment plan
- Clinical authorize and prescribe radiation treatment
- Deliver external beam megavoltage radiation
- Deliver external beam kilovoltage radiation

Clinical Imaging

- Produce radiographic images of the appendicular skeleton for diagnostic purposes
- Produce radiographic images of the chest and thorax for diagnostic purposes
- Produce radiographic images of the spine and pelvis for diagnostic purposes
- Produce radiographic images of the abdomen for diagnostic purposes
- Produce radiographic images of the skull for diagnostic purposes
- Produce radiographic images for diagnostic purposes using mobile x-ray equipment
- Undertake an ultrasound examination of the abdomen to form, or assist in forming, a diagnosis
- Undertake an ultrasound examination of gynaecological structures to form, or assist in forming, a diagnosis
- Undertake an ultrasound to determine and monitor pregnancy
- Undertake an ultrasound examination of the heart to form, or assist in forming, a diagnosis
- Undertake an ultrasound examination to form, or assist in forming, a diagnosis of vascular disease
- Undertake an ultrasound examination of selected musculoskeletal anatomy to form, or assist in forming, a diagnosis
- Produce C.T. scanning images for diagnostic purposes
- Produce C.T. scanning images of the brain for diagnostic purposes
- Produce M.R. images for diagnostic purposes
- Produce images using static image intensifier equipment
- Direct and report on fluoroscopic examination of the lower G.I. tract using contrast media
- Direct and report on contrast swallow using fluoroscopy
- Direct and report on contrast meal using fluoroscopy
- Direct and report on small bowel enema examinations using fluoroscopy and contrast media
- Direct and report on video fluoroscopic examinations of the oro-pharynx and oesophagus using contrast media
- Direct and report on defaecating proctography using fluoroscopy
- Produce images using mobile image intensifier
- Interpret and report on plain radiographic images of the appendicular skeleton

- Interpret and report on plain radiographic images of the axial skeleton
- Interpret and report on plain radiographic images of the chest
- Interpret and report on plain radiographic images of the abdomen
- Introduce and remove a rectal catheter
- Establish intravenous access and administer fluids for use during imaging procedures

Reference: Department of Health (UK) 2003, *Radiography Skills Mix: A Report on the four tier service delivery model*, Department of Health, London.

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