IMAGING INFORMATICS
PROFESSIONALS IN NEW
ZEALAND HEALTHCARE

Kevin Hughes

A thesis submitted in partial fulfilment of the
requirements for the degree of Master of Health Science

Unitec Institute of Technology

2012
DECLARATION

Name of candidate: Kevin Hughes

This Thesis/Dissertation/Research Project entitled “Imaging Informatics Professionals in New Zealand Healthcare” is submitted in partial fulfilment for the requirements for the Unitec degree of: Masters of Health Science (MRT)…

CANDIDATE’S DECLARATION

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- This Thesis/Dissertation/Research Project represents my own work;
- The contribution of supervisors and others to this work was consistent with the Unitec Regulations and Policies.
- Research for this work has been conducted in accordance with the Unitec Research Ethics Committee Policy and Procedures, and has fulfilled any requirements set for this project by the Unitec Research Ethics Committee.
  Research Ethics Committee Approval Number: 2012-1028

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Student number: 1198473……………………………
ABSTRACT

This study investigated the Imaging Informatics Professionals in New Zealand Healthcare. It is a qualitative study which examined who is currently performing this role while analysing their experience, background and educational qualifications to do so. In addition it also examined the continuing professional development of these individuals and what are the current and projected functions of this role both internationally and in New Zealand.

This emerging/evolving role originated from the expansion of Diagnostic Imaging into the world of digital imaging and its further progression into the realm of medical informatics. It has grown from that of a Picture Archiving Communication System (PACS) and or Radiology Information System (RIS) support person to its current position with the greater integration of electronic patient records for all forms of digital imaging and reports. New Zealand Healthcare has a goal of an easily accessible electronic patient record by the end of 2014 and is progressing to this end. With the boom in the amount of data generated by current information and imaging systems, it follows, therefore, that the role of the Imaging Informatics Professional (IIP) has to grow to support these systems and assist in attaining that goal. Additionally they must provide enhanced, efficient, secure and functional care for the patients and end user clinicians while maintaining these features in the respective departments that contribute the data.

This research has demonstrated there is a diverse group of individuals undertaking this role to varying levels across the District Health Boards of New Zealand. The lack of availability of formal training and post graduate courses has been overwhelmingly demonstrated and may well be a contributing factor to the lack of published New Zealand literature. Most of the individuals surveyed have learned what they know from their vendor(s) and on the job. Many feel that the biggest issues are in not knowing what they don’t know and therefore not having a full understanding of the Imaging Informatics field.

Whilst there are some on-line courses offered predominantly from the United States and Canada, training programs are almost non-existent in Australasia. As most respondents indicated their desire to do some form of additional training if it was provided, lack of accessibility to local training only serves to compound the issue. Of those surveyed and interviewed, only one (1) has obtained any formal certification in PACS administration. Today the two (2) available certifications are provided by professional organisations located
outside of Australasia and not from recognised educational institutions. Both of these certifications are by examination only. Only one of the two organisations that offer these examinations is currently available on-line in New Zealand at the participant’s leisure. The other can only currently be sat in an approved supervised location (the closest is in Australia) in pre-defined semi-annual sittings.

The numbers of IIP’s in New Zealand healthcare is very small and may well not justify a formal education or regulatory body. However, most feel there is a need for some education, regulation and recognition of what they overwhelmingly agree is a unique advanced practice role, and one which they and the literature, recognise as a very critical component of the patient care chain.

It is clear that the field of Imaging Informatics will only grow in the foreseeable future in order to provide the support services that are required to maintain a best practice environment for New Zealand. It follows, therefore, that there is a need for both education and regulation of the IIP’s in New Zealand. In addition, the global nature of today’s health care industry may well demand that the education, standards and regulations, conforms not only to that of our Asia-Pacific neighbours, but also those of the international leaders in the field.
ACKNOWLEDGEMENTS

This journey has been a very long one for me relatively late in my career. It has arisen as a result of my desire for personal and professional development in Imaging Informatics. This would not have been possible without the support, encouragement and feedback from a lot of people, some of whom were involved before this project formally began.

I would like to thank my supervisors, Dr. John Poletti and Dr. Suzanne Henwood for their inspiration and guidance throughout this process. I did not make it easy for them!

Specific thanks go to the individuals who provided their time and effort in completing the questionnaire and interviews. Your time, effort and cooperation have been the saving grace of this endeavour. These thanks also extend to the District Health Boards and private enterprises that gave their approval for this research to be conducted with the participation of their staff.

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I would also like to thank Dr. Gillian Whalley for the time she took one afternoon in her kitchen helping me mind map and sort through the topics and reach some decisions.

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<td>Personal Health Record</td>
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CHAPTER 1 INTRODUCTION

This study investigated the Imaging Informatics Professionals (IIP’s) in New Zealand Healthcare. It is a qualitative study which examined who is currently performing this role while analysing their experience, background and educational qualifications to do so. In addition it examined the continuing professional development of these individuals and what are the current and projected functions of this role both internationally and in New Zealand.

Therefore the questions that this project has researched are: What are the roles, tasks and responsibilities of the Imaging Informatics Professionals in New Zealand, who is performing them; what educational resources do they need and what support is available to them?

Many patients will be referred for medical examinations that will produce images and associated information. The majority of these will be performed within the Medical Imaging Department while others will be performed in a variety of departments across the healthcare field. From receiving the referral request, scheduling and corresponding the appointment details and preparations, registering the patient demographic details, performing the examination, reviewing the images, recording, accepting and distributing these results, there are a variety of systems involved that will require the support of Imaging Informatics Professionals.

Dr. Steven Hori, in Bui and Taira, refers to the definition of Imaging Informatics by the Society for Imaging Informatics in Medicine (SIIM) which describes the field as:

“A relatively new multidisciplinary field that intersects with the biological sciences, health services, information sciences and computing, medical physics, and engineering. Imaging Informatics touches every aspect of the imaging chain and forms a bridge with imaging and other medical disciplines” (Bui & Taira, 2010, p. viii).

In a Scientific Computing article, Sequera states Imaging Informatics

“consists of accurately capturing images, extracting pertinent raw data, analysing that data with great precision, displaying it in a readily comprehensible form, sharing
it with colleagues and other professionals, and applying the information gained to the context of individual disciplines to extend the knowledge base” (Sequera, 2004, p. 18)

Revolutions in the fields of medical imaging and biomedical informatics have provided the impetus to develop this emerging role and career path. Hori further states that “from a high-level perspective the healthcare process can be seen in terms of three clinical questions, each related to aspects of the scientific method. For any given patient, the physician has to” investigate:

1. What is wrong (develop a hypothesis);
2. Determine how serious the problem is by using diagnostic procedures (i.e. experiment) and;
3. Interpret the result to decide what needs to be done (analyse and conclude).

This is further qualified when the author states that at each of these stages, “health care imaging takes on a critical role” (Bui & Taira, 2010, p. 4). This infers that the use of Imaging Informatics can be developed by following these scientific methods. Imaging Informatics must therefore incorporate a wide variety of skilled individuals, terminology, systems and integrations covering all aspects of a patient’s healthcare process. These items should then be integrated utilising scientific methodology in order to accomplish this critical role.

In some departments, the evolution of the IIP unknowingly began in the early 70’s, when departments began migrating from paper–based systems to computerised Radiology Information Systems (RIS) and the need for support personnel was identified resulting in the RIS Administrator role being born (Lyche, Richardson, Maliff, Romlein, & Norton, 1999; Wiltgen et al., 1993; Winsten & McMahan, 2000). In the 80’s with the coining of the term PACS, (Picture Archive and Communication Systems), the beginnings of the archival and distribution systems emerged with a realisation that support personnel were also required for these systems and initially these individuals were predominately identified as PACS Administrators (Huang, 2003b). Frequently the person appointed to this role was the Medical Radiation Technologist (MRT) with the most computer interest or knowledge within the radiology department or the team leader of a specific modality (Cabrera, 2002b; Hasley, 2002; Redfern, Horii, Feingold, & Kundel, 2000; B. Reiner, 2002; Siegel & Reiner, 2003). This in turn contributed to the early modality-centric approach adopted by most systems.

The overwhelming adoption of the DICOM and HL7 standards by vendors also allowed for a common language for the integration of the imaging and information systems data and to
facilitate the communication with the systems responsible for hospital patient health records (Blazona & Koncar, 2007; Freiherr, 2009; Huang, 2010). In turn this required a higher level of understanding and cooperation with the central information technology departments to ensure these communications were properly interfaced or integrated and efficient for enterprise wide exchange and benefit. As the years have progressed there has also been tremendous increase in the capacity of the software, hardware, networks, integrations and interoperability of not only the PACS and RIS systems but all healthcare informatics systems. This was reflected in the growth and acceptance of these systems in the healthcare environment (Huang, 2003a). In conjunction with this acceptance was the growth of standards, legislation and accreditation requirements, which the individuals in this role were required to comply with to maintain compliance, accreditation and even funding (Shrestha, 2012). The modality and department centric role of the RIS and/or PACS Administrator has rapidly evolved over the last 20 years and has had a name change to reflect the expanded role, tasks and responsibilities required to cover all aspects of Imaging Informatics and it’s evolution into a patient-centric focus. It is still however a role which is being predominately filled by MRT’s, IT, administrative and management personnel with cross training to provide all these requirements (Gould, 2009; Hagland, 2009a; Hayes, 2006; Honea, 2001).

After a relatively short period of time it was recognised that there was a need for formal certification of the IIP as the role has expanded past that of the training of most Radiographers and IT personnel and expanded to its own unique role. Two main pathways of certification were developed, firstly by the PACS Administrators Registry and Certification Association (PARCA) which was later followed by the American Board of Imaging Informatics (ABII).

PARCA was formed in 2005 and has been offering certification examinations accessible around the world via the internet since that time. They offer five different levels of certification which “provides a roadmap for required skills and a baseline for evaluating available training programs”(PARCA, 2012a). In recognition of the changes in the current environment, PARCA introduced two new levels of certification in 2012 to recognise the move towards Electronic Medical Records (EMR). PARCA has over 2000 members and has issued 891 certificates worldwide. There is a member of the board of directors from Australia which has 24 current members and seven of those are certified. New Zealand has five current members however only one of those is certified (Grazer, 2012).
The Society for Imaging Informatics in Medicine (SIIM) evolved from the Society for Computers Applications in Radiology (SCAR) which also incorporated The Radiology Information System Consortium (RISC). SIIM, in conjunction with the American Registry of Radiologic Technologists (ARRT), created the independent American Board of Imaging Informatics (ABII). This partnership led to the development of the Certified Imaging Informatics Professional (CIIP) examination and its requirements, after the decision to pursue this was reached at the 2005 SIIM annual meeting in Orlando, Florida. The first exam was held in 2007 and today there are more than 2000 members of SIIM with 934 CIIP’s from around the world currently on the register (ABII, 2012). The examinations for the ABII certification are only held twice a year in recognised education centres. A review of the database for the ABII as of November 2012 shows there is only one New Zealand CIIP.

Both of these certification bodies have requirements that must be met prior to being permitted to sit the examinations. They also both have a five year certification cycle which mandates Continuing Professional Development requirements (CPD) and membership.

Imaging Informatics is a relatively young and expanding field which currently has very diverse implementations throughout the world (Fernandez-Bayó, 2011). This has led to an even more varied level of integration with other hospital and community systems. The individuals tasked to support these implementations and associated software applications are from a variety of clinical, technical, management and clerical backgrounds which also adds an element of diversity towards who is performing this role.

The information that was sought in this project is predominately qualitative in nature; the main target group being the imaging informatics professionals in New Zealand healthcare. These are the individuals who provide day to day support to the end users of the Imaging Informatics applications. The project investigated the training, background and CPD available to assist with administering and enhancing the Imaging Informatics systems. The information obtained was used to assess the level of integration that the individuals, departments and professions involved are currently supporting and what educational support they require to perform their role and prepare for the future.

The complexity of this field requires the understanding of the subtleties that influence the role. Any training, educational or other perceived shortcomings with current implementations or known future system enhancements were investigated. Other issues that arose from the literature, data and observation that were preventing or hindering the
development of these IIP’s to improve patient care and utilisation of these systems were also investigated.

The overall aim of this research was to arrive at some recommendations for future best practice for the professional development of Imaging Informatics Professionals in New Zealand. This will assist in determining what can be done to support Imaging Informatics Professionals in their role both now and in the foreseeable future. In addition it examined disparities in current roles and educational backgrounds and combined this with the information obtained from the literature review.

Chapter 2 discusses the background of this role. This is followed by chapter 3 reviewing the pertinent literature. A review of the processes followed for this research including ethical consideration and an evaluation of the methodology is in chapter 4. This is followed by a presentation of the results in Chapter 5 and a review of the data obtained is discussed in chapter 6. To conclude, chapter 7 provides a summary with the key findings, implications and recommendations.
CHAPTER 2 BACKGROUND

For many years “Medical Records” was the responsible department for the compiling, maintaining, cataloguing, coding, distributing and archiving of all the patient information that was recorded in the healthcare setting. This was very time-consuming, required a lot of resources and was subject to the errors of human intervention. The arrival of the computer and then software applications along with increased networking speeds and protocols able to support this function was shown to greatly improve patient care. The Medical Informatics departments emerged and evolved from these advances and the changes required while coordinating and maintaining all the information that these new systems generated.

I have been a qualified MRT for over 25 years, and have been employed in a variety of roles and modalities which has allowed me the opportunity to follow the digital invasion of the field. I began in the early 80’s with exposure to the rapid growth and change in CT Digital Fluoroscopy and Ultrasound along with the personal computer. In the mid 1990’s I was managing radiology departments, purchasing equipment using the DICOM standards and implementing RIS systems to migrate away from the paper based file systems and to provide statistical data while observing the explosion in digital radiography at the RSNA. I began installing modality-centric imaging systems around Nuclear Medicine, CT, Digital Fluoroscopy and Ultrasound along with early teleradiology utilising commercial networks.

I have moved through some lecturing and clinical tutoring roles after I came to New Zealand and now I am a PACS/RIS System Administrator. I have also been a member of the SIIM, formerly known as SCAR, for the last 4 years and I completed my certification as an Imaging Informatics Professional (CIIP) under the auspices of the American Board of Imaging Informatics in 2011 which has both a technical and clinical component. Over the years I have undertaken considerable on the job training and self-directed learning which has crossed many borders and software applications. In addition to RIS and PACS, I also support several other integrated and stand-alone software and hardware components. These include Orthopaedic templating software, voice recognition software, business intelligence and reporting software, DICOM and HL7 Standards, networking (bandwidth, security, LAN, WAN, VPN, routers, switches, etc.), storage (magnetic tape, spinning disk, optical media, CD’s, DVD’s, solid state), integration (interface engine, scripting), hardware, infrastructure
and resources which have all been identified as components that an IIP would need to support and have knowledge of (B F Branstetter IV, 2007a).

Through the 1970’s, as the movement was occurring in the medical records department, many imaging departments were migrating from the use of manual filing systems for patient visits, results, billing, statistics and reports, towards what was to become known as Radiology Information Systems (RIS). Designed to support the operational workflow and business analysis, along with being a repository of patient radiology records and results, these systems required integrations with the Hospital Information Systems (HIS) to obtain patient demographics and provide some patient related information to the HIS in return (The Royal College of Radiologists, 2008). This was a significant beginning for the integration of imaging departments into the realm of Medical Informatics. In New Zealand, the late 70’s also saw the introduction of a form of national unique identifier linked to hospitals via their HIS. This was later followed by the National Health Index (NHI) in 1992 and is still, some 20 years in the future one of the few national health indexes in the world. It is regarded as a significant cornerstone of New Zealand healthcare and is the envy of many international medical informaticists (Delany, 2006).

International development of PACS and ultimately Imaging Informatics has been shown to be varied due to disparate funding, varied operating conditions and different environments (Huang, 2003a). Generally, medical imaging departments began experimenting in the late 1970s with the transfer and storage of digital images from nuclear medicine and computed tomography within Local Area Networks (LAN’s) (Prior, 1992). As such these were designed for a specific set of functions for a specific modality and introduced the end users to soft copy work stations and short term archival using technologies such as Optical Discs however long term archival was still hard copy, printed film.

The first records on the concept of digital image communication and display were in an original paper from German professor Heinz U. Lemke in 1979 at a Digital Radiography conference sponsored by SPIE (International Society for Optical Engineering) at Stanford University Medical Centre chaired by Dr. William R. Brody, himself a pioneer in the field (Huang, 2011). Between these early pioneers there was much discussion and literature generated which led to the a conference on Digital Radiography and the topic of Picture Archiving and Communication Systems in 1982 (Huang, 2003b, 2010). There is also a similar timeline in the European and Asian Medical Imaging communities. The First
International Symposium on PACS and PHD (Personal Health Data) sponsored by the Japanese Association of Medical Imaging Technology (JAMIT) was held in July 1982. The driving force in Europe is the EuroPACS (Picture Archiving and Communications Systems in Europe) which began annual meetings in 1983.

PACS has as a central concept, the communication of medical images between the modalities which generate the images and the devices required to display the images. A key requirement of this concept is the ability to store and retrieve the images and the associated information on demand and with no loss of data. To ensure this was done while maintaining integrity of the patient data and department workflow, integration with RIS systems had to occur. In order for these systems to be fully functional, it was soon recognised and accepted that it was just one aspect of a complete hospital-wide information network. PACS is generally integrated with the other components of this enterprise wide information system across a local area network (LAN) and uses a wide area network (WAN) to communicate across enterprises.

As the number of PACS implementations grew and developed, it was soon recognised that it was not only revolutionising the workflow in the imaging department, but was also rapidly becoming a very critical component of patient care. It would require individuals with strong computer background and clinical knowledge to maintain and support this critical patient care system. These individuals became known as PACS Administrators (PA) and were generally a bridge between the clinical department and the IT department (B. F. Branstetter IV, 2009). With the rapid changes in hardware, software, modalities, standards, legislation and initiatives, the PACS/RIS systems had to evolve as did the training and background of the PA’s. Medical imaging led the way with standards such as DICOM being jointly developed by the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA). This partnership ensured the end users and the vendors all had input into the voluntary standards and assisted in its universal acceptance and adoption. Along with this standard and the incorporation of other healthcare standards such as HL7, the PA’s found themselves supporting other modalities and the move from a modality centric to a department centric focus began. This resulted in even more integration, collaboration and cooperation required with the IS infrastructure of the hospital. The superseding of this department centric model began occurring when other healthcare departments began realising the benefits available from these PACS systems and the PA’s found themselves moving out of the traditional imaging department to support the other ‘ologies’. Along with this change came a transformation and name change from PACS Administrator to Imaging Informatics.
Professional (IIP) with responsibilities outside the boundaries of the traditional modality or department-centric PACS systems.

Founded in 1993 by Dr. Laurens V. Ackerman, the InfoRad section of the Radiological Society of North America (RSNA) showcased live demonstrations of DICOM and has been a key driving force behind the development and clinical acceptance of PACS (Huang, 2010). In 1997 the RSNA began the process of collecting ideas directed towards an integrated healthcare information infrastructure. In turn this led to a joint project between the RSNA and the Healthcare Information and Management Systems Society (HIMSS) which convened in the fall of 1998 (Carr & Moore, 2003). Two initial outcomes of this project were the definition of an organisational structure and that the commitment of the group to clarifying the use of existing standards and that it would not in itself become a standards organisation. Integrating the Healthcare Enterprise (IHE) was established to bridge the gap between the standards and implementation of integrated systems to make interoperability possible. To date, IHE has published 10 integration profiles defined by clinical need which address specific information management problems. Currently New Zealand is in the minority and is not active under the Asia-Oceania IHE umbrella. The Royal Australian and New Zealand College of Radiologists (RANZCR) is a member organization but there are no New Zealand specific associations with IHE apart from the global New Zealand based vendor Orion Health (IHE, 2012).

To lay the groundwork for patient centric Imaging Informatics System in New Zealand, there has been a move to four regional PACS/RIS systems throughout the country under the auspices of the National Health IT plan (Ministry of Health, 2011a). In addition there are regional Clinical Work Station (CWS) and Clinical Data Repositories (CDR) that will need to be interfaced and/or integrated with these solutions. These are just two of the much needed integrations required to meet these goals for all forms of imaging performed in the healthcare environment. The current aims of the National IT Health Board are:

"That by 2014:

• New Zealanders have electronic access to their own health information.

• All health professionals caring for a person, no matter where they are in the country, have secure electronic access to that person’s full health information.” (Ministry of Health, 2011b).
This subsumes a move towards an integrated Electronic Health Record (EHR) or Personal Health Record (PHR) in New Zealand and is a definite move to the patient centric model. Again this will require an extension of the applications, support and training that will be necessary for the Imaging Informatics Professionals to support these goals. For this requirement, one advantage to achieving this goal in New Zealand is that it is one of the few countries in the world to have a national unique patient identifier. This has paved the way to the sharing of crucial patient demographics and clinical information in the effort to move to centralised electronic patient record (EPR).

Imaging Informatics within the New Zealand health care system is a very young and expanding field. There are currently disparate implementations throughout the country with an even more varied level of integration between community providers, hospitals, District Health Boards and regional IT boards. As was identified earlier, the diversity of the individuals tasked to support these implementations and associated software applications, also adds to the inconsistency.

In my experience and research, most IIP’s in New Zealand have been educated on the job, primarily by the application specialists provided by their specific vendor. However a thorough understanding of the standards, theories, techniques, protocols and integrations of all the applications, associated software, legislated regulations and accreditation standards is required by these IIP’s to perform their role both now and in the future. It is essential to support all the applications, end users and the associated professionals in order to provide optimal service and reach the goals of the National Health IT Board. This requires some input and cooperation from the associated professionals and specialists in the clinical field as well as from the IT (Information Technology), IM (Information Management) and IS (Information Systems) sector.

Additionally there is very limited and almost non-existent formal post graduate training available from recognised tertiary institutions in Australasia for those placed or volunteered into these roles. This study will research the current role, background and requirements for these professionals to provide optimal assistance to the end users and to the ultimate goal of improving patient care.

The purpose of this project is to examine the roles of these application support staff, what training and educational support is available to support them currently, and what is required
to provide continuing professional development to prepare for the future of Imaging Informatics in New Zealand. Therefore the questions that this project is going to research are:

What is the role of the Imaging Informatics Professionals in New Zealand and who is performing it; what educational resources do they need and what support is available to them?
CHAPTER 3 LITERATURE REVIEW

This literature review began in February 2011 and was supported both by on-going reviews of the subject matter and utilising automated system updates from a broad spectrum of journal publishers. The main source was the Unitec library Databases with very few restrictions placed on which databases could be searched. Many keyword terms were utilised to represent the broad base of the project. Included were the terms ‘Picture Archiving and Communication Systems (PACS)’ ‘PACS Administrators’, ‘Imaging Informatics Professionals (IIP)’, ‘Health Care Informatics (HCI)’, ‘Medical Informatics (MI)’, ‘Integrating the Healthcare Enterprise (IHE)’, ‘Radiology Information Systems (RIS)’, ‘Electronic Patient Records (EPR)’, Electronic Medical Record (EMR) ‘PACS Administrators training and certification’, and ‘Imaging Informatics training and certification’.

Internationally there is a significant amount of literature regarding Healthcare Informatics, PACS, RIS, and specifically Imaging Informatics as a burgeoning field. There is however very little on these subjects in New Zealand literature. Most of this local literature relates to medical informatics and is at a higher level than this research is investigating and not specific to Imaging Informatics. New Zealand Healthcare Informatics articles that are important and relevant to the IIP role development will be presented.

In order to analyse this topic it was necessary to investigate the component systems which impact the roles and how these components contribute to the overall system. Dr. Bernie Huang is a pioneer in PACS and Imaging Informatics and has published over 200 peer reviewed articles, co-authored or authored eight books and presented at most major PACS conferences around the world (Huang, 2010). In 2003, he stated that Medical Imaging Informatics (MII) comprises “medical images and associated data (including PACS database), image processing and analysis, data/knowledge base management, visualization, graphic user interface, communication networking, image data security, system integration, and application server and user application software. These components are logically organised in a hierarchical software architectural design” (Huang, 2003a, p. xix). This analysis of the components in turn enabled me to assess the literature defining the responsibilities, tasks, experience and education an IIP would require to fulfil the role competently both now and in the future.
INFORMATION SYSTEMS

Radiology Information Systems were designed to support the operational workflow of the Radiology or Medical Imaging Department. Other departments also use some forms of information systems that are generally focussed on supporting the specific requirements of that functional area. These include Cardiology Information Systems (CIS), Laboratory Information Systems (LIS) and many others. The main link all of these have is the Hospital Information System (HIS) for patient demographics, admission and discharge transactions (ADT) and enterprise level coding and statistics support (Mansoori, Erhard, & Sunshine, 2012; Winsten & McMahan, 2000). In radiology, the RIS is generally the repository for the data affiliated with the examination including reports, scheduling, work lists, dictation, resource availability, business analysis and many other functions (The Royal College of Radiologists, 2008). Radiology Information Systems had been providing data to analogue systems long before PACS was available. They now provide both the front and back ends of many PACS systems and are the heart and soul of many Imaging Informatics Systems (Huang, 2010). In fact it became obvious during this review that many references to PAC Systems include the RIS as it is fully integrated within some of them.

In most installations the RIS is connected to the HIS, the Clinical Data Repository (CDR), report distribution systems such as Healthlink in New Zealand, business intelligence and many other systems. These connections can be directly integrated but more commonly they are via interfaces which are developed, depend upon the HL7 standards and utilise one or more interface engines to control and monitor the message flow. HL7 is the common standard employed by most Information Systems to communicate data in a recognised format (The Royal College of Radiologists, 2008). Therefore understanding the components of HL7 messaging and interface engines are skills and tasks required of the PACS administrator in order to fully comprehend and troubleshoot the realm of the data exchange involved in the chain of the PACS system (Carrino et al., 1998; McDonald, 2002; Sinha et al., 2002; Winsten & McMahan, 2000). There is continual growth of these standards to incorporate the many requirements of integrating numerous systems to provide everything from scheduling to reporting, business analysis and billing data (Blazona & Koncar, 2007; Honeyman, 1999; Kijewski, 2011).
PICTURE ARCHIVING AND COMMUNICATION SYSTEMS (PACS)

PACS was coined at the first International Conference and Workshop on Picture Archiving and Communication Systems held in Newport Beach, California in January 1982 (Huang, 2003b). Continued development of PACS and its clinical acceptance was furthered by its inclusion in the InfoRAD section at the annual RSNA Scientific Assembly in 1993 (Bui & Taira, 2010; Dreyer, Hirschorn, Thrall, & Mehta, 2006; Huang, 2010). This presented the first Digital Imaging and Communications in Medicine (DICOM) interface and, in 1994, DICOM 3.0 was released as a result of collaboration between the American College of Radiology (ACR) and the National Electronic Manufacturers Association (NEMA) designed to provide all the tools necessary for the “diagnostically accurate representation and processing of medical imaging data” (Pianykh, 2008, p. 3). The introduction, wide acceptance and adoption of this set of standards, currently consisting of 16 volumes known as parts encompassing the data transfer, storage and display protocols, set the stage for digital imaging to be embraced across the healthcare sector (ibid). Other standards such as HL7 have been incorporated into the PACS in order to enable the integration and communication required between the RIS and other healthcare systems. Information is required in a recognised format to allow the development of software applications utilising these standards to enhance digital imaging. Crossing traditional imaging boundaries has required both clinical and technical support to provide the interoperability of these integrations while adhering to legislative and professional standards.

The concept of digital imaging and communication has been around since the inception of nuclear medicine but became more focussed and indeed necessary with the introduction, acceptance and growth in the imaging family of computed tomography, magnetic resonance imaging and diagnostic ultrasound. Initially these were very basic systems which did not meet the full requirements of a PACS as they had no long term archival capabilities and very limited communications, and then only over dedicated small Local Area Networks. In addition these early systems still required film for long term storage as long term digital storage was too costly and cumbersome. Systems such as these were first identified in the literature through the works of some of the early pioneers of PACS such as Steven Horii, Sam Dwyer III, Eliot Siegel, and Bernie Huang to name a few (Wiley, 2005).
PACS has at its core, the concept of communicating digital images between both the generators of the image and long term archives as well as the end users’ display devices. PACS and RIS followed a very intense path of developing and adopting DICOM and HL7 standards which has allowed the industry and vendors to provide a diverse range of imaging informatics to support and improve patient care (Blazona & Koncar, 2007; Henri, Cox, Rubin, Bret, & Couch, 1999; Jianguo, Jianyong, & Johannes, 2003). This translation of the theories and techniques incorporated in these standards should be the goal of all Imaging Informaticists and their implementations and should be combined with the aim of increasing patient accessibility to their total healthcare records (Honeyman, 1999; Kapoor, 2010).

As the hardware, networking and software solutions were rapidly growing, and costs reducing, immense leaps in the overall system capabilities eventuated creating the economical, technical and clinical need to move from analogue to digital systems. However, most were still modality centric until the integration of the accepted international standards DICOM 3.0 and HL7 removed the barriers to interfacing modalities, systems and software from multiple vendors. Such integration fostered the hospital centric view thus allowing the burgeoning field of Imaging Informatics to blossom (Abraham, Nishihara, & Akiyama, 2011; Anderson, 2007; Blazona & Koncar, 2007; Nagy, 2008; Prior, 1992).

There were, and still are, four philosophical divisions in PACS implementations. The most common one is referred to as a modality centric view where the needs of the specific modality are primary. In a hierarchical model this is followed by the department centric model where the PACS supports all the modalities within a single department of the hospital. The next level is a hospital centric view where the PACS should be one aspect of an information system integrated into the overall hospital system (Prior, 1992). With the arrival of the patient focussed EMR there is now the patient centric model (Swensen, 2012; Swensen & Johnson, 2010; Thompson, 2011; von Heijne, 2012; Zhang et al., 2005). Despite the modality and hospital-centric concepts being more than 20 years old, both schools have continued to evolve and be implemented throughout New Zealand. Much literature has been produced demonstrating how PACS has had an impact on the radiology departments in particular from the administrative personnel through to the radiologists (Carrino, Unkel, Shelton, & Johnson, 1999; M. D. Cohen, Rumreich, Garriot, & Jennings, 2005; Dundas, 2005; Fridell, Aspelin, Edgren, Lindsköld, & Lundberg, 2009; Hasley, 2002; Honeyman-Buck, 2003; Kapoor, 2010; Larsson et al., 2007; Mack, 2006c; Redfern et al., 2000; Siegel & Brown, 1994; Siegel & Reiner, 2003). A good proportion of this has been in regard to the
redesign of the workflow, however, much of it has been retrospective in nature as most of the impact has been recognised after the system had been installed (Cabrera, 2002b; Fridell et al., 2009; Larsson et al., 2007; Redfern et al., 2000). This is another issue that the IIP must be aware of and have the skills and training to identify, proceed to reengineering and ultimately educating the end users (Cabrera, 2002b; Fridell et al., 2009; Nagy, Bowers, Reiner, & Siegel, 2005; Trevino & Page, 2003).

STANDARDS, LEGISLATION AND GUIDELINES

Medical Imaging has led the way for many years with the formation and adoption of industry wide standards in order to improve the interoperability of systems (Dreyer et al., 2006; Huang, 2011; Pianykh, 2008). PACS required the development of the DICOM standard and the information systems require HL7 to allow the systems to communicate effectively disparate of the vendor (Blazona & Koncar, 2007; Honeyman, 1999; McDonald, 2002; Oosterwijk, 2004). The ACR-NEMA development of this standard was a trail blazer with cooperation from academia, vendors and end users to reach a goal to provide an internationally recognised and utilised guideline for the digital communication and archiving of imaging data (Bandon, Lovis, Geissbuhler, & Vallee, 2005; Gibaud, 2011; Honeyman, 1999; Huang, 2011). This standard has now grown to include many forms of medical imaging and continues to be updated regularly.

With the growth of the digital age it was soon recognised there was a need to legislate this data to maintain its integrity and protect the privacy of individuals. From this the Health Insurance Portability Assurance Act (HIPAA) was created in the United States (Cao, Huang, & Zhou, 2003; Zhou Zheng & Brent, 2005). This required some re-engineering of systems to attain compliance and has required constant attention from both vendors and end-users to upgrade these systems.

Integrating the Healthcare Enterprise (IHE) is another initiative created by the RSNA in conjunction with the Healthcare Information and Management Systems Society (HIMSS) and supplemented with technical representatives from the vendor community. Its initial goal was to improve the integration of imaging data into the greater healthcare enterprise to improve interoperability without becoming a standards organisation (Carr & Moore, 2003; Fernandez-Bayó, 2011). It was soon recognised that there was a need to expand this and its domain
moved from radiology to laboratory, pathology, cardiology, ophthalmology and IT infrastructure (Rhoads, Cooper, Fuchs, Schluter, & Zambuto, 2010). IHE produces technical frameworks which provide a description of how to apply some of the existing standards to solve integration issues. In addition there are integration profiles which allow for a common language for end-users and vendors to discuss the integration requirements and capabilities (Carr & Moore, 2003; Freiherr, 2009; Gibaud, 2011; Z. Zheng, Brent, & Anh, 2007). Many of these profiles are integral to the daily production and presentation of the images in any Imaging Informatics environment and the IIP should be familiar with them in order to understand the complexity and issues they may encounter (B. F. Branstetter IV, 2009; Bui & Taira, 2010; Faggioni, Neri, Castellana, Caramella, & Bartolozzi, 2011; Fernandez-Bayó, 2011). Another unique aspect to the IHE initiative is its testing regime. One component of this is the ‘Connectathon’ which allows the vendors the opportunity to test for broad interoperability with all participating vendors and systems (Carr & Moore, 2003; IHE, 2012). The ‘Connectathon’ sessions have taken place internationally and are held every two years in Australia with the most recent being in Melbourne in October 2012.

**IMAGING INFORMATICS**

The literature and reviews of some implementations have demonstrated that if it is done correctly, Medical Imaging Informatics can reduce small time fragments from facets of a clinician’s tasks (Geis, 2007), reduce report turnaround times from hours and even days to minutes (Bui & Taira, 2010; Hicks, 2010) and allow improved access to the images thus improving patient care and reducing average length of stays (ALOS). It also allows for multiple users throughout the integrated system to access a patient’s study and perform consultations (Dreyer et al., 2006; Hicks, 2010) thereby increasing the impact of Radiology reports on timely patient care. This greatly supports the New Zealand National Health IT Board’s aims and further IT implementations and integrations, including Computerised Provider Order Entry (CPOE) and other decision support software to further enhance the quality of care for all patients which will ultimately require further support and integration by the IIP’s (Faggioni et al., 2011; Weir, Staggers, & Phansalkar, 2009) Challenges and requirements of this new patient-centred radiology paradigm can be enabled by the use of informatics thus allowing the patients to be more engaged in their care (Rubin, 2009). Daniel
Rubin reviewed the benefits of imaging informatics on patient centred care and presented the following opportunities for informatics to assist in a patient-centric radiology:

1. Guidance for referring physicians to determine the appropriate procedure
2. Diagnostic decision support for the interpretation
3. Results communication and shared decision making for patient care (ibid).

The integration of medical imaging and electronic patient records appears on the surface to be a natural and logical combination but has been slow in formal development. Early implementation have demonstrated improved accuracy and efficiency of patient management (Ratib, Swiernik, & McCoy, 2003) and the greater the degree of integration has been demonstrated to provide greater benefits (Fernandez-Bayó, 2011).

A methodological strategy introduced by Gordon Guyatt in 1991 of Evidence-Based Medicine (EBM) which is defined as “the process of systematically finding, appraising, and incorporating contemporary research findings into clinical decision making” (B. I. Reiner & Siegel, 2009, p. 345) led to the evolution of Evidence-Based Radiology (EBR) as a subset. However, there are many steps of the imaging chain that affect the outcome of the images and clinical outcomes that are to date, largely ignored in this process. Reiner and Siegel note that it must be recognised that the final radiology product is the sum of “multiple steps, performed by multiple individuals using multiple technologies” (ibid). Imaging Informatics Professionals are a major player in most of these steps and are required to support and implement required quality control and quality assurance procedures throughout the collective imaging informatics chain. Data mining to support the quantitative analysis of this research is gaining momentum with the increased data that the systems can now provide and it is the purview of the IIP to provide it (Nagy et al., 2005; Tateosian, 2006a).

Medical Imaging Informatics has additionally been furthered by the introduction of Medical Imaging Informatics Radiology Fellowship Education (B F Branstetter IV, Bartholmai, & Channin, 2004) and other post graduate programs such as the structured Electronic and Imaging Technology Fellowship programme formed at the Mayo Clinic (Bartholmai et al., 2002).
Various roles of PACS Administrators have emerged with the realisation that the PACS systems required a significant amount of support. However, as rapidly as PACS grew, so did their role (Trevino & Page, 2003). There are numerous peer-reviewed medical articles in the international media discussing the role of the PACS Administrator, their skill sets, and training. Many articles have identified the need to define the role, responsibilities, tasks, competencies and training (Beird, 1999; B F Branstetter IV, 2007a; Cabrera, 2002a; Carbajal & Honea, 1999; Hagland, 2009b; Hinesly, 2006b, 2008; Honeyman-Beck, 2006; Mack, 2006e; Maria & Zheng, 2003; Nagy et al., 2005; Seeram, 2011; Siegel & Brown, 1994; Socia, 2006; Tateosian, 2006b; Trevino & Page, 2003; Valenza, 2010). A study was initiated by the SCAR, the predecessor of SIIM, on the impact of digitalization of Medical Imaging which generated a white paper (Andriole et al., 2002). This is one of the first studies to examine this impact on MRT’s and departments. Some early articles on defining the role of a PACS Technologist identified the need for cross training in the IT and radiology fields (Cabrera, 2002a). Other articles have defined the skill set as one which bridges the domains of the MRT, information systems analyst, and radiology administrator (Honea, 2001; Nagy, 2003; Nagy et al., 2005; Trevino & Page, 2003). Some large institutions recognised this by creating several roles with crossed boundaries (Hinesly, 2006b; Honea, 2001; Tateosian, 2006a).

With greater integrations there arises the need and subsequent demand for a higher level of trained and educated support personnel. Their role and responsibilities involve monitoring of the system hardware and software, data reporting and mining to support management, training of end users, troubleshooting, integration, and legislative requirements, all of which should ultimately be geared to improve patient care. Dr. Paul Nagy, a recognised expert in Imaging Informatics and the director of Informatics Research, Department of Radiology, University of Maryland, was one of the first to be actively involved with identifying the PA role and his initial work presented interesting result (Nagy, 2003). Using three competencies, technical, behavioural and business, he identified 127 tasks organised under 14 roles which he identified would require proficiency to form the basis of a curriculum (Nagy et al., 2005; Trevino & Page, 2003). While the expectation that one individual could perform all of these roles is highly unlikely, it serves to demonstrate what others had been commenting on and what level of support the facilities are experiencing (Honea, 2001; Nagy et al., 2005; Trimble, Socia, Bluth, & Nagy, 2010). In fact some institutions appoint a variety of individuals to
support the breadth of roles required (Blado & Carr, 2004; Cabrera, 2002b; Mensch, Honea, & Orand, 1999; Tateosian, 2006a). These may include a PACS Analyst, PACS Technologist, PACS Coordinator, Digital Imaging Assistant and others with a variety of defined roles and responsibilities. Problems with specialist roles came to the fore with the realisation that PACs was a 24/7, 365 day a year critical clinical component (B. F. Branstetter IV, 2009) and required support available for all components at all levels.

Several articles also commented on the evidence that the level of functionality of the PACS implementation was proportional to the education and experience of the PA’s (Mack, 2006a, 2006b, 2006d; Mensch et al., 1999; Trevino & Page, 2003).

**IMAGING INFORMATICS PROFESSIONALS (IIP)**

As PACS and RIS integrated further into Imaging Informatics, blurring of the clinical and technical divisions has occurred. Kulikowski (1997) identified the limited overlap between medical imaging and medical informatics very early on in the PACS evolution. He further states that the rapid changes occurring in the technology “requires us to improve our understanding of the underlying image data and knowledge and its explicit definition, representation, and use on the computer” (Kulikowski, 1997, p. 252).

There is an ever increasing move to expand PACS from its traditional modality and even department centric approach to incorporate all aspects of healthcare imaging and thus become hospital or patient centric. In order to accommodate this progression, the PACS administrator role had to change also. No longer could the individual be responsible for just the radiology department imaging and informatics but had to focus on the overall patient and clinical outcome while at the same time improving the efficiencies of communication with the greater enterprise. A requirement of this was a much greater appreciation of the role medical imaging plays in the decisions regarding patient care and the opportunities to utilise MII to improve it (B F Branstetter IV, 2007b; B. F. Branstetter IV, 2009; Bui & Taira, 2010; Geis, 2007; Lluch, 2011; Mack, 2006d; Mollura et al., 2008; Müller, Gao, & Luo, 2008; Rubin, 2009).

The IIP is the individual that must support and maintain the components of the system(s) required to obtain these opportunities. These will include but are not limited to; automated
methods to determine appropriateness, CPOE, controlled terminology, order entry decision support, computer-aided detection (CAD), diagnostic decision support (DDS), structured reporting, critical results communication, electronic notification and reminder systems, and accessible personal health record (Carr & Moore, 2003; Rubin, 2009). In order to provide these function the interoperability of the systems must improve and this is one of the goals of the IHE profiles and of other efforts such as the Radlex terminology project sponsored by the Radiological Society of North America (RSNA) (Mollura et al., 2008; Rubin, 2009; Safdar, Siegel, Erickson, & Nagy, 2011; Torres, Damian Segrelles Quilis, Espert, & García, 2012).

Additional responsibilities the IIP must contend with are the adherence and compliance with standards, accreditation guidelines and legislation. HIPAA, IHE, JCI, IANZ, MU, and many others are common acronyms in the daily life of an IIP (Cao et al., 2003; Fernandez-Bayó, 2011; Gibaud, 2011; Henri et al., 1999; Huang, 2011; IHE, 2012; Winsten & McMahan, 2000; Zhou Zheng & Brent, 2005).

**EDUCATION, TRAINING AND CERTIFICATION**

Education and training of IIP’s has historically been provided by the vendors, learned on-the-job and was specific to that implementation (DiIulio, 2007). Issues with this arose when it was realised this did not support the system and compliance fundamentals but was focussed on the specific user interfaces of that vendor. The variables in the implementations resulted in a different opinion of what made a PACS administrator. In some organisations the team was made up of several individuals of varying backgrounds from the IT and clinical domains. Division of some of the tasks eventuated in some facilities while others had clinical based technologists with a strong IT background or vice versa performing the tasks. Over time some resources have appeared to assist the IIP in attaining the knowledge that they require to manage their systems, databases, compliance, integrations, interfaces, and a myriad of other tasks (DiIulio, 2007; Nagy, 2003; Nagy et al., 2005).

Many of these resources initially emerged from the professional organisations that rose to support these early pioneers. The PACS Administrators Registry and Certification Association (PARCA) began providing a roadmap for the required skills in 2005 (PARCA, 2012a). SCAR identified the gaps in the education and knowledge of the PA’s and began to investigate and, in conjunction with Dr. Bruce Reiner and Dr. Elliot Siegel started a program to create a framework for PA’s (Nagy, 2003). Dr. Paul Nagy and others then took up the
challenge which identified 14 roles with 127 tasks that were required to perform the role competently (Nagy et al., 2005). This ultimately led to the formation of the certification program founded by SIIM and ARRT and administered by the ABII.

Internationally there are courses available on-line from a few recognised tertiary education institutions such as the Michener Institute in Ontario, Canada, Ogeechee Technical College, Clarkson College, OTech Inc. and others (PARCA, 2012b). Additionally some “boot camps” are offered by the professional organisations such as SIIM, private education groups and individual vendors. User groups have started within some professional groups to support individuals in the field that are members of that professional association and also by vendors to support individuals that are using their products.

NEW ZEALAND

In contrast there is very limited literature regarding Imaging Informatics Professionals or PACS Administrators in New Zealand. In 2004 the Ministry of Economic Development undertook a review of nine case studies in information and communications technologies in New Zealand (Ministry of Economic Development, 2004). Wakefield Radiology, a private practice provider, was the subject of one of those case studies due to their focus on being at the leading edge of technology. The case studies were commissioned to assist in determining what support the government should provide for New Zealand’s future in Information and Communication Technologies. At the time of the case study, several issues with infrastructure in New Zealand were identified along with the steady progression from teleradiology to a fully electronic implementation of PACS in 2000 and RIS in 2003 (Ministry of Economic Development, 2004). This study identified that “with the new technology, information has become the focus of the system, so that instead of being ‘job-centric’ as before, the process is more ‘patient-centric’” (Ministry of Economic Development, 2004, p. 11). There was no mention, however, of the technological impact on the imaging professionals. Experience with PACS implementations in the public health care sector in New Zealand has led to some internal documentation on lessons learned; however, there have been no formal peer-reviewed published investigations into these implementations and their support.
Healthcare informatics in New Zealand is well established with some formal education opportunities at Otago University, Auckland University, Massey University, Victoria University, and Auckland University of Technology ranging from post-Graduate certificates to PhD (HINZ, 2012). Electronic health issues, decision support systems, information systems, ethics and evidence-based practice are just some of the papers offered. None of these papers has any direct reference to imaging informatics although some of the topics will be relevant to this sub-specialty of healthcare informatics.

The introduction of the NHI in New Zealand has given it a very strong lead in some aspects of the IHE Cross Enterprise Document Sharing (XDS) integration profiles as it requires a unique national patient identifier to provide that interoperability across sites (Carr & Moore, 2003; Delany, 2006; Fernandez-Bayó, 2011). The integration of other domains or departments though has only just begun in New Zealand and the PACS administrators need the knowledge and education to support what will be a rapid growth to ensure the National Health IT Board’s goals are met.
CHAPTER 4 RESEARCH PROCESS

An explanation of the research process for this thesis is presented in this chapter. It discusses the reasons why the methodology was chosen, the choice of data collection methods, data analysis, ethical considerations, and the limitations and restrictions of this process.

METHODOLOGY

The interpretivist, anti- or post-positivist philosophy (Crossan, 2003) was the research approach chosen as the most applicable for this thesis. This philosophy offered a way to utilise qualitative research methods (Letourneau and Allen (1999) cited in Crossan, 2003) or multiple methods (Andrew & Halcomb, 2009; Cresswell & Plano-Clark, 2011). This allowed an approach from several perspectives in order to examine the Imaging Informatics Professionals in New Zealand Healthcare. The application of multiple data collection methods is cited by most researchers in health and social sciences as the predominating choice for case study methodology (Bell, 2005; Bryman, 2004; Cresswell, 2009; Cresswell & Plano-Clark, 2011; Denscombe, 2010; Rapport, 2004; Tashakkori, 2003).

This is a relatively subjective topic which required an inductive, interpretive approach and an understanding of the subject matter. The scope of this research also entailed a “bound system” of individuals; investigated real people in real situations; was “strong in reality;” represented “something of the discrepancies or conflicts between the viewpoints held by the participants;” and was “capable of offering some support to alternative interpretations” (Adelman et al. 1980, as cited in L. Cohen, Manion, & Morrison, 2004, p. 185). This led to the decision to utilise a case study approach as the most appropriate methodology to the research question. Case study research “provide(s) insights into other, similar situations and cases, thereby assisting interpretation of other similar cases;” “be undertaken by a single researcher without needing a full research team;” and “embrace and build in unanticipated events and uncontrollable variables” (Nibet & Watt, 1984 as cited in L. Cohen et al., 2004, p. 185). Merriam also defines the end result of case study research as “an intensive, holistic description and analysis of a single instance, phenomenon, or social unit” (Merriam, 1997, p. 27) which is what this research set out to achieve.

While every effort was taken to maintain objectivity, my personal values and practical considerations inevitably had an impact on this research as noted in the literature (Bryman,
Recognising this assisted me to ensure that this research was relevant to the industry, had validity and reliability, and could be replicated.

**DATA COLLECTION AND ANALYSIS**

Three methods of data collection were employed with this project: A questionnaire; selected semi-structured interviews; and a life experience event from the interviewees. The use of these three data collection tools permits an element of triangulation to ensure maximal validity and reliability.

The base level of analysis of this research was the individual. However, the overall focus is the ‘bound group’ of imaging informatics professionals in New Zealand healthcare. This blended well with the case study approach (Yin, 2002). The number of Imaging informatics professionals in New Zealand Healthcare cannot be specifically determined, but to the author’s knowledge there are approximately 60 -75 individuals. This estimation is due to the fact that some hold multiple roles and there is no definitive register or professional body from which to access this information. To further bind this social unit, the ethics committee condition which required organisational consent prior to any research of these individuals, reduced the sample size, which in turn ensured that the data collection was finite, represented purposeful sampling and conformed with a case study approach (Cresswell & Plano-Clark, 2011; Merriam, 1997).

As this project represented the individuals and their roles at a particular point in time, the research was designed as a cross-sectional study (Bowling, 2009). To accommodate this, a questionnaire was designed utilising SurveyMonkey and electronically distributed to a list of individuals who were performing the role that was obtained from organisations that had provided consent with a pre-set close date. Prior to its distribution this questionnaire was piloted to two colleagues and an external third party. One of the colleagues was an IT person and the other was in the field and they were excluded from the actual study group. The team leaders or managers were all asked to provide an email address for those who, in their opinion, qualified to participate in the questionnaire. These were then entered into the contact list for the questionnaire. The final tally was 31 requests for participation in the questionnaire being emailed with a completion by 26 respondents. The database allowed for automated emails to be sent to those who did not respond to the survey which was done twice and elicited some responses amongst the final tally.
Considerable time was taken to ensure the questions were relevant to the research question, valid and attractive in order to encourage respondents to complete it and supply the required data. Both open and closed questions were utilised in the questionnaire design. This also allowed for data merging, which in turn ensured dependability and validity (Bowling & Ebrahim, 2005; Cresswell & Plano-Clark, 2011; Merriam, 1997; Tashakkori, 2003).

By design, the closed questions were utilised to elicit specific responses without prejudicing the respondent and to provide precise, easy to process quantitative data (Davidson & Tolich, 1999). They were also relatively easy for the respondents to complete, required little effort from the respondent, provided an enhanced comparability while allowing clarity of the response and reduced the possibility of variability. The disadvantage to the closed questions was the loss of spontaneity and the difficulty in ensuring that all possible answers are available, with all the variables of interpretation being covered (Bryman, 2004).

Open questions provided the qualitative data and allowed for responses where the replies were possibly not all known, or were either complex or specific to the individual or their workplace (Bowling, 2009). They also permitted people to answer them in their own words in order to provide rich data or answers not thought of in closed questions and allowed for the respondents’ knowledge and understanding of issues to be elicited (Bryman, 2004; Davidson & Tolich, 1999). In designing these it was important to ensure they put the respondent at ease while encouraging them to think carefully of their response (Jenkins, 2003). Some of the open questions were also used in conjunction with the closed questions to expand on a certain formatted response in order to provide further clarification or explanation. The difficulties with the open questions are that they are time consuming to analyse and code, they require some effort on behalf of the participants, and have limited utility (Bryman, 2004).

Survey Monkey was the engine utilised for the questionnaire which had the additional benefit of providing some tools that were used in the formation of some of the questions. One of these was a database of ‘certified’ questions, some of which were directly used such as basic demographics and some which were for guidance on structure or format as they were specifically designed to minimise bias, assist in promoting best practice (SurveyMonkey, 2012a) and they address directly some of the disadvantages of the closed questions noted previously.
Following Unitec Research Ethics Committee (UREC) approval (appendix 1), an email was sent to all 20 DHB’s and eight (8) known private radiology providers that have a PACS and RIS system, requesting consent to contact employees for inclusion in this research, which included an information cover letter and consent form (appendix 2). Initial response was very limited and subsequent emails, followed up with telephone conversations, were required to obtain consent from the participating DHB’s and private companies. The information provided with the consent request included: a synopsis of the study; its purpose; the voluntary nature of the participation; the UREC registration number; and the contact details for me, my principal supervisor and UREC. When contacted via telephone, some responded with concerns and refused consent while others never responded.

Eleven (55%) DHB’s and two (25%) of the private companies signed consent forms and agreed to allow their staff to participate in the research. The questionnaire and interviews were conducted and primary and secondary analysis was performed in October and November 2012. Both qualitative and quantitative data was obtained and analysed using a variety of means. SurveyMonkey provided some analysis tools within the software package and prepared the responses for export in a variety of formats which enabled easier analysis using different methods which was very beneficial.

The use of the SurveyMonkey tools is subjective and operator dependent, but did provide some components of good data analysis techniques (Bryman, 2004; Jenkins, 2003; SurveyMonkey, 2012b). The SurveyMonkey tools used included the ability to filter responses; crosstab responses; combine these tools to prepare reports, downloads in various formats, and create charts of the quantitative data. The qualitative questions and comments from the closed questions were also categorised and textually analysed to identify themes.

The results obtained from an initial primary data analysis were utilised to assist in selecting from the twelve volunteers from the questionnaire. The most appropriate individuals to represent a cross section of the group for the interviews was selected using four main elements that were established to shorten the list of possible interviewees. One of the elements of the decision was the geography and separation of the four main regions identified in the National Health Board IT regionalisation plan. Ideally two people from each region would have been interviewed but a shortage of volunteers from two regions eliminated this possibility. However, at least one individual from each of the four regions was interviewed. Representatives of the three broad backgrounds that are performing the role was another main
consideration. Individuals who volunteered and were of a clinical, IT, or administrative background were interviewed representative to the number of respondents along with time in the field and gender representation. In order to balance all these requirements a total of seven interviewees were selected from the 12 respondents that volunteered in the questionnaire response. There were a lot of volunteers from 2 of the regions and from radiology MRT backgrounds which added to the difficulty in selecting the interviewees. Table 1 describes the anonymised interviewees, their region, background and time in the field.

**TABLE 1: MAJOR CRITERIA FOR SELECTION OF INTERVIEWEES**

<table>
<thead>
<tr>
<th>Identification</th>
<th>National health IT Board Region</th>
<th>Background</th>
<th>Length of Time in Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>IIP1</td>
<td>1</td>
<td>MRT</td>
<td>6-10 years</td>
</tr>
<tr>
<td>IIP2</td>
<td>2</td>
<td>MRT</td>
<td>4-5 years</td>
</tr>
<tr>
<td>IIP3</td>
<td>2</td>
<td>MRT</td>
<td>4-5 years</td>
</tr>
<tr>
<td>IIP4</td>
<td>3</td>
<td>MRT/IT</td>
<td>0-1 year</td>
</tr>
<tr>
<td>IIP5</td>
<td>3</td>
<td>IT</td>
<td>4-5 years</td>
</tr>
<tr>
<td>IIP6</td>
<td>3</td>
<td>MRT</td>
<td>6-10 years</td>
</tr>
<tr>
<td>IIP7</td>
<td>4</td>
<td>Administrative</td>
<td>4-5 years</td>
</tr>
</tbody>
</table>

Semi-structured interviews were utilised (appendix 4) which consisted of a set of predetermined questions reviewed with each interviewee. However, the questions were reorganised and rephrased intuitively to ensure the conversation flowed easily where needed to elicit certain information from the interviewees; probe for more definition as required and allowed flexibility (Bowling & Ebrahim, 2005; Bryman, 2004). Design of the interview questions was done in conjunction with the individuals’ responses to the questionnaire and those of other respondents to expand on selected topics relevant to the research. The interviews were scheduled with each volunteer to suit their schedule and most elected to do this in their personal time to avoid distractions. Due to the time constraints and geographical circumstances five were conducted via telephone and two were conducted using Skype. All of the interviews were audio recorded with a digital recorder for subsequent transcription along with some shorthand notes taken at the time of the interview. The transcription was performed as close to the interview completion as possible in order to ensure that memory aided in the recall of what was on the digital recording. All of the transcribed interviews were returned for the participants to vet them for content, and instructions regarding any
questions, concerns, deletions, or withdrawals, prior to them being utilised. No changes, withdrawals or deletions were requested. Recording the interviews and subsequently transcribing them, allowed me obtain a complete account which I could not have done without distracting me and interrupting the flow of the interview and reflecting on the responses (Bryman, 2004). The transcription process allowed me to immerse in the data, further my reflections, build my interview technique and listen to them several times to obtain the maximal information.

In conjunction with the interview, the participants were asked to provide any relevant life or critical incidents that may have some relevance to this research. Five of the participants provided a verbal account of an incident they felt was relevant to the research. This ‘life event’ or ‘critical incident’ was undertaken to provide an element of concurrent triangulation (Bowling & Ebrahim, 2005) and elicit an event which had meaning and substance to the participants that could be related back to the themes that had emerged from the primary data analysis (Bryman, 2004; Yin, 2002). In addition it allowed the participant and researcher to focus on a specific incident to increase the specificity and to avoid generalisations (Bowling & Ebrahim, 2005).

In order to provide a holistic analysis, the data obtained in this survey was repeatedly analysed at several stages (Denscombe, 2010). This allowed for the use of an analytic approach at an early stage as an organisational framework to move ahead from the literature to the questionnaire, and from the responses to the interviews. This initial or primary analysis was performed relatively rapidly to keep the momentum and maintain the intent to capture the industry at a certain point in time. The use of multiple stages allowed for the review of the data with respect to themes that emerged and to better define the complexities, subtleties and intricacies of this field (Bryman, 2004; Denscombe, 2010; Yin, 2002).

Reviewing the data and the responses several times also permitted the application of the tools provided by the SurveyMonkey software to be applied in various combinations. A by-product of this was to ensure the reliability and integrity of the results and to attempt to eliminate any personal bias from the researcher. Many themes and categories were identified and utilised to form the filtering and cross tabbing of the data with the software. Some manual theme generation was also performed. Quantitative data was analysed using descriptive statistics to enable the integration of the results with the qualitative data and the literature. This also served to strengthen the validity and reliability of the generalisations and
themes that arose in the interpretation of the data (Denscombe, 2010; Merriam, 1997; Yin, 2002).

RESEARCH ETHICS

Several ethical standards were considered within this research project. The primary considerations that were identified were presented to the Unitec Research Ethics Committee (UREC) for consideration and were approved in July 2012 as UREC registration number 2012-1028 (appendix 1).

UREC emphasises eight guiding ethical principles and these were identified and responded to in the ethics approval process. Informed and voluntary consent was an absolute requirement along with recognition of the need for anonymity of the individuals and their employers in the final result. This also required the employers of these individuals to consent to their involvement prior to approaching the employees. An information sheet was attached to every stage of the process and signed consent was obtained from the employer’s representatives. This information sheet detailed the voluntary participation, right to withdraw from the research and the relevant dates to do this, the contact details for any questions and the confidentiality arrangements. In addition respondents were requested to present any special considerations in respect of individual or cultural concerns they required in order for them to be addressed appropriately.

There were no requests for withdrawal, deletion or special considerations. Subsequent to the UREC approval and conditions, two of the participating organisations required a submission to their local ethics committee for approval prior to obtaining the organisational consent. Verbal consent and confirmation of their voluntary participation was also obtained when initiating the interviews. All data has and will be maintained securely and will be dealt with according to the regulations for five years and will then be destroyed.

EVALUATION OF THE RESEARCH METHODS

Case study was the appropriate research methodology for this project but that also meant that at times I found myself frustrated and overwhelmed with the process. The data collection methods and subsequent analysis was daunting and it is only with the encouragement and support of my supervisors did I overcome these. As an Imaging Informatics Professional myself, I did find myself questioning some aspects perhaps too critically, in order to ensure
there was no personal bias, be sensitive to the data that was being gathered to adapt and be flexible, and to grasp the issue being studied (Bowling, 2009; Merriam, 1997; Yin, 2002). I do have my own preconceived ideas and these are influenced by my experiences, however I realised very early that this research was not to prove any theories I held but rather to embrace the data and contribute to this field in general. This realisation allowed me to be open to other opinions and to listen and analyse the data without any bias while still utilising my knowledge of the field to know what questions to ask and where to probe for greater detail. I believe I have attained this and my recommendations reflect the diversity of the opinions I received in the data collection. I also believe this data and its analysis are fully strengthened by the triangulation of the data.

There were several issues along the way which put some pressure on this research. My own initial lack of attention resulted in a compressed time frame. Piloting the questionnaire was difficult as the field is so small and defined and I did not want to exclude potential participants. The condition to obtain organisational consent from each employer and protect them placed a barrier which resulted in only 11 of the 20 District Health Boards and two private providers participating. The South Island was not well represented nor were four DHB’s that provide services in the major centres. I attempted to get these organisations to participate over a five month period with no success. In addition there were several questions that could have been eliminated but more importantly in hindsight several questions that should have been asked. Perhaps in retrospect, and with time permitting, a second questionnaire seeking further elaboration could have been sought. The SurveyMonkey questionnaire was a very useful tool but did have some small issues with formatting and presentation that confused some respondents when it did not close properly. My distance from my supervisors and tertiary support did have some negative impact on this research however this was recognised early on in discussions.

Overall this has been a very rewarding and challenging experience and I have learned a tremendous amount through all the literature and interaction with my colleagues and supervisors. The future is daunting and despite the frustrations and workload involved, if an opportunity presents itself, I may consider undertaking further research.

This chapter provided an explanation of the process undertaken to produce this research. It demonstrated the choice of the case study as the methodology of choice, the data collection tools utilised, the data analysis performed and the ethical considerations.
CHAPTER 5 RESULTS

Following Unitec Research Ethics Committee (UREC) approval (appendix 1), an email was sent to 20 DHB’s and eight (8) known private radiology providers that have a PACS and RIS system. This email included an information cover letter and consent form (appendix 2), requesting consent to contact employees for inclusion in this research. Initial response was very limited and subsequent emails, followed up with telephone conversations, were required to obtain consent from the participating DHB’s and private companies. The information provided with the consent request included a synopsis of the study, its purpose, the voluntary nature of the participation and the contact details for me, my principal supervisor and UREC. Eleven (55%) DHB’s and two (25%) of the private companies signed consent forms and agreed to allow their staff to participate in the research. Of the remainder, some responded with concerns and refused consent while others never responded despite repeated contact and the assurance of anonymity of the data.

The results of the data that was collected via the questionnaire sent to the participants in this research will be presented in this chapter. The method used was to distribute an electronic questionnaire (appendix 3) directly to the email addresses of the individuals identified by the team leaders of the consenting facilities. This was followed with semi-structured interviews (Bowling & Ebrahim, 2005; Denscombe, 2010) of seven volunteers from the respondents to the questionnaire. Interviews were conducted using a prepared list of open ended questions (appendix 4) designed to expand on that individual’s and the collective responses to the questionnaire. Included in this interview was a “life experience” event representative of their experience in the field.

It is difficult to accurately determine the number of practitioners in the field but to the authors knowledge there are approximately 60 to 75 individuals, including myself, directly and indirectly performing functions of this role, either part-time or full-time, within both the New Zealand public and private healthcare systems. A total of thirty-one (31) unique links to the questionnaire were sent to individuals with an initial response of 9 which equated to a 25.8% response. Those that did not respond to the initial request were sent a total of 2 reminder emails and were approached via telephone which eventuated in a completed response of 26 for an 83.9% response rate.
Survey Monkey was the engine used for the questionnaire which comprised of 52 questions, an ‘additional comments’ question and an interview volunteer and result question, for a total of 54 numbered questions. The majority of the questions were closed-response type with the opportunity to comment also provided with some questions (Jenkins, 2003). Some of the questions were open-ended and allowed for collection of some data of importance to the participants (ibid). All participants also had the opportunity to add any additional comments at the end of the questionnaire.

In this chapter, the results of the questionnaire followed by a summary of the interview and the life experience responses are presented. These will be expanded and discussed in the following chapters. The questionnaire results are presented per question with any qualitative comments presented as respondents provided them, in order to reflect apparent or implied emphasis or belief. Some of the responses were categorised and presented thematically where appropriate. Alterations to wording were made only where required to preserve anonymity of the location or of individuals.
QUESTIONNAIRE

Question 1: Are you Male or Female?

Male: 53.8% (14)
Female: 46.2% (12)

Question 2: What category below includes your age?

FIGURE 1: AGE RANGE OF RESPONDENTS
Question 3: What is your primary qualification? (Please mark all that apply).

FIGURE 2: PRIMARY QUALIFICATION

Of the five (5) responses in the other category:

- three (3) had no formal qualifications;
- one (1) had a non-related bachelor’s degree and;
- one (1) respondents had industry-based IT certificates;

In addition, three (3) respondents selected dual primary qualifications (MRT and IT).
Question 4: How many years have you practiced since your primary qualification was obtained?

FIGURE 3: YEARS OF PRACTICE SINCE PRIMARY QUALIFICATION

The four respondents that reported no primary qualification in question 3 are listed in the ‘other’ category.
Question 5: Do you have any postgraduate qualifications? (Please mark all that apply).

FIGURE 4: POSTGRADUATE QUALIFICATIONS

One (1) respondent has dual post graduate qualifications and there were 5 additional comments added:

- three (3) have other computing courses;
- One (1) MRT has obtained a diploma in computer systems and;
- One (1) is working towards an MBA.
Question 6: Do you hold a current Annual Practising Certificate (APC) from the New Zealand MRT Board or other Government licensing agency?

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<tr>
<td><strong>YES</strong></td>
<td>61.5% (16)</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>38.5% (10)</td>
</tr>
</tbody>
</table>

Of the sixteen respondents that hold a current APC:

- All of them hold a general diagnostic scope;
- One holds an MRI scope in addition to their general scope;
- One holds a Mammography scope in addition to their general scope and;
- One holds an MRI Trainee scope in addition to their general scope.

Question 7: Do you hold any other certifications (i.e. CIIP, PARCA, Microsoft, Cisco, Novell etc.)?

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<tr>
<td><strong>Yes</strong></td>
<td>26.9% (7)</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>73.1% (19)</td>
</tr>
</tbody>
</table>

Of the seven respondents with additional certifications:

- All seven have computer related certifications;
- One has some additional project management and management courses and;
- One has a direct related PACS/RIS certification (CPAS).

Question 8: Do any of your certifications or registrations depend upon mandatory requirements?

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<tbody>
<tr>
<td><strong>Yes</strong></td>
<td>53.8% (14)</td>
</tr>
<tr>
<td><strong>No</strong></td>
<td>46.2% (12)</td>
</tr>
</tbody>
</table>

Of the fourteen positive responses:

- Only one has any requirements outside of their APC requirements. This is for the CPAS certification.
Question 9: Can you briefly describe the mandatory requirements (i.e. practice hours required, education hours and/or credits required, renewal period, etc.).

There were sixteen responses to this question:

- Thirteen (13) as per MRTB requirements. Minimum practicing hours, CPD enrolment and completion;
- Three (3) responded with no requirements or not applicable;
- One (1) responded with a 5 year cycle for CPAS also requires a minimum period of study and continued membership of the regulating body – PARCA in addition to their MRTB requirements.

Question 10: What is the job title for your current position?

Within the 26 responses there were a variety of titles which have been allocated to eleven categories and to which some respondents belong to more than one:

1. MRT – Twelve respondents or 46%;
2. PACS/RIS Administrator - Twelve respondents or 46%;
3. PACS Administrator – Ten responses or 38%;
4. Manager (PACS and department manager included) – Two responses or 7%;
5. PACS Team Leader or Coordinator - Two responses or 7%;
6. RIS Administrator – One response or 3%;
7. System Administrator/Server Analyst (IT) - One response or 3%;
8. Radiology Coordinator - One response or 3%;
9. PAC/RIS Trainer - One response or 3%;
10. PACS/RIS User Support - One response or 3%;
11. IT Manager - One response or 3%.
Question 11: Which of the following categories best describes your employment status?

- Full-time (>35 hours/week): 84.6% (22)
- Part-time (1-35 hours/week): 15.4% (4)

Five free text comments all discussed the hours of on-call support in addition to the scheduled hours of work.

Question 12: About how long have you been in your current position?

FIGURE 5: TIME IN CURRENT POSITION

There were five qualifying comments with this question:

- Three respondents included their time as a MRT prior to PACS;
- One clarified their new role which still has a PACS component and;
- One has been in radiology in other roles for nearly 20 years.
Question 13: About how many physical locations does your organization have that the Imaging Informatics System supports?

FIGURE 6: NUMBER OF PHYSICAL LOCATIONS

Question 14: How many hours per week do you perform Imaging Informatics (PACS/RIS/Etc.) support?

FIGURE 7: IMAGING INFORMATICS SUPPORT HOURS
Question 15: What department or service does your position report too?

FIGURE 8: REPORTING SERVICE

- Three respondents answered with dual departments for their reporting being Radiology and IT;
- One respondent reports to the managing director and managing partner (private enterprise).

Question 16: What is your main workplace?

FIGURE 9: MAIN WORKPLACE TYPE
Question 17: If DHB or Regional how many DHB’s are supported by your Imaging Informatics System?

FIGURE 10: NUMBER OF DHB’S SUPPORTED

Only 23 responses as three of the respondents are private providers.

Question 18: At which type of work place location do you work? (Choose all that apply)

Main or central location: 57.7% (15)

Predominately at main location but some peripheral location on-site support 42.3% (11)
Question 19: Do you provide training for new staff on using your Imaging Informatics Systems?

Yes: 92.3%
No: 7.7%

Respondents supplied four comments:

- Online training is provided at one site;
- One has the training provided by IS trainers;
- One does informal training with structured training provided by another team member;
- One who stated it is done by other PACS team members.

Question 20: If yes, what staff do you provide training to? (Please select all that apply)

FIGURE 11: TYPE OF STAFF TRAINING IS PROVIDED TO
Question 21: If yes, what applications do you provide training for? (Please select all that apply)

FIGURE 12: APPLICATION TRAINING IS PROVIDED FOR

Two additional comments were provided by the respondents in the ‘other’ category:

- One also supports Medical Photography;
- One supports Electronic Radiology Request application.
Question 22: What DICOM Modalities does your system currently actively support and provide to clinicians? (Please tick all that apply)

FIGURE 13: DICOM MODALITIES CURRENTLY SUPPORTED

The ‘All Other Responses’ column includes:

- One response from a site which supports three DICOM modalities (SR, ES, PX);
- One who is unsure and;
- One is not applicable as they are RIS only.
Question 23: What systems, hardware and software does your Imaging Informatics System support either directly or indirectly? (Please tick all that apply)

FIGURE 14: SUPPORTED SYSTEM, HARDWARE AND SOFTWARE

Responses in the ‘Other’ category include:

- Medical Photography (which has modality XC, SM, GM or sometimes OT);
- One who included statistical and reporting based software and;
- One IT based support that was unsure.
Question 24: How was your training provided? (Select all that apply)

FIGURE 15: INITIAL TRAINING

Two additional comments were provided:

- One stating no training was provided and;
- One a vendor specific course.
Question 25: How adequate do you feel the training was you received when you started in your role?

FIGURE 16: PERCEPTION OF ADEQUACY OF TRAINING

Twelve comments were provided by the respondents with a variety of responses as detailed below.

- Minimal training was provided initially. Most of my knowledge I have learnt on the fly from trial and error. Not an ideal situation and this has caused issues in up skilling other members of staff to assist the role. Vendor support has carried us through. With a new PACS the training provided is a high priority for me;
- Although I was able to do any of the tasks I needed, I was not helped as to what tasks needed to be performed prior to go live, most of them came from filling a need, and this took up to 1 month after, as issues came to light;
- Good training, are expected to do self-research;
- No training supplied so can’t comment on this;
- Unfortunately training was given to the administrators a long time prior to go live, at a
time when we had limited system availability. As the administrators had the task of
configuring the RIS system, we did become very familiar with the software, but this
was not training, but trial and error;
- The training from the vendor for PACS and RIS was adequate but the hardware,
networking, steps for setting up a new Modality was learnt on the job;
- Unfortunately some things could only be taught as the problem occurred;
- Vendor provided a 4 hour training session that covered clinician, radiologist and
administration modules;
- Small team, loss of long-time staff,, specialised role, so difficult to provide extensive
training;
- There was no plan as such as to what I need to learn. I’m still learning now kind of
wish there was a book that I could work through so I could have a better
understanding of our PACS system;
- There was such a lot to take in within the short period of vendor supplied training (1
week) that the majority of what we’ve learnt has come from playing with the system
and asking questions as we've gone along;
- Took over for my father who was in hospital.
Question 26: Are you part of a focussed single discipline team, multi-disciplinary team, supported by other teams or vendor or a combination? (Choose all that apply)

FIGURE 17: TEAM STRUCTURE

The comments supplied with the ‘other’ category included:

- One no training provided and;
- One vendor-specific course.
Question 27: How skilled at their jobs are the members of your team?

FIGURE 18: PERCEPTION OF SKILL LEVEL OF TEAM

Only one additional comment was supplied:

- Extremely skilled in the main clinical role. IT knowledge is from experience on our part and the Vendor covers any configuration and hardware changes.
Question 28: How often do you lack the skills needed to do your job?

FIGURE 19: PERCEPTION OF LACK OF SKILLS

There were five additional comments detailed in the following table:

- I know when to call in the vendor for support and we receive a prompt response;
- Always have senior PACS members to advise;
- Initially this would have been an extremely often response. Over time our team has developed a lot of complimentary skills. at (my work place) we work well together, and use each other’s strengths to benefit the team;
- I feel that sometimes topics being discussed by my colleagues are above my skill level. I have tried to find courses that I could do to improve my qualifications, any feedback would be great!;
- If I get stuck on something I ask. Most of the time the job is a matter of knowing who to go to when a problem arises if necessary.
Question 29: In a typical day, how likely are you to use Vendor support to assist with your work?

FIGURE 20: VENDOR SUPPORT USAGE

Five additional comments were provided as detailed below:

- Only if it something technical (server related);
- Unless upgrade time then very likely;
- This is difficult to quantify as we have a good relationship with the vendor, but in terms of problem solving we rarely contact engineering or Apps support;
- Depending on the topic, I normally escalate with our IS colleague, and then take it from there;
- We have only recently gone live with the PACS install and are currently implementing the new RIS (from the same vendor) so the vendors are constantly around and on the premises at the moment.
Question 30: How easy is it to get the resources you needed to do your job well?

FIGURE 21: PERCEPTION OF EASE OF ACCESS TO REQUIRED RESOURCES

Four additional comments were provided as detailed below.

- Time is always precious; we complete these tasks amongst our normal working day;
- If we require assistance, this can be a very long slow process. Vendor support is readily available. Support from within our team is also readily available;
- Due to annual leave and the multi hats I wear, time is extremely hard to co-ordinate either away or for someone to come to my workplace;
- As per question 28, I had no IT experience before starting this job.
Question 31: Have you completed any formal education directly related to the PACS, RIS or Informatics systems?

Yes: 7.7% (2)
No: 92.3% (24)

There were seven additional comments with this question which were placed into four categories:

1. Vendor Sponsored – had three responses;
2. Would like to have some – had two responses;
3. Conference PACS Stream – had one response;

Question 32: If yes, please specify (name of course, which Institution and year completed)

Only two responses to this question which mirrors the response in question 31, however the written responses do not reflect defined PACS/RIS formal education rather both listed tertiary computing courses.

Question 33: Have you attended any conferences dedicated related to the PACS, RIS or Informatics systems?

Yes: 61.5% (16)
No: 38.5% (10)

Question 34: If yes, please specify (name of conference or association, location and year completed)

There were 15 responses to this question which were placed into four categories:

1. RadAIM which includes a PACS stream - Eleven (73%) responses (four of which have attended two of these conferences);
2. Vendor-Specific User group – 2 (13%) responses;
3. SIIM – One response (6%) and;
4. HINZ – One response (6%) which stated it was a waste of time.
Question 35: Have you attended any user-group sessions directly related to the PACS, RIS or Informatics systems?

FIGURE 22: USER GROUP ATTENDANCE

Question 36: If yes, please specify (Vendor sponsored, Frequency and year)

- RIS Working Group, PACS Working Group, Waiting Lists Workings Group (all regional);
- Vendor sponsored, December 2011 Philips PACS User Group Meeting, Amsterdam. This is on every 2 years. (two responses);
- IntelePACS Administration Course – 2007;
- SIIM – 2011;
- Carestream;
- Various PACS and RIS (UK and NZ) and normally once a year.
Question 37: Overall, how satisfied are you that you can access relevant education, neither satisfied nor dissatisfied with it, or dissatisfied with it?

FIGURE 23: ACCESS TO RELEVANT EDUCATION

There were six additional comments in response to this question which were placed into 3 categories:

1. Would like to have some – Four responses;
2. None available in NZ – Three responses and;
3. Uses Online Resources – Two responses.
Question 38: What courses or education would you suggest should be required for a new Imaging Informatics professional?

There were 22 responses to this question which were placed into 15 categories. Some responses encompassed more than one category:

- Networking had ten responses (45%);
- Clinical skills had six responses (27%);
- Post Graduate Certificate courses had three responses (13%);
- Vendor Managed or Vendor Specific Courses had three responses (13%);
- Post-Graduate Diploma in Imaging Informatics had two responses (9%);
- HL7 had two responses (9%);
- DICOM had two responses (9%);
- CIIP had two responses (9%);
- Adult Education had one response (4%);
- Business Models had one response (4%);
- Database had one response (4%);
- Microsoft Office Apps had one response (4%);
- Interfacing had one response (4%);
- Hardware had one response (4%);
- Senior Team leader to go too had one response (4%) and;
- Unsure had one response (4%).

Question 39: What skills do you think a new Imaging Informatics professional should have?

There were 20 responses to this question which could be placed into 27 categories with most respondents using multiple categories:

- IT skills had 14 responses (70%);
- Networking had nine responses (45%);
- Clinical Knowledge had seven responses (35%);
- Communication skills had 6 responses (30%);
- Problem Solving Skills had 4 responses (20%);
- Database Management, Adult Education and DICOM each had 3 responses (15%);
- Workflow process, ability to work under pressure, willing to learn, vendor specific training, troubleshooting skills, and conflict management training each had two responses (10%);
- Business Intelligence software, business models, client-server knowledge, data integrity, HL7, Microsoft Office, multi-tasking, negotiating skills, quality control and quality assurance, relevant standards, team player, time management, and unsure all received one response each (5%).
Question 40: What continuing education would you want to have available for Imaging Informatics professionals?

There were 22 responses to this question that were placed into 23 categories. Many of the responses were assigned multiple categories:

- User-Group meetings was by far the most common response with seven (31%);
- National Conferences and Vendor specific education each had 4 responses (18%);
- Courses that provide the latest updates in technology and NZ based workshops each had 3 responses (13%);
- Courses that discuss the tools available, provides the latest updates for the software, advanced IT, clinical knowledge for IT-based, Funding to attend international PACS/RIS dedicated conferences, and Unknown each had two responses (9%);
- Courses that lead to PARCA or CIIP certification, papers at conference, on-line courses, courses that lead to formal NZ qualification, networking, HL7, courses provided by a national organisation, Course that can be used to meet mandatory CPD requirements, business process, workflow process mapping, Australasia based, and understanding current IT is all that is needed, each received one response (4%).
Question 41: Do you feel you are trained and competent with the following standards, guidelines, and regulatory agencies as they pertain to Imaging and Informatics in healthcare?

FIGURE 24: KNOWLEDGE OF RELEVANT STANDARDS

There were two comments to this question:

- Depends on what standard you need to meet. I can read a HL7 message, and understand DICOM tags and I think I understand how the DICOM transfer protocol works, but I am not an expert. I have picked up what I know from reading articles and talking to engineers;
- I don’t know what half of the things are above.
Question 42: Are you aware of the following organisations as they relate to Imaging Informatics?

FIGURE 25: AWARENESS OF SUPPORTING ORGANISATIONS FOR IMAGING INFORMATICS
Question 43: How challenging is your job?

FIGURE 26: INDIVIDUAL’S LEVEL OF CHALLENGE IN THEIR ROLE PERCEPTION

<table>
<thead>
<tr>
<th>Level of Challenge</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely challenging</td>
<td>11.5 %</td>
</tr>
<tr>
<td>Very challenging</td>
<td>65.4 %</td>
</tr>
<tr>
<td>Moderately challenging</td>
<td>23.1 %</td>
</tr>
<tr>
<td>Slightly challenging</td>
<td></td>
</tr>
<tr>
<td>Not at all challenging</td>
<td></td>
</tr>
</tbody>
</table>

There were six additional comments in this question:

1. This is variable. There are a lot of repetitive tasks that are performed daily. There are also challenges that present themselves unexpectedly. In the lead up to an upgrade and the immediate post upgrade period, the workload is high and the resources are stretched;
2. At times.....;
3. It’s become easier as I strive to understand the basics of what is happening within all our Information Informatics within our department. However I would like to know more!;
4. The various systems integrated with in a PACS system makes learning systems very complicated. Trying to work out where an error is occurring can require in-depth investigation;
5. I think for me it’s really challenging because I don’t know enough;
6. Time to complete tasks and the steep learning curve are the main challenging areas.
Question 44: How do you feel about your job, neither like nor dislike it, or dislike it?

FIGURE 27: JOB SATISFACTION

Four additional comments were provided on this question:

- The PACS role is challenging. I would like further training to feel more confident in a number of areas. It is always dissatisfying correcting the mistakes of others with little thanks;
- Love the job, but I don't feel like I know much at all!;
- Yes and No;
- I like the problem solving as well as the ability to keep something up and running. Some days are more challenging than others as in every other profession I'm sure!
Question 45: In a typical week, how often do you feel stressed at work?

FIGURE 28: IDENTIFIED LEVEL OF STRESS AT WORK

Four additional comments were provided in response to this question:

- Radiologists are not very patient when there are PACS or PC errors;
- Becomes frustrating when issues arrive that require outside support, i.e. vendor; or that cannot be resolved immediately due to lack of knowledge in a particular area;
- It happens where we often don’t have a member of our PACS team on duty and we’re in another area and suddenly have to sort an urgent PACS problem when we’re busy being an MRT. This I find extremely stressful;
- Going live with a new RIS PACS was very stressful and I was required by management to take time off, due to stress.
Question 46: How do you feel about your work with PACS, RIS &/or IS, neither like nor dislike it, or dislike it?

FIGURE 29: PERCEIVED AFFECTION WITH JOB

There was only one comment provided with this question:

- I'd like it a great deal if I knew more and understood more!
Question 47: How do you feel about the size of your team? Should it be larger than it is, smaller than it is, or is the size about right?

FIGURE 30: PERCEPTION OF SIZE OF TEAM

Four additional comments were provided in response to this question:

- Could possibly have 0.5 fte available when required;
- I think our team is about the right amount, the only time it needs to be bigger is if more than one person is away;
- We do not have a specific PACs administrator currently trained. It is a work in progress;
- I was the sole PACS RIS administrator, but now have a second team member working part time in PACS. Required FTE allocation is still yet to be calculated.
Question 48: Given your skills, how well do you feel you are paid?

FIGURE 31: SATISFACTION OF REMUNERATION

Two additional comments were provided in response to this question:

- If I look at people (Team Leaders) on the same grade, and see what they do and are expected to be responsible for, it annoys me. However in other centres you may have more competent team leaders, in which case I would be less concerned;
- The numerous systems that we are expected to know about and manage, compared with the two pay step increase as indicated by apex is somewhat minimal. Interestingly MRI has its own pay scale, I feel that PACS should have its own pay scale as well.
Question 49: What actions can your employer take to build a better workplace?

- I am working towards a better training program for the new PACS team. I do not want them to learn on the job as I did. Some dedicated time for administration tasks also needs to be applied. I would love to have an IT professional on staff but the cost cannot be warranted;
- Big question. For me, supporting me to get on whatever course I find to support my role, whatever course that eventually turns out to be;
- It’s the Employer Employee relationship which matters and You should be valued as a staff for you to like the organisation;
- Provide both resource and financial support for opportunity to attend training to ensure a more competent administrator and grow internal knowledge bases. Become more involved in overseeing and planning of system direction in regards to software enhancements, upgrades, and integration with neighbouring systems, administrator roles and providing strong affirmed leadership to the administrators of the system;
- Listen to the people down the chain when it comes to putting in new systems. far too often the system that is installed does not meet to requirements of the end users because 'managers' who don’t really understand what is required give the ok;
- Good as it is;
- Better workstation facilities;
- Increase Resource/Training program;
- N/A;
- PACS Admin is treated like the poor relation, where PACS-assigned staff are pulled out to cover clinical areas in cases of annual leave and / or sickness absenteeism. Ring-fenced staffing for this important area would greatly improve the effectiveness of the team and reduce frustration among its members;
- Have more time allocated for PACS. It seems to be the poor cousin. More meetings where we can meet as a team and discuss issues, updates, little problems, training etc.;
- Keep staff morale up, keep communication open, thank the staff, pay increase;
- Employers do a pretty good job on this front - more feedback possible on some HR issues, i.e. remuneration;
- Our PACS environment is good. I do feel that there needs to be more education for all radiographers in our work place in regards to the PACS system;
- Better management of the IS department, so to allow better communication with other departments. This would allow for faster troubleshooting and upgrades;
- More access to training, conferences options is an on-going issue. Only one or two a year are permitted to go to the bigger radiography events;
- Earthquake strengthening :).
Question 50: Do you feel this role requires a defined scope of practice?

Yes: 73.1% (19)
No: 26.9% (7)

Seven additional comments were provided in response to this question:

- There is a significant clinical component and if the role is not filled by someone with a clinical background they need ready access to clinical support. Especially when correcting/reassigning images;
- It sits outside of clinical, and outside of the traditional IT scope, but touches on both. It is clinical, managerial and mistake fixing as well as involvement in projects etc.;
- This is an imaging role, but it sits across all modalities. In our dhb, also includes not radiology DICOM imaging;
- I don't feel that PACS Admin requires a scope of practice, however I feel there would be potential benefit in having one. That said, as not all PACS Admins are MRTs this could be potentially an issue;
- Due diversity of this practice it needs to be defined;
- Its very specified role and there is a lot of information that needs to be learnt;
- I believe it would benefit from a bit more structure - definitely.

Question 51: If you are an MRT do you think this should be classed as a role extension or advanced practice role?

Advanced Practice Role: 78.9% (15)
Role Extension: 21.1% (4)

Nine additional comments were provided in response to this question, 4 are from Non MRT’s:

- Not really Radiographic practice, as there is learning but little skill involved, its moving into a completely different area, but still informed by a clinical mind-set;
- Unsure;
- It is a unique role, across all modalities;
- Not MRT;
- N/A;
From experience, the role extension of today is the standard practice of tomorrow. I don't think that the majority of MRTs have either the aptitude or the wish to extend in this direction, especially as the II role becomes more complex and diverse;

Yet again very specified role;

As one of two part time PACS administrators I'm happy regarding my position as a role extension but I think it depends on the amount of responsibility or expected from the individual. If the role was expected to take on more IT functions and RIS support then definitely it should be an advanced practice role. You're also no longer working within the boundaries of the radiology department but taking on responsibility that has impact on a more hospital wide scale;

This is an entirely different set of skills to imaging. Aptitude at one doesn't mean that you can translate it.

Question 52: Do you feel you have room to advance in your current role?

Yes: 69.2% (18)

No: 30.8% (8)

Eight additional comments were provided in response to this question:

- If by the above question do you mean can I get better, than yes, but as I am solely responsible for pretty much anything Radiology outside of network, I can't see me taking on extra responsibility;
- Junior member, would like to become full time PACS;
- There is little room for advancement in the current role as we are restricted to specific tasks and due to apparent financial constraints, limits training, limits areas of opportunity to advance;
- This role could possibly lead into a more is related occupation, such as clinical applications. Probably a change of direction rather than advancement. Regionalisation does open the opportunity for a pacs manager position possibly;
- As team leader of a PACS team at the DHB level with an additional scope of practice in MRI there is no real further progression for me without stepping away from the PACS / Clinical role, perhaps into a management role;
- I know there is a lot more that I need to learn and potentially in the future I will be able to move onto to new roles with the knowledge that I will have
- This job is giving me the skills to project manage, report analysis and more;
- As PACS is fairly new in our hospital and the feeling of the more I know the less I know, I feel there are options available.
Question 53: Please add any comments you would like to make or any questions you would like to see addressed at a further stage.

There were only three responses to this question:

- MRT who become RISPACS admins are hamstrung by a lack of formal IT knowledge and qualifications, which at best mean they can’t help the IS/IT teams and at worst can mean that they can't 'fight their corner' and can be railroaded. Either way they can be ineffectual at their job. It is as bad for the IT guys who are RISPACS admins as they either don't get the urgency of the issues, or can't prioritise, or are unable to ground their knowledge in the practical application of what they do and look after, and they are not effective as RISPACS admins because of that. What is required is a qualification that covers both these aspects of the job, filling in the knowledge and understanding gaps of both the IT and clinical guides, or at least a recommendation to study certain qualifications (e.g. a basic networking course) in a 'roadmap to competency'. Cheers;

- Am happy for you to contact me if you need more info. I was unable to answer some questions as I am solely IT and don’t deal with any of the clinical support for PACS;

- N/A.

Question 54: If you would like to receive a copy of this data or participate in further interviews and/or focus groups, please complete the following question:

There were twelve respondents to this question. These were the responses used to determine the interviewees. The data provided is confidential and will not be placed here to protect the anonymity of the respondents.
INTERVIEWS

There were 27 responses to the questionnaire with 12 individuals volunteering to be interviewed. Of these 12 volunteers, seven respondents were selected for interview representing a cross-section of the industry. Five of these were from a radiography background, one was from an administrative background and one was from an IT background. All of the interviewees are full-time employees. However, only three are full-time imaging informatics, and the remaining four are part-time or as required to support the imaging informatics team. Two of the participants were female and five were male.

Diversity in their location was also considered in the selection, with at least one interviewee from each of the four New Zealand Health IT Board regions in an attempt to ensure the entire country was represented. Collectively they represented the diversity in education, training, certifications and continuing professional development observed in the responses. The identities of the individuals interviewed are confidential and they will only be identified by their generic identity as outlined previously in Table 1.

1. Verify demographics:
   There was no deviation from the questionnaire responses

2. Verify their role, and departmental and reporting structure:
   Six (6) of the respondents are employed by the Radiology Department but have a strong liaison with the IS/IT Departments. One of the interviewees is employed by the IT Department.

3. Defining the workplace size and coverage:
   All of the participants work within the District Health Board environment. One interviewee works within a current regional solution providing support to 3 DHBS’s. One interviewee supports only 1 hospital with the remainder supporting from 2 to 10 sites.
4. Discuss your reasons for entry into your current Imaging Informatics role:

<table>
<thead>
<tr>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>I got thrown in the deep end to cover and told to learn the job as no one else could do it.</td>
</tr>
<tr>
<td>I had experience in the UK and was willing to take on the role.</td>
</tr>
<tr>
<td>Is part of my normal role to support servers and connectivity internal and some external but mostly work stations to server connectivity. Have a PACS Admin that does basic troubleshooting</td>
</tr>
<tr>
<td>Interest and working in high tech, computing and previous IT experience</td>
</tr>
<tr>
<td>Wanted to do PACS in UK but moved to NZ and when the project here started I put my hand up to help and have been there ever since</td>
</tr>
<tr>
<td>I showed some computer interests in my department and was seconded into the role as I was the only one that put up their hand!</td>
</tr>
<tr>
<td>Was the IS coordinator for radiology to liaise with IS then when they were looking for people to do PASC I put my hand up. I like computers and it interested me</td>
</tr>
</tbody>
</table>

5. Discuss your response in the questionnaire with regard to your training when you started in the role:

<table>
<thead>
<tr>
<th>Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate</td>
</tr>
<tr>
<td>Learned a lot in the planning but really only had a half hour from the engineers who taught “if this then look at that”. First month was steep learning curve but by a couple of months was fine. Can’t do tasks you have not been taught i.e. vendor asked why I had not done some database management but I had not been shown or taught what to do. Agree with comment of don’t know what you don’t know</td>
</tr>
<tr>
<td>My training and experience as a server analyst was all I had to go by. My training is moderately adequate because of that</td>
</tr>
<tr>
<td>No specific requirements or training was provided directly as part of the PACS/RIS implementation.</td>
</tr>
<tr>
<td>Moderately Adequate. A lot to take in within a 1 week vendor training. Learned most of it by playing on system and asking questions.</td>
</tr>
<tr>
<td>Moderately adequate</td>
</tr>
<tr>
<td>Vendor supplied on-site and on the job and previous experience in UK</td>
</tr>
<tr>
<td>Very limited training supplied by the vendor and I learned what I could on the fly mostly with support from the vendor help desk.</td>
</tr>
<tr>
<td>Moderately adequate. Vendor supplied the training and we did an offsite training course with the vendor for a week for PACS and a two week training course on-site from the vendor for RIS</td>
</tr>
</tbody>
</table>
6. What training is provided for any new users of your system and who provides it:

<table>
<thead>
<tr>
<th>Done in conjunction with orientation. If they want further training it can be done by us or by the Radiologists working on the system.</th>
</tr>
</thead>
<tbody>
<tr>
<td>All done by me, text documents that I have generated.</td>
</tr>
<tr>
<td>Not involved at this level.</td>
</tr>
<tr>
<td>We are part of the staff induction and we train all the PACS component.</td>
</tr>
<tr>
<td>Small enough to give a hand on the fly as we see issues or they call us for help.</td>
</tr>
<tr>
<td>We do most of the training at main site for new staff at their induction. Training is more focussed on the radiology team</td>
</tr>
<tr>
<td>I do all the local training of new end users. Some regional support when required.</td>
</tr>
<tr>
<td>Clinical workstation team does the training outside of radiology. We trained them initially</td>
</tr>
<tr>
<td>Radiology trained by PACS team</td>
</tr>
</tbody>
</table>

7. Discuss the Imaging Informatics Support provided by your department:

<table>
<thead>
<tr>
<th>Hardware supported by Third party and is located on-site. Some specialists within the team look after specifics such as database and networking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modalities per questionnaire some echoes are on the system. PT and MG not on-site but PT are imported.</td>
</tr>
<tr>
<td>Cardiology sends to PACS but does not use RIS. Ability to handle endoscopy but no driver as yet to pursue this.</td>
</tr>
<tr>
<td>We have three teams that deal with specific issues in IS. Service desk deals with network outlet outwards, Infrastructure and operations deals with network out to servers and then the application team which deals with interlink stuff, such as HL7 and DICOM support.</td>
</tr>
<tr>
<td>If PACS/RIS then PA is called first then if it needs more the service desk is called and the issue assigned to the appropriate team depending on what the issue is.</td>
</tr>
<tr>
<td>On-site hardware currently but moving to an offsite data centre for our region. We do the software and IT does all the hardware, networking, PC’s. we have to liaise closely with IT and work together for the overall system connectivity</td>
</tr>
<tr>
<td>Dedicated advanced workstations for modalities.</td>
</tr>
<tr>
<td>PACS, RIS, Orthopaedic templating, VR, Document scanning, HL7 interfaces, digitising CR, RF, CT, MG, MR, XA, OT, are all part of the system. IT maintains most networked and interfaced systems</td>
</tr>
</tbody>
</table>
We support the modalities and basic PACS. Advanced visualisation is provided on dedicated workstations for CT Colonography etc. Echo has a separate PACS administrated by cardiology. Cardiology does use our PACS and RIS for angios.

8. What services and support do your vendor(s) provide:

<table>
<thead>
<tr>
<th>2 vendors for PACS and RIS. RIS vendor supports VR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware is supported by Third Party as previous and software is supported by the respective Vendor.</td>
</tr>
<tr>
<td>IS supports hardware but support from vendor for issues as required.</td>
</tr>
<tr>
<td>We house the servers but the vendor comes in to patch them. We do basic support and will do some checks for the vendor and basic networking issues but if things look good and still a problem then the vendor is contacted.</td>
</tr>
<tr>
<td>We had a solutions architect/project manager got it all installed and did a lot of the work. The vendor configured it and looked after it but it would have been better if there had been some documentation and training review besides being handed the diagrams.</td>
</tr>
<tr>
<td>The vendors seem to think that as we are IS we can fix it but if you don’t know the system or have some of it shown to you then you wind up calling the vendor. They know how it is all linked but we have to know 30 or more systems or servers to support you do not know the insides of their solution and at what stage of patches OS etc. that is on their system as they just think you will know it.</td>
</tr>
<tr>
<td>The vendor has been around as they are working on stage two which is the RIS so it has been pretty good. They supplied 1 week of training but most has been picked up from playing with the system and asking questions. There is 24/7 help desk support as well as local software support engineer</td>
</tr>
<tr>
<td>Hardware is all on one site and run/operated by DHB. Backup are taken off site for database recovery. Some Vendor black box. We do some support of this with the vendor due to geographical support using VNC.</td>
</tr>
<tr>
<td>Vendor provides a managed service so all hardware and software, upgrades, some training, 24/7 365 help desk support</td>
</tr>
<tr>
<td>Vendor provides all software updates.</td>
</tr>
</tbody>
</table>

9. How do your clinicians access Imaging results and reports:

| Mobile laptops in the wards and departments. Not aware of any tablets in use |
| CWS initiates a URL call to PACS at the patient or exam level with generic user limited viewing rights. |
| Some after-hours teleradiology reporting |
Not involved at this level.

All on PC and can access PACS at any PC’s. We have dedicated viewing stations for PACS also

Via PC’s on the wards and in their offices. Some after-hours teleradiology reporting of emergent cases

Via Clinical Work station and API which launched the associated images.

Wireless and tablets for ward rounds

Only Orthopaedics have direct PACS viewer access

Wireless access used on the wards. They can open at the patient level using clinical work station software and can open a full access web service for image archive retrieval

10. Discuss the model of PACS/RIS system utilised:

<table>
<thead>
<tr>
<th>Model Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interfaced PACS and RIS</td>
<td>We have web-based RIS which only holds RIS data</td>
</tr>
<tr>
<td>Fully integrated PACS/RIS from Single Vendor</td>
<td>Not involved at this level.</td>
</tr>
<tr>
<td>We have had a RIS that supplied a work list to modalities. We have a new PACS and a new RIS about to go live.</td>
<td></td>
</tr>
<tr>
<td>Vendor model using integrated RIS/PACS</td>
<td>Interfaced system for PACS and RIS. Single vendor with sub-contractor for RIS. Vendor monitors hardware 24/7.</td>
</tr>
<tr>
<td>Integrated single vendor PACS/RIS/VR</td>
<td></td>
</tr>
</tbody>
</table>

11. Please explain and discuss the integrations your Imaging Informatics system has and the interface engine:

<table>
<thead>
<tr>
<th>Integration</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIS distributes via interface engine to clinicians portal and into clinical data repository for all patient information. We monitor it but supported by IS</td>
<td></td>
</tr>
<tr>
<td>As previous. All integrated from one vendor for PACS and via interfaces with IS to rest of systems.</td>
<td></td>
</tr>
<tr>
<td>It is integrated with several aspects of our larger IS but this is more the realm of the applications team.</td>
<td></td>
</tr>
</tbody>
</table>
PACS will be fully integrated with new RIS. All modalities send their images to our PACS and private provider.

Have Interface engine but IT monitors and controls the interfaces.

Interfaced RIS (European based) and PACS (American) from same vendor.

IS has main interface engine, and other interface engines are utilised.

HL7 interface engine connects PACS and RIS as well as integrated messaging with other hospital information systems. Some internal interfaces with Clinical Work Station software.

We get into some of this along with four interfaces for the likes of electronic referrals in, reports out, sign off. We do not send reports to external clinics only internal into the system.

This is a work in progress.

12. Do you support orthopaedic Templating software or any other integrated imaging software:

Our current VR is an updated product with structured reporting. First one installed outside of US.

Supported by orthopaedics for software but hardware by IS

Orthopaedic templating and VR. I do the training. Tried to move radiologists training to a radiologist without success. VR is only for integrated work within the RIS. Transcriptionist workflow available but is not used

Not involved at this level.

Some training provided as a training session. I am learning it as much as them when I am showing it. The RIS is going in soon. VR is not going in. We will have a separate RIS administrator.

Orthopaedic templating not used but now we have a new orthopaedic surgeon who has requested it and have it on a radiology workstation. VR used integrated with RIS

Basic support training for orthopaedic templating end users and for VR users in the RIS.

Integrated VR within the RIS. We do not have any orthopaedic templating we still print film for them.

13. Do you support Operating Systems, network, hardware or other IS functions in support of the Imaging Informatics:

We monitor interfaces but they are supported by IS, the imaging hardware supported by vendors and some things in the radiology department.

Some basic first line help desk type PC and hardware support but mostly provided by IS with support from vendor when required.
Most of it is supported by the vendor for PACS RIS. It would be good to have defined lines of support from the vendor.

IS supports this

We have an IT person on our team and use the IT group as required. We do first level support then pass IT issues on.

No. Most of this is done by the IS department. Some very basic end user support is performed but most is referred to IT.

Some basic troubleshooting but mostly done by IS

14. Discuss some of the standards involved with performing and understanding the Imaging Informatics role:

Competent in DICOM for our system. Medical physics supports some new modalities, and we review to ensure it will work with our system or use vendor for questions.

I heard the terms at SIIM but not aware of them. IT would be relevant to the role and be good to have an overview.

Feel inadequate on a lot of the actual standards. Am aware of some but would love to find out as I don’t know if they are relevant. Security is not considered beyond access at user level.

Knowledge of some of this as it applies to connectivity and networking in my role would be good. Some of this though is probably system or vendor specific.

Know some of the basics of DICOM and HL7 and I don’t know what I don’t know but I think I know enough to do my job but more might help

I have a basic understanding and I am possibly the only person on team that has that level an interest in them. Are they good to have - yes are they need to know for day to day work – don’t know.

Some knowledge of DICOM and HL7 but far from knowledgeable. Heard of IHE not sure of what it is. Heard of HIPAA but not sure of what it is

Would like to know more about HL7 but there are specialists

15. Please comment on your knowledge of EHR or EMR:

I think they are moving down this track with a central repository for imaging which has been discussed.

This is being discussed at a regional level.

Not involved at this level.
Some actually happening as part of regional but external to radiology

Some of this happening and some discussion of this at the state and national level at RadAIM conference I attended.

I think this will be driven outside of radiology but radiology will be co-opted as we understand the systems and integrations required to make it successful.

Very limited knowledge. Have heard the term IHE but not sure what it entails. IS maintains most aspects outside of radiology at our DHB. The DHB is working towards this.

So far staying within Radiology.

16. What formal adult education or other training have you had to help you with your role:

Vendor sponsored course on the PACS and been to SIIM conference once. Not sure what is available except from the vendor and on-the-job training.

The role is one which requires not someone who just wants to push buttons but must realise it is an adjunct to being a radiographer or IT person. Each has to have training and understanding of the other. I feel it is easier to train a radiographer in IT than an IT in clinical but both need to be there or a super user support from clinical available for IT PA. Again mind set must change for either one to realise and perform the role properly.

I had some CCNA training as part of my degree but nothing beyond that. It helps with my role.

Just my IT and vendor courses. I am working on my post graduate courses for MRI but some training would be great but there is none available for new people.

Did some computer and Microsoft courses as I was interested in doing PACS before I left UK

Did PARCA as I was looking for something PACS related to do to provide me some legitimacy in my role; but have not found it very useful. Sat the 2 certification exams for CPAS and it was web based ad you can re-sit it until you pass.

I have no additional Adult teaching and learning courses.

Very not adequate training provided when started role

On-site training from primary vendor for Orthopaedic templating support plus some online videos were provided to me to learn from.

No directly through work. I investigated the PARCA courses but felt I had done more at my computing diploma.

17. Discuss what qualities, training etc. should an IIP have:

Awareness of the appropriate standards and legislations.
They need to have a problem solving mindset. Qualification would help to train people to what they should know but they still need the problem solving mindset.

Adult education,

Ours has some service desk experience and some basic troubleshooting and I think that is good but knowing who to call for escalating support makes it good.

Workflow knowledge, some clinical some IT, some overall training of Basics of DICOM, HL7 etc. project management

First it should be someone who wants to do the job i.e. puts their hand up when the opportunity presents. Must have some Clinical knowledge (i.e. sagittal reformats of the pancreas need to be deleted) and IT knowledge.

Should be someone who has an interest and knowledge in IT and clinical. Both roles need to be represented and a thorough understanding of the workflow is essential. Some knowledge of the relevant standards and legislation would be good.

Some training and computing courses, Good communicator,

18. Discuss membership of Professional Organisations:

I think it would be beneficial to have some knowledge of any of them. I found some of it at SIIM conference was beneficial for me but some of it would be more for some of the others in the team. It helped me to understand some of the other roles better that I cover at times. The journal was good for some things when I had the time to review it.

Attended RadAIM conference once – was useful for networking and some courses on IHE, compression ratios but only gave me an overview of RIS/PACS generally. Not directly helpful to day to day PACS/RIS administration and you don’t know until you need it how informative it was. It helped in setting up the new RIS.

Conferences and training need to be aware of early so you can plan for or around them

Not involved at this level.

Sharing ideas with other PACS. Gives you some support structure and the opportunity to network

Certification could make a difference but don’t think it would give us a voice as most of the motivation for change is politically driven. As the work we do becomes more complex and wide reaching, Certification is the only way to be sure the people who are administering these patient records in whatever form, have an appropriate understanding of what is necessary and what is useful. Not only to have the minimum standard but to encourage debate because if you have certification you will have discussion on what skills abilities and viewpoints are necessary to obtain that certification. It is the discussion as much as the certification that is important.

I think vendor groups and groups working in the same field would be great to have. It is not new problems but usually a problem someone else has had. Having these groups is very good
CIIP, SIIM and PARCA I am aware of, but not sure who ABII are. Feel there would be benefits from professional association but not sure of daily relevance. Need to investigate them some more. They are not readily accessible in NZ except on-line and are not officially recognised. Current CPD requirements for MRT registration are enough to maintain.

A user group would be beneficial. It would be great to meet all the ones you communicate with and find out we all have common issues.

19. Discuss the availability and intentions to pursue any further qualifications directly related to Imaging Informatics:

I am looking at doing an IT course to get my knowledge up. Not aware of too many PACS courses around so hard to do any. None found in Australasia. Not enough information around. It is hard to know what to take as you don’t know what you don’t know.

The user group and connections with others in the field would be great.

There are some benefits but really there is a need for local groups to meet and have some networking. International ones can be too specific to their own environments but then if we had a presence maybe this would change. The NZIMRT user group being set up will be good for the communication amongst the small group in New Zealand.

Some overview of PACS/RIS specifics at a higher level for network, communications requirements building upon the IT persons training would be good but better if it is stuff I will use not just material to fill space

Just finishing a PGDip in MRI

RadAIM Conference where I did some CT and MR and general and had some informatics lectures were useful with reservation - as in useful to gain knowledge as to how other people do things but utility limited by fact I am not Australian and it was focused on the Australian systems. EHR was good on an abstract level but interest was in state-wide vs. national as this could be applied to NZ as could some of the IHE discussions but also should be looking to international standards.

PARCA Certification has not helped me and when my 5 year cycle is up I don’t think I will renew. If there were some courses and certifications available I might enrol but so far certification has not done anything for me.

Not aware of any Australasia post graduate qualifications. Not sure if RadAIM worth it for PACS/RIS but would like to attend a PACS/RIS conference but funding is hard to obtain for overseas conferences. If more courses available locally or even within NZ, I would definitely be interested.

RadAIM was some benefit but many issues discussed were Australian oriented issues that we do not have. It is good for networking

20. Discuss what recognition should be given to Imaging Informatics Professionals:
It should have some combination of IT and Clinical recognition but is unique in the grey areas that it covers both. It has become very critical to patient care and should have some definition and certification to the role. It affects the patient and the systems need to work efficiently for the patient care and there needs to be a standardised solution.

It is not radiology nor is it IT. It is easier to train a clinical person in basic IT than for an IT person to learn clinical and this is not just terminology it is workflow processes also. This is the problem IT background seem to have is understanding the workflow variability in medicine in general. In the broad definition of Advance practice being something outside of normal training and requiring additional training then it is advance practice. If you take role extension to be something that is different and an extension to the basic training then it is role extension. It depends on the definition. It really is a parallel to both IT and clinical training with additional training required of both.

Not involved at this level.

It is so much outside of radiology but still has the clinical aspects and is a bigger job than I first realised. So it is an advanced role and not role extension but almost should be a new entity. Whether IT or Clinical background it has parts of the role outside of the main training.

Advanced practice is moving outside of your field into someone else’s field. So is it advanced practice like UK where it is MRT’s moving into radiologist roles so they do not have to do them and due to the shortage of radiologists no but it is moving outside our training boundaries into others but no one has the total role covered.

Should probably be a unique practice as it is outside of both IT and Radiography training. A regulatory body may be so small that a few voices may have too much influence to shape a national programme. Stepping outside MRTB may pull us (MRT’s) in two directions even more.

Should be advanced practice.

It should be its own discipline and should have a registry but not as part of MRTB probably. Would it have the numbers though to support it?

21. Discuss if any training in PACS, RIS or other aspects of Imaging Informatics should be provided at the undergraduate level to end users:

They should have a basic overview of the impact of what they do has on the PACS but not in-depth.

Some basic discussion needs to be taught but not in-depth.

Some better overview of the systems and interfaces etc. but not needed to be at a high level. Just need to provide them with an understanding that there are different components involved.

Only basics given but some exposure should be given so they understand the impacts of DICOM and HL7 and some basic legislation.
Some basic overview would be good at more than just a terminology level.

Terms such as DICOM, RIS, and PACS were discussed in my UG training but more should be provided in both the MRT’s and Radiologists training programs as it is guiding the roles and equipment more than ever.

Yes some basics of DICOM as it is the standard now but they need to know the difference between database changes and DICOM header changes.

22. Discuss if formal courses should be made available what should be included:

| Adult education, IT courses, DICOM overview, HL7 messaging, understanding upcoming technology, Global standards, Networking, OS or Microsoft office basics including databases, basic clinical and image review techniques, project management. |
| In Australia/New Zealand any education is better than nothing |
| Basic networking, switches packets, router, traceroute, basic PC knowledge, Troubleshooting, DICOM tools, Basic HL7, project management, Pertinent regulations, Perhaps prepare for some international certification exams like PARCA or CIIP, Should be valid for CPD credits, Clinical for IT background, data integrity for IT people, basic IT for clinical background, Some user group sessions both at vendor level and national level. |
| As discussed earlier. Some of the higher end information that makes it unique would be great. Not anything for me in my role that would not be useful. |
| It would be nice to have some basic non-vendor specific basics and global picture of what is happening and selection. |
| Adult education training and DICOM, HL7 etc. to appreciate what PACS is and terminology to help me with pitfalls; Project management |
| Role is so many different things rolled together. |
| IT or Admin personnel must have clinical knowledge, basic network and architecture, operating systems, help desk level support, interpersonal skills, good communication, skills to train people, DICOM overview, HL7 messaging overview, applicable legislations, project management, most of PM tasks are daily, weekly, monthly etc. standard tasks for me |
| A day or two of HL7 training would be great including message structure, interface engines |
| Network and network structures |
| Feels some sort of qualification is important for recognition and knowledge and the tertiary institutes should provide them to prepare for CIIP or PARCA certification and be recognised towards PGCert, PGDip or Masters. |
| Some adult education training would be a benefit |
| Key components of the standards such as DICOM, HIPAA and other standards Trouble-shooting both general and system specific, Hardware, security, routers, switches,
Probably too late in my career as I am close to retirement. A few years ago I would have
Networking, hardware, database design, DICOM understanding, HL7 messaging, project
management, some adult education, Microsoft office – word, excel, access, Web design,
Reporting tools,

23. Any other questions that arose during the discussions:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>What other modalities or “ology’s” do you have on your system?</td>
<td>Have dental (oral) health on the PACS.</td>
</tr>
<tr>
<td>Have dental (oral) health on the PACS.</td>
<td>Any other PACS systems in your DHB?</td>
</tr>
<tr>
<td>IS supports cardiology PACS for Echoes.</td>
<td>Was the PACS system more beneficial or would analogue been better during the earthquake?</td>
</tr>
<tr>
<td>It was invaluable to be able to send images and reports to the hospitals we transferred patients to. It was great to have this for the patients and clinicians at both ends to know that patient care could be continued as their images were there before the patients in some cases.</td>
<td></td>
</tr>
<tr>
<td>Do you do QA/QC?</td>
<td>Radiologist workstations</td>
</tr>
<tr>
<td>Health checks (audits) on RIS</td>
<td>Work lists to check data</td>
</tr>
<tr>
<td>Work lists to check data</td>
<td>Ensure people are using system properly</td>
</tr>
<tr>
<td>Ensure people are using system properly</td>
<td>No exceptions etc. in the PACS</td>
</tr>
<tr>
<td>No exceptions etc. in the PACS</td>
<td>Check for transfers</td>
</tr>
<tr>
<td>Check for transfers</td>
<td>Do you have security on the external contacts?</td>
</tr>
<tr>
<td>Do you have security on the external contacts?</td>
<td>We only send via healthzone.</td>
</tr>
<tr>
<td>We only send via healthzone.</td>
<td>What issues are you finding with regionalisation?</td>
</tr>
<tr>
<td>What issues are you finding with regionalisation?</td>
<td>Aspects of some issues must be discussed prior to making decisions. Instead they are being labelled as IT based and they are not involving the end users and experts to discuss each other’s aspects.</td>
</tr>
<tr>
<td>Question</td>
<td>Response</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Do you have a lot of input into the new RIS?</td>
<td>This is being handled by my colleague but it has a huge impact. There will be a lot of changes for our private reporting component.</td>
</tr>
<tr>
<td>What is happening regionally?</td>
<td>We are getting a regional PACS where all images will be stored.</td>
</tr>
<tr>
<td>What do you think can be done to improve your system?</td>
<td>I think I do too much fire-fighting rather than preparing and it is a source of frustration.</td>
</tr>
<tr>
<td>What is the cause of your high stress level at work?</td>
<td>Mostly due to my lack of knowledge and experience in the role.  It has reduced this moving to a regional team who teach me a lot just like the adage give a man a fish vs. teach a man to fish.  The local teams add to the stress level due to their lack of understanding of what is required to make the system work.</td>
</tr>
<tr>
<td>What is the implication of the addition to your department size?</td>
<td>I was not really able to get a day off but having someone else to bounce ideas off and discuss issue with is a big relief and I can now take a day off without getting phone calls.</td>
</tr>
<tr>
<td>What is the reason for your Remuneration concerns?</td>
<td>It is an advance practice but there is no recognised training to support it so it is hard to justify.  MRI and US have their own scales and so should PACS.</td>
</tr>
<tr>
<td>Do you do QC on the workstations?</td>
<td>The MRT’s do their own.  We have just got a puck so we can now go and do some monitoring of the Radiologist workstations.  We have been slack but improving it for accreditation.</td>
</tr>
</tbody>
</table>
Provide an opportunity to add anything relevant to this topic:

<table>
<thead>
<tr>
<th>Hard questions you are asking but they do need to be asked and keep me informed and I would love to see the results.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I think we have covered everything already!</td>
</tr>
<tr>
<td>Proper planning and management of projects would make a huge difference when putting in new systems and realising that there are reasons why some systems don’t work together or infrastructure that might be requires. Too often the management or teams will come and demand systems are built and configured without consulting the people in the know and this creates more issues that might have been flushed out earlier.</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>There are as many of opinions and views as to where we go next as there are people. It is amazing</td>
</tr>
<tr>
<td>It is a very under-appreciated role that is constantly expanding. It is what I like to call the vegemite syndrome where you are spread thinly over a very large area. Users assume you know how to get all their software and hardware working and think you are an IT person even though they work with you as a radiographer. Having to train and educate from clerical personnel up to specialist consultants and all the systems involved means I am spread very thin but have to have a high level of knowledge. We have only been in complete RIS/PACS system for less than one year. PACS administrators need to start looking outside their departmental box and move to the bigger picture to realise what the implication of the radiology department reports are on the rest of the system. As the PACS and imaging at large come into the fold then more support of other departments will be required.</td>
</tr>
<tr>
<td>I think we have covered everything!</td>
</tr>
</tbody>
</table>
LIFE EXPERIENCE

All of the interview participants were asked to share an experience that has some relevance to this study. This is just a summary of those responses. Many of them felt these influenced and were also contained within their responses to the questionnaire and the interview questions.

Personally for me IT and telecommunications would be great and server support would be great. On call when a server failed and felt I couldn’t help. It made me want to learn more and get my colleague to show me more.

Many changes have occurred from our older system to our new system. Many of this was due to changes in legislation and many radiographers were not happy as it makes them more responsible for the data and not so easy to change it. It takes some knowledge to know these but you don’t know what you don’t know and this is probably the single biggest issue I have with the system. I know what my vendor engineers and others have given me. I had over 14k exams from our old system when we migrated to our new system to fix due to changes in ways of handling images. Migration made me aware of this but I was not aware of these issues until the issue came up and bit me. It also made me look like I did not know my system and like an idiot and this I do not appreciate. I know better for next time but again it was a lesson learned after the fact because I did not know what I could have known.

Someone went on leave and made a change on a Friday with no documentation. We had an issue and were called and then put three hours into trying to sort but finally had to contact the person on leave but if there had been documentation of changes it would be a simple fix to change a tick box. Knowing what is going on can make a huge difference so there needs to be communication amongst all teams when even small changes are made.

I am so new at this I am not sure if anything I have is relevant. It was a huge learning curve getting started.

Find that the time I am spending on PACS has been decreased due to fact that I am in a high tech area and am needed to cover for people that are sick or not available. As the team lead this is not good. I have found that when something goes awry then I am expected to drop whatever I am doing and fix the issue immediately. When I get back to my desk to do my PACS work there is something which is on the desk that may have prevented the issue so I am becoming reactive with the PACS rather than Proactive if I could spend the time there. PACS/RIS is one of areas that people don’t really think about until it hits the fan.
I was provided with only 4 hours of training and thrown into the role. It is hard to know what I don’t know and so when I find out things I have done are not accurate it is no surprise. Moving to a regional system has exposed me to what knowledge I was lacking and being green around the gills has made it great knowing I have this support available to me. I rely very heavily on the vendor and team support and what I have gleaned from the engineers and support teams to educate me. I have very limited knowledge of the underlying background standards and legislations which I have learned have an impact on how the system works effectively. This has led to a realisation that in our previous local system we have a large amount of dirty data. This has come to light when we have attempted to plan a migration of data into the new system and was ultimately caused by our lack of knowledge.

The training from the vendor was good but there were some things that were learnt on the job such as networking, hardware, steps for setting up new modalities. I took the computer courses at night and exited with a diploma as the number of students was not enough to make the degree courses available in the evenings. This course work has helped me a lot in my role and a few years ago I would have taken more courses.
Discussion of the questionnaire results, interview questions and ‘life event’ are presented in this chapter and integrated with the literature review where appropriate. The results obtained are representative of the diversity of the individuals and roles encountered in this field and is validated by the literature (Hinesly, 2006b).

The literature and methodology has prepared the way for these results to be analysed, coded and presented using triangulation where supported. The demographics of the respondents did not provide any surprises or issues. There is almost equality amongst the genders and the age range and length of time in the role reflects the traditional department-centric model where there are generally individuals with some post undergraduate experience employed or allocated into the roles. Over 80% (22/26) of the respondents were in the two age brackets covering 30-49 years of age (figure 1) with 30.7% having 10 years or less experience and 34.6% having 11 to 20 years of experience (figure 3) since their primary qualification. Only 7.6% of the respondents were over 50 which might ensure there will be some continuity for a few years if those in the younger age groups remain in their positions. In addition this also coincides with the literature that investigated the level of confidence with new technology in radiographers (Rogers, Pratt, Brown, & Gambling, 2010) which found no link between age and confidence when using PACS, RIS and HIS.

A response which demonstrates the relative immaturity of this field in New Zealand, is that 65.4% of the respondents have been in their current position for five years or less, while the remainder have only been in their roles for six to ten years (figure 5). On further reflection, and when discussed with some of the interview volunteers, the number of individuals that have been providing imaging informatics support for five years or less, is probably higher as some respondents included their employment prior to assuming their current role. It was stated by two respondents that their PACS system had only been installed in the last few months and the new RIS was being implemented in the next few months by other team members. Considering that PACS was introduced in the eighties, gained wide acceptance at the modality level in the nineties and the departmental level at the beginning of this century, this is indicative of the relatively recent implementation of this technology in New Zealand healthcare.
While 84.6% of the respondents are employed fulltime only 42.3% are performing imaging informatics support fulltime (figure 7). Some find this is difficult as they are removed from clinical to do support only as required in addition to their normal work. Others find the reverse occurring with themselves being pulled from imaging informatics support to do clinical work on a regular basis. One respondent commented this was because PACS was the poor cousin until there was an issue. One of the interviewees commented that it was difficult to get his PACS work done as he was constantly pulled to cover clinical as he was in a clinical position which has limited staff available (IIP-3) while another said the interruptions to his clinical work were generally for what was considered minor support however major issues required his immediate attention and clinical work suffered as a result (IIP-4). This evidence is consistent with the department centric model and the literature when the individual is placed into this role on a part-time basis. There are numerous incidences in the literature that support the assertion that the importance of the Imaging Informatics role is lost until there is an issue in the system and staffing resources should be dedicated to maintain an efficient running system (Beird, 1999; Cannavo, 2000; Hasley, 2002; Honea, 2001; Mack, 2006a, 2006d)

Primary qualification responses also align with the literature on radiography led PACS systems (Mack, 2006a), where a majority of the IIP’s (greater than 80% in figure 2) of the respondents have a formal radiography background, and three of the other category came from a radiology administration background. Sixteen of the respondents also detailed that they are maintaining their MRTB annual practicing certificate which requires them to perform clinical work and mandatory CPD. Many recognised experts in the field, and both certification boards, recognise the requirement and importance of clinical experience (Cabrera, 2002; Hagland, 2009; Hinesly, 2006a; Honea, 2001; Kho, Bluth, Meenan, & Nagy, 2012; Mack, 2006b; Nagy, Bowers, Reiner, & Siegel, 2005; Oosterwijk, 2007). It is also interesting to note that three respondents had dual qualifications in radiography and IT. In addition, four of the 26 respondents (15.4%) were from an IT trained background outside of radiology (figure 2). This figure is also duplicated in the reporting structure of most of the respondents with 84.6% (figure 8) responsible to the radiology department. Of interest is the fact that three of the respondents stated they have a dual reporting structure including both radiology and IT/IS, which the literature states will provide an optimal solution for the overall function of the system (Cannavo, 2000; Channin, Bowers, & Nagy, 2009; Hagland,
Only three of the respondents report solely to the IS/IT department.

All of this demographic data serves to define who is performing this role in New Zealand healthcare. The majority of these individuals are from a radiology background (either clinical or administrative) with support from the IT teams. The majority have stated that they are maintaining their original clinical scope of practice and almost half are job-sharing their clinical role with their imaging informatics. Also of some significance is the fact several are maintaining additional scopes of practice in the high tech modalities within radiology such as MRI, and Mammography which require advanced scope of practice. The radiology or department centric model is further identified as the predominant model in New Zealand healthcare as the responses demonstrated the vast majority are reporting to the radiology department as the management structure for their role (figure 8).

Most of the DHB’s and private enterprise now have a radiology centric implementation and are just beginning the journey into regional integrated enterprise solutions. Support structure of the respondents indicates that most implementations in New Zealand are of an enterprise nature, that is to say their systems support multiple locations. Only 11.5% of respondents indicated they support a single location (figure 6). This is evidence of the move towards regionalisation as directed by the Ministry of Health and the National Health IT board (Ministry of Health, 2011a, 2011b). In addition it can be seen in figure 32 that as of July 2012, the regional readiness assessment towards the National Health IT Boards target is well progressed for Imaging/Picture Archive when compared to the other regional projects (Ministry of Health, 2012).

Most of the participants (92.3%) in the questionnaire indicated that they provided training. The majority of these provide training in radiology based applications such as PACS, RIS and Voice Recognition to radiology department staff and medical staff but less than half provide this support to the extended healthcare team (figure 12). The applications not radiology based or high-end such as orthopaedic templating, advanced visualisation, and voice recognition are provided by specialised IT trainers or super users in these facilities. Some of the respondents also extend the use of trainers or super-users to other applications within their role. This radiology centric focus is further demonstrated in figure 13 as the common radiology DICOM modalities are supported by the majority of systems but there is a sharp drop off of support for those modalities outside of radiology.
The lack of formal training for these imaging informatics professionals is evidenced in figure 15 where 92.6% of the respondents stated their training was on the job with 57.7% supplied by the vendor. Only eight respondents indicated they had some previous PACS/RIS experience before assuming their current role which was substantiated by the interviewees. These individuals indicated this was mostly as an end-user and only one of those interviewed had some direct experience as a PACS system administrator prior to beginning their current role. The interviewees unanimously had comments on this situation. When questioned they stated that even with the lack of previous experience, their training was adequate to operate their system, however much learning was done on the job after the system went live. Some commented that at the time of training and even now “I don’t know what I don’t know” (IIP-2, 3, 5 & 7). Figure 16 demonstrates the respondents’ perception of the adequacy of their

<table>
<thead>
<tr>
<th>Region / DHB</th>
<th>Northern</th>
<th>Midland</th>
<th>Central</th>
<th>South Island</th>
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<tr>
<td>Continuity of Care</td>
<td>Regional Score 1</td>
<td>Regional Score 3</td>
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<td>Clinical Information System</td>
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<td>Clinical Support Systems</td>
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<td>Patient Administration System</td>
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Scoring for the Individual DHBs:
- Red: DHB is operating a legacy (unsupported) or orphan solution, or has no solution in place
- Pink: DHB is operating a local solution not aligned with agreed regional solution
- Amber: DHB is implementing a local (or regional) solution aligned with agreed regional solution
- Pale Green: DHB is operating a local solution aligned with agreed regional solution
- Green: DHB is operating on the agreed regional solution

Scoring for the Region:
- Red: No DHB has experienced operating a regional solution and there is no plan
- Pink: At least one DHB plans to implement a regionally capable solution
- Amber: At least one DHB is operating a regionally capable solution
- Green: At least half of the DHBs are operating the agreed regional solution locally

Figure 16 demonstrates the respondents’ perception of the adequacy of their
training and while 20 stated it was adequate or better six responded it was less than adequate and 50% of those found it extremely not adequate. Combining these with the respondent’s perception of their own lack of skills demonstrates over 80% felt they have a lack of skills to do their job. Of interest though is the fact that 88% thought that the skill level of their team was extremely or very skilled. Many of the respondents also indicated that their teams were supported by vendors, other teams or were part of a multidisciplinary team. Only 36% indicated they were part of a single focussed team. This compares very well with most of the literature on PACS implementations. These recommend ensuring the team has components of both clinical and IT and that it is very difficult to get all the skills required from an imaging informatics professional in one individual (Cabrera, 2002b; Hagland, 2009a; Hinesly, 2006a; Mack, 2006d; Nagy et al., 2005; Tateosian, 2006a).

The lack of satisfaction with access to relevant education to support their roles was demonstrated in figure 23. Only nine of the respondents stated they were slightly or moderately satisfied which left 50% dissatisfied at some level. Supporting this concern is the 84.6% of respondents that have no post-graduate qualification and while 26.9% have some computer certifications, only one has a direct PACS/RIS certification. In addition 92.3% have stated they have not completed any formal PACS, RIS or informatics education. Quantifying this is figures 24 and 25, which identifies the lack of knowledge of industry relevant standards, guidelines, agencies and organisations. This supports the responses that indicate the individuals are proficient in their vendor systems but not aware of the industry in general. Again this is supported in figure 20 with the majority utilising vendor support at some level to assist with their daily work. The interviewees also found that they were very reliant on the vendors especially initially to assist them in learning their systems and in troubleshooting. During the interviews, all of the participants commented on this lack of general knowledge but how they all feel competent with their own systems. Some of the interviewees also found that since the questionnaire they have identified some of the standards and organisations mentioned (IIP-6, 5, 3 & 2).

All of the respondents find their role challenging with over 75% finding it very or extremely challenging (figure 26). They also like their jobs either moderately or great deal and yet the same number find there is a level of stress in the role. These again identify the individuals that are performing these duties are those that enjoy a challenging but somewhat stressful career. Some of the respondent and the interviewees commented that they feel the stress mostly when things are not operating as they should. In addition, dealing with the many
different individuals representing diverse levels of education, personality and roles across all levels of personnel. It has also come from having to learn new domains such as networking and other IT or clinical work flows along with standards, interfaces integration with other systems and departments. Additionally three of the interviewees identified that trying to maintain a clinical scope of practice along with doing the imaging informatics role, caused stress as clinical seemed to have priority in the eyes of the greater department until there was an incident (IIP-3, 4 & 6). One of the life/work experiences was directly related to this issue when IIP-3 stated that the amount of time spent “on PACS issues has been decreased due to the fact I am in a high-tech area and am needed to cover for people that are sick or not available” but that when there is an urgent issue “I am expected to drop whatever I am doing and fix the immediate issue.” This has led to this individual “becoming reactive rather than proactive with PACS…PACS/RIS is one of the areas that people don’t really think about until it hits the fan.”

73.1% of the questionnaire respondents felt this role should have a defined scope of practice however as one comment stated it is outside of both the clinical and IT domains. To further this argument, 78.9% felt that the role should be classified as an advanced practice role as it is outside of the bounds of normal MRT training. In the interviews the participants were asked to expand on this and they all felt that this was a role that cannot be defined as an advanced practice by MRT’s or other but rather should have its own unique definition.

The largest concern of most of the respondents and participants of the interview is the perceived lack of educational offerings to support their role. Only 61.5% of these individuals are aware of the SIIM organisations that support the profession internationally but only 26.1% are aware of PARCA as detailed in figure 25. Combining this with the lack of knowledge and awareness of the regulatory bodies that impact the profession demonstrates the need for more generalised educational support for this industry in New Zealand. Searches of the Australia and New Zealand tertiary education provided no information on courses specific to PACS or Imaging Informatics. There is a small offering provided from the United States, Canada and Europe that can be obtained on-line but in discussion with the interview participants, many feel this is not beneficial. Some have attended the RadAIM conference PACS stream in Australia and have found this somewhat useful after the fact but not directly relevant to their day to day job (IIP-6, 2 & 5). It has served to expose them to terms and trends within the field and allowed them to network with others in the field. A realisation that others have the same issues has also given them some peace of mind. Only 1 respondent
to the questionnaire has attended the SIIM conference which is the only conference dedicated solely to Imaging Informatics. This individual has stated that a lot of the topics were not directly beneficial to the day to day role but did expose some short comings in their personal knowledge. It also enabled them to share information with others on the team and brought a realisation that they need to do some further education (IIP-7).

To research what support these professionals need involved a lot of inductive reasoning from the responses to several questions and the interviews. An average of 50% of the respondents felt they were trained and competent in DICOM and HL7 (figure 24) and yet many felt this was an important item for training and knowledge of new people into the field. During the interview some expansion was sought on this issue and five out of the seven were not aware of the volumes of the DICOM standard and did not regularly use DICOM conformance statements to prepare for new modalities or assist in troubleshooting. Therefore this demonstrates the knowledge of the standard is not reflective of being trained or competent in its use. Very few of these individuals were aware of the other agencies and organisations which could lead them to educational opportunities. PARCA has a list of links on its website specifically for this purpose (PARCA, 2012b). There has been considerable interest in the formation of a user-group under the auspices of the NZIMRT and one of the interviewees was driving this. Many felt this would be a very good beginning to providing some opportunities for these professionals. The issue that arises from this is the exclusion of those who are not members of this society.

When questioned about the courses or education that should be required 45% responded with networking and 27% had clinical skills. There is an obvious bias here with these responses reflecting the large proportion of radiology based individuals versus those from other backgrounds. The interviews provided an opportunity to further expand on these responses. The interviewees were all in favour of some courses being made available as a general overview to imaging informatics. Most stated DICOM, HL7 and networking as obvious choices but when questioned further many offered up project management skills, regulations, troubleshooting skills, PC skills and adult education training as some of the topics. It was also mentioned that there may need to be some additional IT courses for the non-IT backgrounds and some clinical courses for those with an IT background to cover the basics and terminology.
An additional question was posed to the interviewees to collaborate the responses in the questionnaire regarding individuals entering the field and also the undergraduate radiography programmes. All of the interviewees felt that the new MRT graduates had heard the term DICOM but their understanding of the basics and the communication channels was lacking. All of the interview participants stated some more education including an overview of messaging, standards, and communications should be provided during the undergraduate training. This could then be combined with some post graduate education to prepare new individuals to enter the profession and perhaps even plan an entry with certification. This would be difficult with the ABI certification (CIIP) as experience is one of the pre-registration factors. This is not the case with the PARCA certification. These represent the two current pathways for certified entry into the profession.

Several of the interviewees had comments on training and, in some, their life/work experience had a component in them that related to a lack of education or training. Lack of knowledge was identified by IIP-6 as an integral part of the their experience when it was stated that “I know what my engineers and others have given me” and when a particular “issue came up and bit me…it made me look like I did not know my system and like an idiot” “I know better for next time but again it was a lesson learned after the fact because I did not know what I could have known”. This demonstrates the reliance on the vendors to impart their knowledge to their clients and is indicative of most of the individuals that responded to this research. Another participant mentioned only having four hours of training prior to being thrown into the role and stated “it is hard to know what I don’t know and so when I find out things I have done are not accurate it is no surprise” (IIP-2). It was further stated there is a heavy reliance on the vendors and colleagues to guide this individual and in realising the early lack of knowledge has made some of the data in their system faulty simply due to a lack of knowledge of standards and regulations. One further life/work experience identified by IIP-7 had a lack of knowledge of some components of the system causing frustration when they failed when they were on call. This person stated the incident “made me want to learn more and get my colleagues to show me more.” All of this data demonstrates there is an overwhelming need for some educational support for the professionals that are providing this role in New Zealand healthcare.

The preferred level of obtaining continuing professional development for those in the field and those who may want to enter it is to provide some courses at the post graduate level. Again there may well be a bias here as most have at least an undergraduate degree level
education. This will also serve to assist many to accumulate the credits they need to maintain their practicing licenses, will serve to recognise the advanced nature of this role and support an increase in the level of remuneration that 30.7% responded is not well (figure 31). Amongst the interviewees, all felt that some training courses should be available, have a New Zealand or at least Australasian component, and all of the training should lead towards some form of recognition both locally and internationally while being aligned with the international certifications of PARCA and ABII.

SUMMARY

The case study research methodology and the multiple data collection models were aptly suited for this research. The breadth of data obtained matches the diversity found in the individuals, implementations, roles and tasks they are performing. The next chapter will present some conclusions and recommendations based on this research.
CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

Imaging Informatics Professionals in New Zealand Healthcare were the focus of this qualitative study. The research questions were:

- What are the roles, tasks and responsibilities of the IIP’s in New Zealand?
- Who is currently performing this role?
- What educational resources do they need?
- What support is currently available to them?

To address these issues, the study analysed the experience, knowledge, background and educational qualifications that IIP’s currently possess directly related to their role. In addition the study also examined the continuing professional development of these individuals, their expectations of the role and the current and projected functions of this role both internationally and in New Zealand.

It became apparent from the results and discussion that imaging informatics is a relatively immature field in New Zealand healthcare. With this immaturity comes a lack of organised education pathways, an issue identified by most of the respondents to the questionnaire and by the interviewees. The majority of the individuals performing this role in New Zealand are from a radiology background; however there are some with an IT background and also some who have dual radiography and IT backgrounds. The latter are the best suited individuals to take on this role; however the intricacies of the industry based standards, guidelines, government legislations and communication protocols are not included as part of either training regime. Measures such as participation of IIPs in regional groups or adoption of some of the legislations, standards and guidelines such as HIPPA, IHE and others would serve to benefit the patients and to provide some recognition of the important role of these professionals. The study indicated that the individuals currently in this field are leading the way for the future while providing a critical component of the patient care pathway, emphasizing the importance of the measures suggested.
The specification of the role of the Imaging Informatics Professionals in New Zealand has been very difficult to ascertain, but some clear trends emerged. The literature has stated there are many different implementations with many methods of supporting them and the data obtained in this research has reinforced this. Most of the data demonstrates that the prevalent imaging informatics model is radiology department-centric. In this model the role of IIP is to provide support to the radiology department staff and to the two primary radiology software applications specifically, while some IIPs are also providing additional IT support. It is also apparent that the best model is one where the clinical trained personnel are supported and integrated with the IT/IS support personnel and vice versa. This ensures all aspects of the multiple systems are well supported and integrated within the greater healthcare environment.

The variety of tasks these individuals are performing also was discussed in the literature and the results of this study and these tasks have been demonstrated to be very diverse. Many IIPs are branching out into supporting additional digital software such as voice recognition, orthopaedic or other templating, while some are moving outside of the radiology departments with support for endoscopes, dental imaging, electronic order entry, and advanced visualisation. Some IIPs are now expanding their role into modalities outside of the radiology department and the National Health IT goal of an electronic medical record (EMR).

Due to the lack of individuals with post-graduate qualifications combined with the department-centric imaging informatics approach within Medical Imaging, there is a lack of New Zealand literature on this subject. In addition, the lack of local or regional educational programmes and recognition of the foreign certifications also contribute to this shortfall. Additionally there are no Australasian based education courses available for these professionals to obtain any post-graduate qualifications and encourage research in this field. Anyone interested in the field searching for appropriate qualifications will find the two certification pathways identified in the literature and may discover the availability of overseas on-line courses. The content within these courses is of course geared to their relative national audiences and does not include any New Zealand or Australasian specific components.Whilst compliance with overseas national legislation and guidelines are included in the solutions supplied by the vendors that supply the New Zealand market, this is not an ideal situation and in fact was found to be a deterrent to many of the participants in this study. The level of support we provide to help these individuals now and in the future will be an ongoing concern. Provision of easily accessible education for this role should be coordinated with
improvements in the treatment of imaging informatics in New Zealand’s undergraduate radiography programmes.

Most of those in the IIP role desire some further education and there is a move to begin a user group forum within the NZIMRT, but this will only capture the members of that association. Attempts are also underway to invite some recognised experts to provide workshops in New Zealand and Australia. Relatively small attendance numbers make these workshops very expensive and funding restrictions limit attendance. Recognition of the existing overseas certifications would also benefit these individuals and encourage participation. The impediments identified to the pursuit of overseas training opportunities includes the lack of resources provided by the employers and the need for overseas travel to relevant conferences and examinations. There is not a large enough cohort of these individuals to warrant a New Zealand based postgraduate certificate. However, in conjunction with our Australasian neighbours or with recognition or support of overseas courses by New Zealand education institutions, this goal may be accomplished.

Despite the modality-centric, department-centric and hospital-centric concepts being more than 20 years old, these models have continued to evolve and be implemented throughout New Zealand. However, these models need to be aligned under the patient-centric concept in order to meet the aims of the National Health IT Board (Ministry of Health, 2011b) and to move into the realm of Imaging Informatics. Only by effecting this can they encompass all forms of images and their associated data into an easily accessible form.

The findings of this study regarding the roles, tasks and responsibilities of the IIP’s in New Zealand and their limited access to the necessary educational resources suggest the following recommendations:

1. The industry provide support for New Zealand to join the IHE group.
2. Employers should provide funding and leave to individuals to attend the international conference.
3. A trans-Tasman or Australasian partnership be established to develop some courses to assist the individuals that wish to pursue a postgraduate certificate, diploma or masters degree.
4. Encouragement for individuals to take advantage of existing courses that may have some relevance such as adult education training, computer networking, PC skills, and others.
5. Workshops with New Zealand content be made available in this country
6. Clinical training courses be provided for those entering the field from a non-clinical background
7. An overview of imaging informatics and its implications be incorporated undergraduate MRT degree courses
8. IIPs should prepare for, embrace and actively participate in the move by the National Health IT Board towards their 2014 goal.

Formalising an academic pathway and recognising certification will establish an identity and recognition of the critical role imaging informatics professionals play in the New Zealand health system, and will lead to potential improvements in patient care.
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APPENDIX 1: UREC APPROVAL

Kevin Hughes
36 Sunrise Avenue Mt. Maunganui, 3116
26.7.12
Dear Kevin,

Your file number for this application: 2012-1028

Title: Imaging Informatics Professionals in New Zealand.

Your application for ethics approval has been reviewed by the Unitec Research Ethics Committee (UREC) and has been approved for the following period:

Start date: 25.7.12 Finish date: 25.7.13

Please note that:

1. The above dates must be referred to on the information AND consent forms given to all participants.

2. You must inform UREC, in advance, of any ethically-relevant deviation in the project. This may require additional approval.

3. Organisational consent/s must be cited and approved by your primary reader prior to any organisations or corporations participating in your research. You may only conduct research with organisations for which you have consent.

You may now commence your research according to the protocols approved by UREC. We wish you every success with your project.

Yours sincerely,

Gillian Whalley Deputy Chair, UREC

Cc: John Poletti Cynthia Almeida
APPENDIX 2: INFORMATION SHEET AND ORGANISATIONAL CONSENT FORM

INFORMATION FOR ORGANISATIONAL CONSENT

Research Project Title: Imaging Informatics Professionals in New Zealand

Synopsis of project:

This is a research project evaluating the roles, qualifications and experience of individuals that are performing the clinical and information technology (IT) support for the production, storage and distribution of images created in the New Zealand health care setting.

What am I doing?

I am evaluating the individuals and their roles to determine who is performing these support functions and what training and educational requirements are needed to support these individuals both now and in the future. This will help to develop these roles and individuals to better support the published goals of the National Health IT Board and improve patient care.

What it will mean for you:

I invite you to consent for individuals within your organization participate in this research via a questionnaire, one-on-one interview, and/or focus group session. I anticipate this will take from 15 minutes to 1 hour dependent upon the participation method. The interviews and focus group sessions will involve both video and audio recording and will likely occur at the national conference, via video or teleconferencing or at a mutually agreed time and location. These will then be transcribed, coded and analyzed prior to their inclusion in the final result.

If you agree to consent could you please complete and sign the attached consent form. Each participant in the interviews and focus group(s) will also be required to sign a consent form. This does not stop you from changing your mind if you wish to withdraw from the project. However, because of my schedule, any withdrawals must be requested prior to November 01, 2012, when the study will be finalized.
Your name, and information that may identify you, will be kept completely confidential. All information collected from you will be stored on a password protected file and only you and I (the researcher) will have access to this information. My supervisors and advisors may have access to some of the data but only in an anonymous format.

If you require any additional support during the interview and/or focus groups for language, personal or cultural reasons, please do not hesitate to let me know and I will try my best to accommodate you.
Please contact me if you need more information about the project at 0276462222, email xkevinh@gmail.com, or post to 36 Sunrise Avenue, Mt. Maunganui 3116

At any time if you have any concerns about the research project you can contact my supervisor:
My supervisor is Dr. John Poletti, phone 815 4321 ext. 5186 or email jpoletti@unitec.ac.nz

UREC REGISTRATION NUMBER: 2012-1028

This study has been approved for the period 25/7/2012 to 25/7/2013 by the UNITEC Research Ethics Committee pending organisational consent. If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the UREC Secretary (ph: 09 815-4321 ext 6162. Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
Organisational Consent

I, .........................................................................................(name)

..........................................................................................(Position in organisation)

Of ...........................................................................................(organisation)

give consent for Kevin Hughes to undertake research in this organisation as discussed with the researcher.

The consent is subject to approval of research ethics application no 2012-1028 from 25/7/2012 to 25/7/2013 by the Unitec Research Ethics Committee and a copy of the approval letter being forwarded to the organisation as soon as possible.

Signature: ...........................................................................

Date: ____ / ____/2012
APPENDIX 3: QUESTIONNAIRE

Survey of Imaging Informatics Professionals' Qualifications,

Imaging Informatics Professionals in New Zealand Health Care

PARTICIPANT INFORMATION FORM

My name is Kevin Hughes and I am a current practicing MRT, PACS/RIS System Administrator and a Certified Imaging Informatics Professional (CIIP). I am currently enrolled in the Master of Health Science (MRT) degree in the School of Health and Community Services at Unitec New Zealand. I am seeking your help in meeting the requirements of research for a Thesis course which forms a substantial part of this degree. This questionnaire is one component of the research data for my thesis and it is anticipated this will take approximately 10 to 15 minutes of your time to complete.

The aim of my project is:

To evaluate the roles, qualifications, experience, training and continuing professional development (CPD) requirements of individuals that are performing the clinical and information technology (IT) support for the production, storage and distribution of images created in the New Zealand health care setting. The most common term for this role is that of a PACS (and or) RIS System Administrator. As the digital imaging has expanded to other departments of the health care setting from Radiology it is becoming more of an Imaging Informatics role. I anticipate this survey and thesis will help to develop these roles and individuals to better support the goals of the National Health IT Board and provide improved patient care.

Neither you nor your organisation will be identified in the Thesis. All information collected from you will be stored on a password protected file and only you and myself (the researcher) will have access to this information. My supervisors and advisors may have access to some of the data but only in an anonymous format. You are free to ask me not to use any of the information you have given prior to November 15, 2012 and you can, if you wish, ask to see the Thesis before it is submitted for examination.

I invite you to take part and trust that you will find your involvement interesting. If you have any queries about the research feel free to contact me as detailed below or you may contact my principal supervisor at Unitec New Zealand. My supervisor is:
Dr. John Poletti phone: 815-4321 ext. 5186 or email: jpoletti@unitec.ac.nz

This questionnaire is designed to maintain anonymity and no identifiable information will be utilised in the results or will be disseminated. Only those requesting a copy of the results or voluntarily participating in further interviews or focus groups will be contacted directly. The data obtained from these sessions will be dealt with strictly confidentially.

I would be very grateful if you would take the time to complete this questionnaire, not only for my personal benefit but also for the benefit of the profession.
You can exit this survey at any point and return to complete prior to November 1, 2012.
Survey of Imaging Informatics Professionals' Qualifications,

Once you have completed this survey please press submit. If you are completing this in hard copy format, please return the completed questionnaire by November 01, 2012 to:
Kevin Hughes, 36 Sunrise Avenue, Mt. Maunganui 3116. If you have any questions I can be reached via email at xkevinh@gmail.com or via telephone at 027 646 2222.

Thank you for your participation.
Survey of Imaging Informatics Professionals' Qualifications,

Part 3: Questionnaire

3.1. Are you male or female?
- Male
- Female

3.2. Which category below includes your age?
- 18-20
- 21-29
- 30-39
- 40-49
- 50-59
- 60 or older

3.3. What is your primary qualification? (please mark all that apply)
- Diploma HRT
- Diploma IT
- Degree HRT
- Degree IT
- Certificate IT
- Other (please specify)

3.4. How many years have you practiced since your primary qualification was obtained?
- Less than 1 year
- 1 - 2 years
- 3 - 5 years
- 6 - 10 years
- 11 - 15 years
- 16 - 20 years
- 21 - 25 years
- 26 - 30 years
- 31 - 35 years
- 36 - 40 years
- Greater than 40 years
- Other (please specify)
**Survey of Imaging Informatics Professionals' Qualifications,**

1. Do you have any postgraduate qualifications? (please mark all that apply)
   - [ ] No
   - [X] PGCert MRT
   - [ ] PG Dip MRT
   - [ ] Masters MRT
   - [ ] Masters IT
   - [ ] PD Dip IT
   - [ ] Masters Information
   - [ ] Industry Certification (please specify)
   - [ ] Professional Association Certification (please specify)

   **Other (please specify)**

2. Do you hold a current Annual Practising Certificate (APC) from the New Zealand MRT Board or other Goverment Licensing agency?
   - [X] Yes
   - [ ] No

   **If yes please specify Licenses and/or Scope(s) of Practice**

3. Do you hold any other certifications (i.e. CEIP, PARCA, Microsoft, Cisco, Novell etc.)?
   - [X] Yes
   - [ ] No

   **If Yes, Please specify**

4. Do any of your certifications or registrations depend upon mandatory requirements?
   - [X] YES
   - [ ] NO

   **Comment**
Survey of Imaging Informatics Professionals' Qualifications,

5. Can you briefly describe the mandatory requirements (i.e., practice hours required, education hours and/or credits required, renewal period, etc.).

6. What is the job title for your current position?

7. Which of the following categories best describes your employment status?
   - Employed part-time, working 1-35 hours per week
   - Employed full-time, working >35 hours per week

Comment

8. About how long have you been in your current position?
   - 0 - 1 Years
   - 2 - 3 Years
   - 4 - 5 Years
   - 6 - 10 Years
   - 11 - 15 Years
   - 16 - 20 Years
   - 21 - 25 Years
   - 26 - 30 Years
   - Greater than 30 Years

Comment

9. About how many physical locations does your organization have that the Imaging Informatics System supports?
   - 1
   - 2 - 5
   - 6 - 10
   - 11 - 15
   - 16 - 20
   - 21 - 25
   - 26 - 30
   - Greater than 30

Other (please specify)
14. How many hours per week do you perform Imaging Informatics (PACS/RIS/EDC) support?
- Full time
- 9 - 16 hours
- 17 - 24 hours
- 25 - 32 hours
- No defined amount but as required

Comment

15. What department or service does your position report to?
- Information Technology
- Radiology
- Clinical Applications Team
- Information Management
- Cardiology
- Information Systems
- Radiation Therapy
- Other (please specify)

16. What is your main workplace?
- New Zealand DHB Hospital
- New Zealand District Health Board
- New Zealand Regional IT Board
- New Zealand Private Practice Clinic
- New Zealand Public Health Trust
- New Zealand Private Hospital
- New Zealand Private IT provider
- New Zealand Imaging Informatics System Vendor
- Asia Pacific Imaging Informatics System Vendor
- World Wide Imaging Informatics System Vendor
- Other (please specify)
Survey of Imaging Informatics Professionals' Qualifications

17. If DHB or Regional how many DHB’s are supported by your Imaging Informatics System?
   - 1  - 5  - 9
   - 2  - 6  - 10
   - 3  - 7
   - 4  - 8

Comment:

18. At which type of workplace location do you work? (Choose all that apply)
   - Main or central location
   - Peripheral or support centre
   - Various locations
   - Predominantly at main location but some peripheral location on-site support
   - Other (please specify)

Comment:

19. Do you provide training for new staff on using your Imaging Informatics systems?
   - Yes
   - No

Comment:
Survey of Imaging Informatics Professionals' Qualifications,

28. If yes, what staff do you provide training to? (please select all that apply)
- [ ] MRTs
- [ ] Consultants
- [ ] Nurses
- [ ] Radiologists
- [ ] Registrars
- [ ] Allied Health Professionals
- [ ] Admin/Clerical staff
- [ ] House Officers
- [ ] IT support
- [ ] Medical Students
- [ ] Other (please specify)

21. If yes, what applications do you provide training for? (please select all that apply)
- [ ] PACS
- [ ] Radiology Information System (RIS)
- [ ] Clinical Information System (CIS)
- [ ] Cardiology Information System (CIS)
- [ ] Hospital Information System (HIS)
- [ ] Voice Recognition Software (VR)
- [ ] Orthopaedic Templating
- [ ] Neurology Templating
- [ ] Other Templating
- [ ] Clinical Data Repository (CDR)
- [ ] Clinician Work Station (CWS)
- [ ] Advanced Visualisation (3D, CAD, etc.)
- [ ] Other (please specify)
Survey of Imaging Informatics Professionals' Qualifications,

**Q21. What DICOM Modality does your system currently actively support and provide to clinicians? (Please tick all that apply)**

- [ ] CA
- [ ] TG
- [ ] IVUS
- [ ] DX
- [ ] ST
- [ ] RG
- [ ] RF
- [ ] ES
- [ ] PR
- [ ] XA
- [ ] CT
- [ ] RT
- [ ] CT
- [ ] XC
- [ ] KTP
- [ ] MG
- [ ] GM
- [ ] RTS
- [ ] US
- [ ] HD
- [ ] RTJD
- [ ] MR
- [ ] ID
- [ ] RTR
- [ ] PT
- [ ] EM
- [ ] EPS
- [ ] NH
- [ ] PK
- [ ] VF
- [ ] SK
- [ ] ECG
- [ ] WSD
- [ ] LS
- [ ] CAD
- [ ] FA

- [ ] Other (please specify)
Survey of Imaging Informatics Professionals' Qualifications.

23. What systems, hardware and software does your Imaging Informatics System support either directly or indirectly? (please tick all that apply)

- PACS
- Radiology Information System (RIS)
- Clinical Information System (CIS)
- Cardiology Information System (CIS)
- Hospital Information System (HIS)
- Voice Recognition Software (VR)
- Orthopaedic Templing
- Neurology Templing
- Other Templing
- Clinical Data Repository (CDR)
- Clinician Work Station (CWS)
- Advanced Visualization (3D, CAD, etc.)
- Other (please specify)

- Interface Engines (HL7)
- DICOM Routing
- Form Scanning (pdf, DCM etc.)
- Report Distribution
- Printers
- Healthlink
- Main Permanent Archival Storage
- Mirror Permanent Archival Storage
- Temporary Archival Storage
- Diagnostic Display Monitors
- Networking

24. How was your training provided? (select all that apply)

- On the Job
- Vendor Supplied on-Site
- Previous experience
- Formal training
- Other (please specify) or Comment

- ELSI
**Survey of Imaging Informatics Professionals' Qualifications.**

**23. How adequate do you feel the training was you received when you started in your role?**

- Extremely adequate
- Very adequate
- Moderately adequate
- Slightly adequate
- Adequate
- Slightly not adequate
- Moderately not adequate
- Very not adequate
- Extremely not adequate

**Comment**

---

**26. Are you part of a focused single discipline team, multi-disciplinary team, supported by other teams or vendor or a combination? (Choose all that apply)**

- Focused single discipline team
- Multi-disciplinary team
- Supported by other teams
- Supported by vendor
- Other (please specify)

---

**27. How skilled at their jobs are the members of your team?**

- Extremely skilled
- Very skilled
- Moderately skilled
- Slightly skilled
- Not at all skilled

**Comment**

---
Survey of Imaging Informatics Professionals' Qualifications,

31. Have you completed any formal education directly related to the PACS, RIS or Informatics systems?
   ☐ Yes ☐ No

Comment

32. If yes, please specify (name of course, which Institution and your completed)

33. Have you attended any conferences dedicated related to the PACS, RIS or Informatics systems?
   ☐ Yes ☐ No

34. If yes, please specify (name of conference or association, location and year completed)

35. Have you attended any user-group sessions directly related to the PACS, RIS or Informatics systems?
   ☐ Yes ☐ No

36. If yes, please specify (Vendor sponsored, Frequency and year)
**Survey of Imaging Informatics Professionals' Qualifications**

37. Overall, how satisfied are you that you can access relevant education, neither satisfied nor dissatisfied with it, or dissatisfied with it?

- Extremely satisfied
- Moderately satisfied
- Slightly satisfied
- Neither satisfied nor dissatisfied
- Slightly dissatisfied
- Moderately dissatisfied
- Extremely dissatisfied

Comment

38. What courses or education would you suggest should be required for a new Imaging Informatics professional?

39. What skills do you think a new Imaging Informatics professional should have?

40. What continuing education would you want to have available for Imaging Informatics professionals?
### Survey of Imaging Informatics Professionals' Qualifications

**Q 41. Do you feel you are trained and competent with the following standards, guidelines, and regulatory agencies as they pertain to Imaging and Informatics in healthcare?**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>DICOM</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>HL7</td>
<td>☐</td>
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<tr>
<td>CDA</td>
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<td>HIPAA</td>
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<td>IHE</td>
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<tr>
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<tr>
<td>SNOMED</td>
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<td>☐</td>
</tr>
<tr>
<td>ICD-10</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

**Other (please specify)**

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135
Survey of Imaging Informatics Professionals' Qualifications,

# 42. Are you aware of the following organisations as they relate to Imaging Informatics?

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAPM</td>
<td></td>
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<tr>
<td>RSNA</td>
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<td>RANZCR</td>
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<td>SIIM</td>
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<td>PARCA</td>
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<td>HL7</td>
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<td>ACHI</td>
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<td>UKCHP</td>
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<tr>
<td>HINZ</td>
<td></td>
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</tr>
<tr>
<td>IMIA</td>
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</tr>
</tbody>
</table>

Other (please specify)

# 43. How challenging is your job?

- Extremely challenging
- Very challenging
- Moderately challenging
- Slightly challenging
- Not at all challenging

Comment


Survey of Imaging Informatics Professionals' Qualifications,

44. How do you feel about your job, neither like nor dislike it, or dislike it?
   - Like a great deal
   - Like a moderate amount
   - Like a little
   - Neither like nor dislike
   - Dislike a little
   - Dislike a moderate amount
   - Dislike a great deal

Comment:

45. In a typical week, how often do you feel stressed at work?
   - Extremely often
   - Very often
   - Moderately often
   - Slightly often
   - Not at all often

Comment:
48. How do you feel about your work with PACS, HIS &/or RS, neither like nor dislike it, or dislike it?

F  Like a great deal
F  Like a moderate amount
F  Like a little
F  Neither like nor dislike
F  Dislike a little
F  Dislike a moderate amount
F  Dislike a great deal

Comment

49. How do you feel about the size of your team? Should it be larger than it is, smaller than it is, or is the size about right?

F  Much larger
F  Somewhat larger
F  Slightly larger
F  About right
F  Slightly smaller
F  Somewhat smaller
F  Much smaller

Comment
Survey of Imaging Informatics Professionals' Qualifications,

48. Given your skills, how well do you feel you are paid?
   - Extremely well
   - Vary well
   - Moderately well
   - Slightly well
   - Satisfied
   - Slightly not well
   - Moderately not well
   - Not at all well

   Comment:

49. What actions can your employer take to build a better workplace?

50. Do you feel this role requires a defined scope of practice?
   - Yes
   - No

   Comment:

51. If you are an MRI do you think this should be classed as a role extension or advanced practice role?
   - Role extension
   - Advanced practice role

   Comment:
Survey of Imaging Informatics Professionals' Qualifications,

53. Do you feel you have room to advance in your current role?
   ✔ Yes    ☐ No

Comment:

55. Please add any comments you would like to make or any questions you would like to see addressed at a further stage.

54. If you would like to receive a copy of this data or participate in further interviews and/or focus groups, please complete the following questions:

Name:

Company:

Address 1:

Address 2:

City/Town:

ZIP/Postal Code:

Country:

Email Address:

Phone Number:
APPENDIX 4: INTERVIEW QUESTIONS

PARTICIPANT INFORMATION FORM

My name is Kevin Hughes and I am a current practicing MRT, and PACS/RIS System Administrator. I am currently enrolled in the Master of Health Science (MRT) degree in the School of Health and Community Services at Unitec New Zealand. I am seeking your help in meeting the requirements of research for a Thesis course that forms a substantial part of this degree. This interview is one component of the research data for my thesis.

The aim of my project is:

To evaluate the roles, qualifications and experience of individuals that are performing the clinical and information technology (IT) support for the production, storage and distribution of images created in the New Zealand health care setting. This will help to develop these roles and individuals to better support the goals of the National Health IT Board and improved patient care.

Neither you nor your organisation will be identified in the Thesis. All information collected from you will be stored on a password protected file and only you and myself (the researcher) will have access to this information. My supervisors and advisors may have access to some of the data but only in an anonymous format. You are free to ask me not to use any of the information you have given, and you can, if you wish, ask to see the Thesis before it is submitted for examination.

If you require any additional support during this interview for language, personal or cultural reasons, please do not hesitate to let me know and I will try my best to accommodate you.

I invite you to take part and trust that you will find your involvement interesting. If you have any queries about the research, you may contact my principal supervisor at Unitec New Zealand.

My supervisor is: Dr. John Poletti phone: 815-4321 ext. 5186 or email: jpoletti@unitec.ac.nz

UREC REGISTRATION NUMBER: 2012-1028

This study has been approved by the UNITEC Research Ethics Committee from (date) to (date). If you have any complaints or reservations about the ethical conduct of this research, you may contact the Committee through the UREC Secretary (ph: 09 815-4321 ext 6162). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.
The answers you provide in this interview will be maintained with anonymity and no identifiable information will be utilised in the results or will be disseminated. Only those requesting a copy of the results or voluntarily participating in further focus groups will be contacted directly. The data obtained from these sessions will be dealt with strictly confidentially.

I am very grateful of your time to participate in this interview, not only for my personal benefit but also for the benefit of the profession. I anticipate this will take approximately 1 hour of your time.

You can exit this interview at any point and all results can be removed prior to finalising the data no later than of November 16, 2012

If you have any questions I can be reached via email at xkevinh@gmail.com or via telephone at 027 646 2222, 021646261.

Thank you again for your participation.
Interview ALPHA (to be labelled appropriately).

1) Verify Demographics.
   Age, Sex, Qualifications, Years of practice, II experience

2) Role, departmental and reporting structure

3) Define your workplace? (Size, coverage).

4) Define the Imaging Informatics Support provided by your department (Modalities, Software, Integrations, hardware)

5) What services and support do your Vendor(s) provide? (Hardware, software, upgrades, training, education)
6) What access do your clinicians have to Imaging and reports? (i.e. PC, Apple, tablets, on-site, remote all reports in CDR or separate databases for specialties) do you have teleradiology?

7) Discuss the model of PACS/IS system utilised? (What features are appealing, monitoring, reporting, business intelligence, data mining.

8) Discuss hardware and archival solutions?

9) What DICOM modalities does your PACS provide support for? What (if any) support is provided by external suppliers (i.e. VNA)?

10) Please explain and discuss the integrations your Imaging Informatics system has and the interface engine?

11) Do you support orthopaedic Templating software or any other integrated imaging software (VR)? Can you expand on this support (does it include training of end users, ongoing licensing, updates, hardware and networking support, local, distance, multi-site, network, internal, external etc.)

12) Do you support Operating Systems, network, hardware or other IS functions in support of the Imaging Informatics? If not whose responsibility is it?

13) Discuss your reasons for entry into the Imaging Informatics role.
14) Discuss some of the standards involved with performing and understanding the Imaging Informatics role? (DICOM, HL7, IHE, HIPPA, IS, IT, privacy, document control, etc.)

<table>
<thead>
<tr>
<th>Standards Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>DICOM, HL7, IHE, HIPPA, IS, IT, privacy, document control</td>
</tr>
</tbody>
</table>

15) Please comment on your knowledge of EHR or EMR: Is your facility working towards this actively?

<table>
<thead>
<tr>
<th>Knowledge of EHR or EMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comments about EHR or EMR</td>
</tr>
</tbody>
</table>

16) What training is provided for any new users of your system(s) and who provides it?

<table>
<thead>
<tr>
<th>Training Provided for New Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Details of training and provider</td>
</tr>
</tbody>
</table>
17) What formal adult education or other training have you had to help you with your role? Who provided this, was it adequate, what shortfalls have you found, etc.

18) Discuss membership of Professional Organisations? Benefits, etc.

19) Discuss the availability and intentions to pursue any further qualifications directly related to Imaging Informatics? Include conferences, on-line, vendor, etc. and what you think you need to improve your role and satisfaction.

20) What recognition should be given to Imaging Informatics Professionals (i.e. should it be recognised as a practicing discipline, is it IS, clinical, combined, etc.)?

21) Do you think any training in PACS, RIS or other aspects of Imaging Informatics should be provided at the undergraduate level to end users?
22) If you think formal courses should be made available what do you think should be included? Do you think it should be at a PGCert level or PGDip or Master’s level?

23) Do you have any relevant “life/work experiences to share that are relevant to this study?

24) Additional Questions.

25) Do you have anything you would like to add?