Counties Manukau District Health Board

Radiology Health Services Plan

February 2008

1.0 Current Services

The CMDHB Radiology Department has undergone significant changes since 2001, in terms of facility, equipment, service provision and workforce. The most important changes to have shaped the current Radiology provision at CMDHB are as follows:

- In early 2001 CMDHB introduced a Picture Archiving and Communication System (PACS) throughout the organisation. This revolutionised the distribution of radiological images and CMDHB was the first NZ hospital to adopt this technology. Mammography is the only imaging modality that does not produce digital images at CMDHB.
- A major review of Radiology Services in 2001 identified the service gaps and informed service development over the following years.
- The Radiology Department at MMH underwent major facilities redevelopment between the end of 2003 and mid-2005 during which the department was re-configured and the majority of equipment replaced. This new department has resulted in enhanced workflow with a consequent reduction in waiting lists and has served as an attraction to recruit and retain staff.
- An MRI service within the Radiology Department has been introduced in 2007. This has enhanced the scope of imaging services available on-site, and serves to attract and retain staff, particularly Radiologists and MRT's.
- A project to introduce a new Radiology Information System (RIS) is underway and is due for completion by mid-2008. This will provide an improved workflow for all Radiology staff and will introduce new technologies to the service including Voice Recognition and Electronic Ordering of examinations - to internal CMDHB referrers in the first instance.
- Breast Screening was introduced to CMDHB in mid-2005 and this impacted significantly on the number of Radiologists employed to work in Radiology. In the absence of being able to fill all newly funded positions, this resulted in the loss of some service provision within Radiology.
- The service is currently undertaking a job sizing with a likely consequence of the requirement to strengthen the Radiologist presence at CMDHB.
- Having RMOs on-site 24/7 was introduced in 2007 with a consequent improvement in out-of-hours imaging response times.

1.2 Current service provision

CMDHB Radiology currently provides an imaging service in the modalities of Plain Film, Special Procedures, Interventional, Mammography and, Ultrasound, MRI and CT scanning to the population of Counties Manukau District. The Radiology service is utilised by internal DHB referrers and external community referrers. A small amount of imaging is performed for research purposes and funded by CCRep.

Approximately 150,000 procedures were performed in 2006, a 0.6% increase from the previous year. However, the complexity of procedures performed increased by 2.6% (as measured by Radiology based Relative Value Units).

All referrals to Radiology are prioritised for urgency by Consultants or senior MRTs according to local guidelines. This ensures appropriate and efficient use of the available resource. It is also the task of the Radiology Department to ensure the safe and efficient use of radiation to minimise the public cumulative dose from medically derived sources and to limit it to that necessary for the appropriate diagnosis and treatment of patients.

As a guideline the following priorities are used:

Immediate – imaged within hours
P1 – urgent – imaged within 1-2 weeks
P2 – semi-urgent – imaged within 2-6 weeks
P3 – routine – imaged within 12 weeks

Current waiting times for procedures from receipt of referral to investigation occurring are as follows:

Current Wait Times (from receipt of referral to investigation)	
Modality / Procedure type	**Longest wait times - weeks**
CT	13
Mammography	0
Plain Film	3
Ultrasound	12
Angiography / Interventional	3
Barium Enema	3
Micturating Cysto-urethrogram	3
Intravenous Urogram	4
Hysterosalpingogram	4
Special Procedures various	5

Current budgeted FTE is 147 FTE split across the following groups:

- Medical Radiation Technologists (MRT's) 54
- Consultant Radiologists 22
- Clerical 16.41
- Registered Medical Officers 11
- Nurses 11.4
- Sonographers 10
- Patient Care Assistants 7.6
- Administrative/Managerial 4.5
- Student Sonographers and MRT's 10
- Transcription staff [1] 6

CMDHB Radiology is a training facility for up to 11 Radiology Registrars, up to 30 MRT students (across 3 years) and 3 Sonographer students.

The majority of work is performed between the hours of 8am and 5pm Monday to Friday with provision for acute work outside of these times by on-call arrangements. Radiology Registrars provide the general Radiology on-call requirement but SMO's provide first call for MRI and interventional modalities. Voluntary evening sessions are run on an as required basis to reduce waiting lists.

The Radiology Department at MMH includes a 14-bed waiting and post-procedure day stay area to support the interventional service. The CT and MRI suites share a 10-bed waiting and post-procedure day stay area.

The Radiology Department provides digital images to CMDHB via the GE Centricity PACS system. Radiology is also responsible for the maintenance and upgrade of the PACS, and in conjunction with the Health Alliance IS department, the storage facility for the images. The images are available to internal referrers via a web viewing module directly through Concerto or indirectly through Southnet.

Radiology provides a digitising service for patients with images from community providers on conventional film. The result of this process is the display of the image in a digital format. Radiology is also able to import images from various other DHB's or send images to them. Alternatively, images can be burnt to or loaded from a CD with this service available 24/7.

The Radiology Information System (RIS) is outdated, largely unsupported and planned for replacement in 2008/2009.

The table below provides a summary of the facility, equipment and service provided by CMDHB Radiology.

[1] Transcription staff work within the Radiology service but are managed by the Clinical Transcription Service

Modality	Equipment	Location	Hours of work	Service Provided
Plain Film (PF)	4 General Purpose x-ray units 1 General Purpose x-ray unit with tomographic capability	MMH	0800-1700 M-F	Mixture of scheduled community and ad-hoc in-patient examinations.
Plain Film (PF)	2 General Purpose x-ray units 1 Dental Orthopantomograph (OPG) 2 Trauma C-arm x-ray units	Emergency Care, MMH	24/7	Dedicated to EC patient examinations Ward patients examined in EC Radiology at weekends
Plain Film (PF)	9 General Purpose mobile x-ray units	MMH	24/7	Used to image in-patients who cannot be transported to the Radiology department for clinical reasons.
Plain Film (PF)	4 General Purpose x-ray units 1 General Purpose x-ray unit with tomographic capability	MSC	0800-1700 M-F	Predominantly out-patients with some Community patient examinations.
Special Procedures (SP)	5 Mobile fluoroscopic x-ray units 2 Mobile fluoroscopic x-ray units	MMH MSC	24/7 0800-1700 M-F	Used to provide 'live' images in theatre and CIU. On-call on MMH site.
Special Procedures (SP)	2 General Purpose fluoroscopic x-ray units	MMH	0800-1700 M-F	Perform Special Procedures such as Barium Enemas and Barium Swallows. Also used by Speech Language Therapy and Gastroscopy department to perform ERCP's. One of the units is used to perform minor interventional procedures.
Interventional (IR)	1 Dedicated C-arm fluoroscopic x-ray unit (room is theatre standard)	MMH	0800-1630 M-F	Mixture of out-patient, in-patient, community patient and EC patient procedures. Majority are vascular interventional but other interventional procedures are performed such as vertebroplasties, arthrography, and drainages.
			1630-0800 M-F 1630-0800 F-M	On-call for in-patients and EC patient examinations at MMH site.
Computed Tomography	1 16 slice scanner 1 single slice scanner (to be replaced	MMH	0800-1630 M-F	Mixture of out-patient, in-patient and EC patient examinations. Some community patient examinations are performed.

(CT)	2008)		0800-1630 Sat+ Sun, 1630-0800 M-Sun	On-call for in-patients and EC patient examinations at MMH site.
Magnetic Resonance Imaging (MRI)	1 1.5T scanner	MMH	0800-1700 M-F	Mixture of out-patient, in-patient and EC patient examinations. Some community patient examinations are performed.
			0800-1700 Sat+ Sun, 1700-0800 M-Sun	On-call for in-patients and EC patient examinations at MMH site
Ultrasound (US)	6 General Purpose US units 2 General Purpose US units	MMH MSC	0800-1630 M-F	Mixture of out-patient, in-patient, community patient and EC patient examinations
			1630-0800 M-Sun 1000-1500 Sat+ Sun	On-call for in-patients and EC patient examinations at MMH site
Mammography (Mamms)	2 Dedicated Mammographic x-ray units 1 Breast US unit	MSC	0800-1630 M-F	Mixture of out-patient and community patients examined. Includes breast interventional procedures and US scans.

The following table illustrates the procedures currently performed by the Radiology service and the issues raised by services around current provision i.e. the gap

Modality	Procedures performed	Issues raised by referrers
Plain Film (PF)	All types of diagnostic examinations	Radiology is working with the Orthopaedic service to introduce Prosthetic Templating. Emergency Care require a Radiologist report on all examinations within 1 hour.
Special Procedures (SP)	All types of diagnostic examinations including ERCP's for the Gastroscopy service and Video-fluoroscopy for the Speech Language Therapy service (SLT).	The SLT service require their images to be centrally stored and obtainable from multiple locations within CMDHB. More ERCP sessions are required or a dedicated facility established in Gastro.
	Radiology provides MRT's to staff the Medical service Catheter Laboratory and assists in the administration of the Cath Lab IT system.	
Interventional (IR)	All types of vascular interventional procedures.	Increasing demand from renal service for dialysis access work.

	All types of non-vascular interventional procedures.	The Orthopaedic service requires a more timely service for patients needing therapeutic pain relief and those needing biopsies of lesions i.e. within 1 week
Computed Tomography (CT)	All types of diagnostic examinations including Paediatric scanning under General Anaesthetic.	The Medicine service requires a more timely service for Oncology patients for initial diagnosis i.e. within 2 weeks. There may be a role in the future for CT coronary angiography. Given the surgical procedures performed at MSC access to an on-site CT scanner would be desirable.
Magnetic Resonance Imaging (MRI)	All types of diagnostic examinations including Paediatric scanning under General Anaesthetic.	Breast MRI capability would be preferable. The Medicine service requires Cardiac MR scanning capability (currently out sourced). Surgical services require on demand access to MRI at MSC site to improve the level of service offered to out-patients.
Ultrasound (US)	All types of diagnostic examinations.	Majority of vascular US imaging performed by Surgical service at Vascular Laboratory, Module 8, MSC. Radiology compliments this service.
	US guided biopsies and FNA's including weekly Prostate biopsies at MSC Radiology.	
	Radiology and Women's Health are introducing a combined service in 2008.	Increasing demand for obstetric scanning, linked to population growth and funding changes, requires an increase in the US service.
Mammography (Mamms)	All types of diagnostic examinations including Breast US scanning .	
	Stereotactic biopsies and Hookwire Localisations.	The Surgical service requires a more timely service for patients with breast lesions i.e. within 1 week.

2.0 Key Issues

2.1 Volume growth

Forecasting of future radiology activity is difficult because service demand is not directly attributable to population increase in the CMDHB catchment area. Many other factors complicate both the volume forecasts and service delivery in Radiology. These factors include:

- Prevalence of specific pathology and disease e.g. renal failure.
- Improvements in technology e.g. CT colonography may replace a proportion of Colonoscopies.
- Changes in MOH funding criteria changing referral patterns e.g. changes to Section 88 Maternity Act.
- Staffing e.g. different Consultant Specialities demand different types of examinations and procedures.
- Changes to clinical care pathways e.g. guidelines in the diagnosis and treatment of stroke.

Previous volume growth predictions have been based on extrapolating data on historical actuals (which averages out the peaks and troughs of Radiology staffing), combined with knowledge of the trends in the medical imaging field and discussion with specialist services regarding their requirements.

It is apparent that there is a change towards more complex imaging and more intervention by Radiology as a routine in the diagnosis and treatment of patient conditions. This is illustrated by the increases in Interventional Radiology (including Mammography Intervention), CT and MRI scanning. This affects the departmental resource levels and skill mix across the different health professional groups.

	2004	2005	2006	Av. Annual increase
Interventional	6.99%	8.19%	16.38%	10.5%
CT	20.3%	4.23%	1.62%	8.7%
MRI	12%	7.5%	15%	11.5%
Mammography	-9%	5.3%	26.3%	7.5%

These levels are significantly higher than the demographic growth for the same period.

Comparatively, Plain Film volumes have shown only a small increase per year with a reduction in Special Procedures e.g. Barium enemas and Micturating Cysto-Urethrograms. Ultrasound volumes have also increased on average 5.5% p.a. over the last 3 years.

The volume of work from Emergency Care has been steadily increasing particularly, in Plain Film and CT examinations. A significant proportion of this work occurs outside normal working hours and the Radiology service is faced with growing expectations as to the level of service offered during these hours. This will require re-modelling of the service offered by Radiology with consequent impacts on staffing resource requirements and terms of employment.

The Plain Film volumes at MSC result in Radiology working at above capacity levels many days. However, the main issue arises as a result of the patterns of referrals from the clinics which peak at mid-morning and mid-afternoon resulting in inconsistent waiting times. Greater numbers of clinics on certain days also leads to increased volumes of work on those days creating longer waiting times. Radiology has attempted to address this by increasing numbers of staff on busier days.

Until recently, there has been a lack of recognition by services of the flow-on effects on radiology services. Consequently, the Radiology Department has had to be reactive in its planning. Hence the service has been unable to meet the needs of its customers in the time-frames required. Improved communication by the services through management and clinical channels is required, particularly involvement in future service planning.

2.2 NSW Role Delineation model

It is apparent that through the assessment of surgical and medical services using this model the Radiology services at MMH are sufficient to meet current requirements but insufficient at MSC. According to this model the current gap exists because of lack of:

- A CT scanner
- 24hr on site Plain Film service (currently, on-call service provided)

However, the NSW model is more appropriately configured for the needs of a general hospital, not for the elective surgery/outpatient service provided at the Manukau Campus. The development of additional modalities at MSC would support the provision of more ambulatory services and support improved integration across the care continuum for many patients – particularly with the development of multidisciplinary clinics. In addition additional modalities would be available for scanning elective inpatients when required.

Should a Level 6 service be required at MSC, an MRI and an Interventional facility would be necessary plus the provision of 24hr on-site Plain Film and Ultrasound services. While MRI may be developed in the future, there is no plan for the Manukau Campus to have an intervention facility, nor any current indication that plain film or ultrasound services need to be available 24/7.

Introducing mirrored services on both sites creates significant resourcing issues with staff. With a worldwide shortage in Radiologists (particularly), Sonographers, and to a lesser extent, Medical Radiation Technologists (MRTs) devolvement of services to multiple sites increases the FTE requirements through increased travel between sites and the reduction in ability to 'share' staff in multiple areas in times of shortage.

2.3 Workforce trends and issues

Currently, there are worldwide shortages in Radiologists, Sonographers, and Radiology nurses. With the significant increase in training MRT's in recent years, MRT shortages are often localised rather than national or international.

Radiologists

With imaging becoming an increasingly integral part of the diagnosis and treatment of patient conditions the demand for Radiologists has outstripped supply, particularly in New Zealand. CMDHB is often competing with other DHB's and the Australian market for Radiologists. There is a desire to 'grow our own' Radiologists but newly qualified Consultants often want to travel overseas to gain experience and pay off student debt. However, NZ is able to attract overseas Consultants because of its reputation of a unique and relaxed 'lifestyle'.

To assist in 'growing our own' Radiologists it is important to invest in training through the introduction or continuance of fellowships, particularly in the areas of Mammography, Musculo-skeletal Radiology, Interventional Radiology and MRI.

Attracting overseas Radiologists is also possible by creating relationships with overseas hospitals. This can be in the form of providing sabbaticals to overseas Radiologists who will then 'sell' the CMDHB Radiology 'experience' to their colleagues.

The facilities and equipment of the CMDHB Radiology Service are at a par with many overseas departments. Continued investment in up-to-date equipment will continue to act as an attractant to potential Radiologists.

Staffing shortages often result in the loss of non-clinical time in preference to clinical activities. This works against providing an environment which stimulates education and research. It will be important to ensure that Radiologist FTE remains at a level which allows adequate time for educational activities as these activities will provide long term benefits to the DHB.

Sub-specialisation within the Radiology environment is creating difficulties in a number of ways:

- Inability of Radiologists to work across the Radiology continuum thereby reducing flexibility of the workforce
- Recruiting suitably experienced Radiologists

However, it also assists the DHB by providing enhanced collegial relationships with other services within multi-disciplinary teams (MDT's) with the result of an improved outcome for the patient.

Planning the Radiologist workforce requires notification of new services or new service expectations well in advance of the planned new work (e.g. 6-12 months) to allow time for recruitment.

Sonographers

Ultrasound scanning remains a rapidly evolving technology which is mobile and relatively cheap to purchase and set up. Scanning can be done by Radiology RMO's and SMO's which is learnt 'on the job' but is generally secondary to the initial scan by the Sonographer. Sonographers are required to obtain a Post Graduate Diploma specialising in Ultrasound scanning which takes 2 years to complete. CMDHB trains 2 new Sonographers a year.

There has been a major shortage of Sonographers nationally as ultrasound scanning has proliferated in the private market. Consequently, the salaries of Sonographers have shown large increases and the public health sector has struggled to keep pace with these rises. CMDHB must remain competitive in terms of remuneration but must also ensure that the environment created for Sonographers allows for personal and professional growth.

Overseas many Sonographers are credentialed to provide reports on the ultrasound scans they perform. However, in NZ this is very limited and many hospitals require the Sonographer scans to be checked by an SMO. In some private scanning facilities many sonographers already perform and report on scans that are not checked by a Radiologist. There is a growing desire by senior Sonographers in NZ to extend their skill base by reporting some types of examinations. An initial step would be to allow Sonographers (like RMOs) to issue unauthorised reports which are then checked by the SMO prior to release. This idea needs further exploration as it would free up critical SMO time and scanning room time. However, with the Sonographer labour market still tight this may be a double-edged sword. Similarly, this could have a detrimental effect on the training of Radiology Registrars in the art of ultrasound scanning.

The ultrasound service is currently working with Women's Health to implement a joint scanning service for Obstetric and Gynaecology patients. This initiative will provide a number of benefits to CMDHB patients and staff:

- A 'one-stop' shop for patients to receive diagnosis and treatment
- Reduced patient traffic around the hospital
- A collegial environment enhancing learning for Sonographers, students and doctors
- Increase through-put in ultrasound in the Radiology department by freeing up an Ultrasound room which can be utilised for other patients
- Mitigate the severe shortage of SHO's in Women's Health by relieving them of scanning duties

Student Sonographers regionally are finding it difficult to get enough practical training in the scanning of Obstetric patients (20 week anatomy scans) because Community Midwives generally send their patients to private facilities where the scan can be provided on demand with no cost (parking or fees) to the patient. Radiology has worked with some of these private providers in a collaborative way to allow student's access to Obstetric scanning, and in return, Radiology provides their students with scanning experience of other body parts.

Radiology nurses

Registered nurses can specialise in Radiology. No Radiology specific qualification is required but 'on the job' training takes approximately 12 months for a nurse to achieve competency in the Interventional setting.

Fully trained Radiology nurses are difficult to attract nationally but CMDHB Radiology has a Clinical Nurse Educator (CNE) to assist in training. The Radiology nurse does not perform 'typical' nursing tasks but is more akin to a theatre nurse. Radiology nurses are required to perform an on-call service and this discourages many nurses from working in Radiology positions.

Any changes to the model of Interventional work at CMDHB will require cognisance of the impact of such changes on the availability of Radiology nurses.

Medical Radiation Technologists (MRT's)

Recruitment of MRT's has been difficult in recent years but latterly the volume of MRT students has grown such that CMDHB Radiology can choose the best qualifying students. The desire to work at CMDHB has been assisted by creating a culture of learning and support which is particularly important with the Health Practitioners Competency Act requirements. It is important to note that the turnover of MRT's is quite high because it is a generally young workforce which aspires to overseas experiences a year or two after qualifying. Radiology has worked to ensure that the MRT's experience of CMDHB is such that they will want to return in the future.

The relatively high turnover of staff results in continued training of younger staff in the modalities, particularly CT, Interventional and the Catheter Laboratory (Cath Lab). The introduction of the Cath Lab into the MRT roster has ensured that the Cath Lab is 'protected' from staffing shortages and increased staff professional interest and experience thereby improving retention.

Recruitment of Mammography-trained MRT's is an issue. Mammographers are required to gain a post-graduate certificate if they are to practice as part of the BreastScreen Aotearoa programme (Breast Screen Counties Manukau) but this is not required to perform general mammography. Inclusion of the MRT in multi-disciplinary meetings is vital to enhance skills and retain interest.

Recruitment of MRI trained MRT's is also an issue. The MRT Board has dictated, through the HPCA Act, that MRI MRT's should have or be studying towards a post-graduate diploma in MRI scanning. Only a small proportion of the current workforce in NZ and overseas has obtained this, or an equivalent, qualification.

There is a shortage of experienced MRI MRT's in the public sector primarily because of the private sector dominance in this field of imaging. This means that remuneration rates are often higher in the private sector and CMDHB needs to remain flexible with its remuneration options. It must also maintain an environment where personal and professional growth can occur.

MRT's desire to extend their scope of practice and this has been achieved in a number of ways overseas:

- By performing IV cannulation and injection of contrast media
- By simple Plain Film reading
- By performing procedures such as Barium Enema's

Some of these actions cross the Radiologist's current skill boundary and the Royal ANZ College of Radiologists is against the introduction of such training for MRT's. It is important to consider the ramifications on Radiology Registrars should this scope extension occur but more flexible use of MRTs would free-up critical Radiologists time to undertake activities that cannot be undertaken by other groups of staff.

2.4 Technology trends and issues

Radiology relies heavily on technology to provide its imaging service. Recent years have seen a huge increase in the capabilities of software and hardware for modalities such as CT and Ultrasound and also in the PACS and RIS fields. This has meant more efficient workflows but also increases in the scope of imaging such that more complex imaging is often now the first diagnostic investigation in the treatment of patients. The introduction of software to imaging modalities has meant that continual investment in software revisions is required so that the systems remain supported by the suppliers. It has also, but to a lesser extent, opened imaging up to software virus attacks.

A description of the current and future technology for each modality is described below:

Plain Film

CMDHB Radiology currently images all its patients using Computed Radiography (CR) systems with the exceptions of the Interventional room which uses a Digital Radiography (DR) system and Mammography

which uses conventional hard copy film. CR does not provide the most efficient workflow although it is significantly better than the conventional film based process. DR is more efficient because it removes the need to handle image cassettes. However, DR technology is not advanced enough and cost effective enough to replace CR throughout the Radiology service. In 2-3 years time the technology is likely to have matured, be versatile enough to replace the current CR system and prove cost effective in the majority of the Plain Film service e.g. MSC Radiology. This will see an improvement in patient throughput per MRT, particularly at MSC and for community imaging.

Special Procedures and Interventional

These modalities use similar Image Intensification equipment but in different ways. The equipment has utilised advances in hardware and software to provide more compact, more powerful and more flexible systems with enhanced image production. With increasing use of Interventional procedures x-ray dose reduction is an issue, particularly to the staff who regularly use the equipment.

The use of image intensification for Special Procedures is reducing as other technologies such as CT Colonography (which are less invasive and less onerous for the patient) improve in ability to detect pathology. However, minor Interventional procedures are increasing so there will always be a need for this type of equipment.

As Interventional procedures get more complex the requirement for them to be performed in theatre or in a purpose built facility close by will increase. This has to be weighed up against decentralisation of Radiology staff and equipment and the costs associated with it.

CT scanning

CT scanners have rapidly evolved in the last 5 years with vendors concentrating efforts on reducing scanning times, reducing the ‘footprint’ of scanners and improving software applications such that most general image manipulations occur automatically with little manual intervention. The benefits of reduced scanning times have been largely offset by increased Radiologist read times as the numbers of images to be interpreted has increased. However, the sensitivity of the scans has improved such that lesions of 1mm can now be visualised.

Large slice CT scanners e.g. 64 slices, reduce scans times significantly and provide the ability to image the heart function such that diagnostic studies of heart physiology can now be made. This comes at a cost of increased image datasets and increasing patient x-ray dose. Consequently, any acquisitions of CT scanners should include a cost for image storage in the PACS.

CT scanners are also being linked to Nuclear Medicine technology via the Positron Emission Tomography (PET) CT scanner. This emerging technology provides high specificity of lesions but is largely a complimentary tool to other imaging technologies such as MRI scanning. The cost of a PET CT scanner is not greatly different to that of a large slice CT scanner. However, the high cost is associated with the production of the radio-isotope required to be used in PET which can only be supplied by a Linear Accelerator. The location of this to the PET CT scanner cannot be more than a few hours away since the half life of the radio-isotope is short.

This emerging technology is currently very expensive and has a relatively low through-put of patients. It is useful for Oncology patients and it would appear that there is a regional requirement, and a national imperative, for a scanner. CMDHB Radiology believes this should be sited at ADHB and be acquired through a collaborative DHB purchase. Each Auckland DHB could then share sessions dedicating each to their own patients. Further discussion at a regional level is required.

MRI scanning

Technology trends similar to CT scanners have occurred in MRI scanners such that shorter scan times and improved image manipulation are possible.

The magnetic strength of MRI scanners has increased to the extent that up to 7Tesla (T) Scanners are being trialled. However, the most cost effective magnetic strength remains at 1.5T currently with 3T scanners becoming more common place for high end use e.g. research. As the effects of higher magnetic strengths are increasingly understood 3T scanners will become more dominant in the conventional market place.

Since MRI scanners do not use x-rays they are able to be used in small clinics and low field MRI scanners for limb imaging are now available. This is predominantly attractive to the private market place.

MRI scanning of the breast is a growing area with special scanner equipment available which allows interventional procedures to be performed. As the requirement for this grows investment in this technology will need to be considered.

Ultrasound scanning

Improvements in US scanner hardware and software has provided the opportunity to visualise increasing detail from a scan and permitted a growing range of applications to become available such that the scope of US scanning has increased. The automated functionality and compact size of scanners has also caused a proliferation in their use and availability. Significant cost is still associated with high end US units used in Radiology but lower cost units are also available for clinic or theatre room use which allow e.g. location of blood vessels for placement of therapeutic catheters.

Proliferation of US units outside of Radiology presents CMDHB with issues which require consideration prior to the acquisition and use of these units. These considerations include:

- Credentialing of clinicians in interpretation of images
- Training and support requirements
- Image availability after the scan
- Image storage and administration costs

Mammography

CMDHB Radiology and BSCM operate a service which utilises the same equipment at the MSC site. This equipment consists of conventional film based (analogue) mammography units and medium range US scanners. Digital mammography has been available for a number of years but the investment required is relatively high. This is mainly due to the high cost of digital plates (The large size digital plates required for the South Auckland population have only recently become freely available) but also because the digital mammograms are required to be displayed using software which is specialised to Mammography reading and review. This is performed in a different manner to that of Plain Film x-ray images.

Digital attachments for interventional breast use are available to be used on analogue units. These provide an opportunity for an enhanced and more efficient service without the requirement to invest fully in digital units.

PACS & RIS

CMDHB Radiology is a fully digital department with the exception of Mammography where the images are acquired in the conventional fashion of processed film. Significant investment into the Picture Archive and Communication System (PACS) has resulted in an up-to-date image management and distribution system allowing viewing of CMDHB images at any PC in the hospital setting with a minimal image retrieval time. Continued investment is required to ensure that the software and hardware remain at a supported level and advantage is taken of new features.

Improvements in hardware and system management applications have allowed the expansion of fast and relatively cheap media to be used to store these images. Growth of this image storage is likely to increase as more cross sectional imaging modalities are acquired.

Enhancements in network connectivity and speeds allow the Radiology service to send and receive images from a number of other New Zealand DHB's. Connectivity with the private sector is also possible and this will enhance the ability of CMDHB to utilise the private sector services in the future, if required.

The Radiology Information System (RIS) is out-dated resulting in inefficient work practices and creating a level of clinical risk. A PACS integrated RIS is to be implemented in 2008 and will offer the advantages to be gained from electronic referrals and voice recognition software.

The introduction of electronic referring for internal referrers allow users to track the progress of their patient's through the Radiology process and will avoid the clinical risks associated with the loss of paper referral forms.

Electronic referring also affords the opportunity for Radiologists to report studies remotely. This could assist in better utilisation of staff in some situations. For example, a Radiologist on maternity leave may be able to undertake work more flexibly from home.

It is envisaged long-term that electronic referring to Radiology can be offered to community referrers. However, this is dependant on secure access and the GP practices investing in up-to-date technology.

2.5 Primary Care / Community Radiology

Surveys of community referrers highlight the need for these referrers to have direct referral access to all imaging modalities. Currently this is only provided to Plain Film and Ultrasound services. Access to CT and MRI is provided in three ways:

- Via referral and assessment by a CMDHB specialist (e.g. physician/surgeon). This is largely because the patient is likely to require CMDHB Specialist follow-up after the scan and so is already scheduled for this follow-up. It also serves as a mechanism to ensure appropriate use of expensive investigations.
- For patients who are long term follow-up/surveillance but have been otherwise discharged to the community.
- If a Radiologist has suggested a CT or MRI scan as the result of findings from another Radiological examination.

The Radiology Department does not believe that the clinical decision making of all the community referrers is often robust enough to ensure appropriate referring, based on previous experience. However, this issue could be addressed by limiting access to patients meeting specific 'referring rules'. Before this can be considered referrers requiring access to CT or MRI may benefit from further education in the use of diagnostic imaging.

This may be achieved by offering referrers a 'preferred referrer' status from Radiology after the referrer has, for example, spent several days in the CT department alongside a Radiologist, been educated regarding radiation protection guidelines and educated in the advantages versus the disadvantages of CT against other modalities. This could result in increased volumes of requested scans putting the service under further pressure.

Conversely, it may also have some benefits; it may free up some CMDHB Consultant clinic time if patients could be directly referred, reduce the profligate community referrer and improve the community referrer Radiology relationship. Further consultation with the Primary sector is required to ensure an appropriate educational model is developed

The vision of Primary Community Health Centres (PCHC) introduces the concept of providing a co-located plain x-ray and ultrasound service within the Community. This is currently supplied by the private sector but at facilities not necessarily near the PCHC. The imaging facilities within the PCHC could be provided by CMDHB Radiology service or a private provider. Whichever model is preferred there are a number of requirements that need to be mandatory:

- All images are directly acquired in a digital format and available on demand to CMDHB Radiology in the event that the patient presents to CMDHB and previous imaging records are required. This is essential to reduce the need to duplicate tests and hence promote cost-effectiveness.
- All examination results are available to CMDHB in an electronic format which links directly with CMDHB results repositories or CMDHB Radiology RIS. As above, this is also essential to reduce the need to duplicate tests (and hence promote cost-effectiveness), to support clinical decision making for patients subsequently referred to hospital, and to enable the efficient reporting by DHB radiologists.
- All referrals are reviewed by CMDHB Radiology to ensure the appropriateness of the request and the optimum use of the imaging resource. This is essential to avoid poorly-indicated investigations that both increase costs to the health system and unnecessarily expose patients to risk.

With the current shortages of Radiology trained staff the availability of appropriate personnel to resource these PCHC imaging facilities may be problematic in the short term. The centralised hospital based service provides the most efficient utilisation of staff and equipment but conflict in the management of community/out-patient and in-patient work creates delays in the examination and treatment of hospital based patients. This issue would largely be addressed by increasing the imaging facilities at MSC such that CT and MRI are also offered and there is an increase in the number of US rooms. This would allow community/out-patient examinations to be performed away from the acute MMH setting whilst still providing the opportunity to best utilise the available staff i.e. in two main centres rather than one main centre and multiple peripheral centres.

A further possibility is that Private Providers could provide the Radiology services at MSC. This may reduce the capital and operational investment that CMDHB requires. However, evidence from other NZ Radiology departments where public/private partnerships exist within the hospital setting suggest that this creates significant operational issues, mainly related to staff employment. A number of hospitals in NZ are moving away, or wish to, from this model to a fully publicly funded and operated Radiology department.

In order to work out how best to improve access for Community Radiology further work is required to be done to identify the level of unmet needs, consider the impact of the future volume growth, and consider the future models for the delivery of Community Radiology services.

Use of Private Radiology Providers for CMDHB patients

Provision of Radiology services in NZ is freely split between public and private providers. Some CMDHB services utilise private providers to provide services which Radiology cannot provide. This is mainly limited to CCRep for research purposes, to MRI scanning and to the use of Primary Options in Acute Care (POAC) but Mercy Radiology also support clinics held at Botany SuperClinic (BSC). Use of private providers raises a number of issues for the Radiology service and for other CMDHB services:

- By supporting private providers it could be argued that this ‘encourages’ staff to find employment at these practices (rather than in the public system) i.e. the more work these centres get, the more staff they require and the greater the remuneration they can offer.
- Many of these providers cannot provide digital images or electronic results for patient attendance at CMDHB resulting in either repeat examinations at CMDHB or increased administrative overheads.

2.6 Regional Considerations

The push to regional services between the three Auckland DHB’s impacts on Radiology in the following ways:

- Procurement of equipment – there is a potential to save significant capital costs in the procurement of like equipment across the region. However, historically, each DHB has purchased the equipment which fits its own requirements best. There is a danger, because of the relatively small size of the NZ medical market place, that purchasing from a sole supplier could cause long term increases in costs by the loss of suppliers, and thus competition, from the market.

- Standard operating platforms – standardisation of applications is desirable to reduce the re-learning required by doctors who work at all the DHB’s (generally RMO’s). However, the impact on Radiology staff is very low as the majority work in CMDHB only.
- Inter-District Flows – the return of tertiary services to each DHB has provided both increases and decreases in work load. It is important that Radiology is kept abreast of the services being returned so that it can adequately resource or understand the effects of the new service.
- Staffing – very few staff work across the DHB’s but there may be options to utilise staff more flexibly in some circumstances. For example, a Radiologist at ADHB could read a Plain Film examination from CMDHB.
- PET CT scanning - this emerging technology is currently very expensive and has a relatively low through-put of patients. It is useful for Oncology patients and it would appear that there is a regional requirement, and a national imperative, for a scanner. This would be best sited at ADHB and acquired through a collaborative DHB purchase. Each Auckland DHB could then share sessions dedicating each to their own patients. Further discussion at a regional level is required.

- Nuclear Medicine scanning – ADHB currently provide this service for CMDHB and WDHB. This service scans on average 50 patients per month from CMDHB. It would not be feasible, with current volumes of referrals, for CMDHB to provide a cost effective Nuclear Medicine service.

2.7 Funding

ACC

Current ACC rules prevent Radiology from gaining revenue from ACC for first presentations of trauma or for 7 days after this time but can claim costs from ACC for clinic follow-up appointments and any related imaging. Radiology receives revenue from ACC from two sources; Plain Film work and a High-Tech Imaging contract. The latter covers a range of examinations and procedures related to MRI and CT scanning, Ultrasound scanning and some Interventional and Special procedures. This revenue is currently captured by the CMDHB ACC Elective team on behalf of Radiology. The process is manual but with the introduction of a new RIS, which will provide better patient information, this process will improve and increased revenue is anticipated.

The High-Tech Imaging contract stipulates imaging within 10 days of referral and these referrals often compete with more acute referrals. Development of an out-patient/community focussed Radiology facility at MSC would resolve these conflicts.

Community Referred Radiology Contract

This provides publicly-funded radiology services following referral from GP's and private specialists. The specification is determined by the MOH. CMDHB Provider Arm receives $1,381,380 for community radiology (through PBFF) but the Radiology service provided imaging equivalent to $2,434,717. The Radiology Department does not receive this directly as revenue but it should be used to provide impetus to develop Community Radiology services in the future.

2.8 Equipment

Forecast requirements for equipment and facilities required over the next 20 years have been developed

Radiology	2007	2011	2015	2020	2025
Angio/Interventional (MMH)	1	1	2	2	2
Angio/Interventional (MSC)	0	0	0	0	1
CT MMH	2	2	2	3	3
CT MSC	0	1 (2008)	2	2	3
Nuclear Medicine Lab	0	0	1	1	1
Special Procedures (MMH)	2	2	2	2	2
Special Procedures (MSC)	0	1	1	2	2
Ultra Sound MMH	6	6	7	8	9
Ultra Sound MSC	2	5	6	7	8
MRI (MMH)	1	1	1	2	2
MRI (MSC)	0	1	1	1	2

Plain Film (MMH)	6	6	7	7	7
Plain Film (MSC)	5	6	6	7	7
Mammography	2	3	3	4	4

The years are indicative and a number of assumptions have been applied. These are:

- That MMH remains the acute site and MSC remains an out-patient/elective facility.
- That the volumes of work used to predict the equipment requirements are based on providing the same services into the future with similar models of care.
- That growth in more complex imaging continues.
- That staffing will be sufficient to utilise these facilities.
- That Mammography does not include Breast Screening Counties Manukau facility and equipment.
- That Ultrasound does not include the US service offered by Surgical Vascular Laboratory, Echocardiography or Women's Health.

This table should be viewed as a living document and reviewed on an annual basis.

3.0 Key Directions

✓ *The MMH Radiology department will be re-sited in 2013 to a newly created clinical services block.*

✓ *Developments of additional capacity at Manukau to meet the growing demands of ambulatory care, new services on that site (e.g. rehabilitation) and the increases in elective surgery.*

✓ *Mammography is likely to move into a purpose-built facility within the next 5 years which would combine surgical breast services, Breast Screening Counties Manukau, and the Mammography service CMDHB Radiology provides. This will be at Manukau and may become a dedicated service physically separated from the Radiology Department. This new facility would provide the opportunity to convert the entire Mammography and Breast Screening service to Digital Mammography equipment. In the interim, investment in digital interventional mammography attachments should be made to promote efficient work practice.*

✓ *A 3rd CT scanner should be acquired and placed at Manukau to provide separation of acute and elective CT scanning. This would enhance the service provided to Middlemore Hospital referrers.*

✓ *Investigate the requirement for a 24hr Plain Film service at Manukau.*

✓ *Ensure re-investment in new equipment continues to ensure the best imaging is provided to the patient and referrer.*

✓ *Investigate a 3T MRI scanner as the next MRI acquisition.*

✓ *Promote a regional PET CT service.*

✓ *Promote access to CMDHB Radiology PACS by community providers.*

✓ *Introduce electronic Radiology orders to CMDHB clinical staff and investigate its introduction to community referrers.*

✓ *Continue existing Radiologist fellowships and introduce others to assist recruitment.*

✓ *Promote sabbaticals with overseas hospitals amongst all staff groups.*

✓ *Promote and maintain educational activities within Radiology.*

- ✓ *Encourage and support role extension amongst MRT's and Sonographers ensuring buy-in from the Radiologist team.*
- ✓ *Promote services integration and support Multi-disciplinary teams. This will improve patient care, enhance staff learning and assist in retention.*
- ✓ *Investigate decentralisation of services and the impacts on the Radiology workforce.*
- ✓ *Promote a longer working day in order to fully utilise the investment in equipment e.g. ten to twelve hour days are routinely worked in Europe on MRI scanners.*
- ✓ *Investigate the impact of weekends in the 'routine' working week since the volume of work at weekends is growing and the requirements for lower acuity work to be performed is increasing to ensure the patient is discharged from hospital as soon as possible. The need for a routine seven-day week for Radiology is growing.*
- ✓ *Investigate the feasibility of home based reporting for Radiologists to provide greater flexibility of work practice.*
- ✓ *Investigate the feasibility of cross DHB utilisation of Radiology staff to assist when staffing numbers are low.*
- ✓ *Develop GP educational model for imaging in conjunction with the introduction to PHO's of a 'preferred referrer' status to allow access to CT and MRI services. This will reduce FSA's whilst ensuring that imaging is appropriately utilised.*
- ✓ *Investigate further all options for the provision of Community Radiology.*
- ✓ *Develop contract with Mercy Radiology to improve quality of service provided to CMDHB at Botany SuperClinic.*
- ✓ *Encourage private providers to invest in digital imaging equipment through the contractual process.*
- ✓ *Ensure Radiology involvement in organisational service planning.*
- ✓ *Ensure robust claiming methods are used for optimising ACC revenue.*