Review of HSC Imaging Services

Interventional Radiology

January 2016

INTRODUCTION

SECTION 1: "WHERE WE ARE NOW": - AN ASSESSMENT OF INTERVENTIONAL RADIOLOGY SERVICES IN NI

SECTION 2: "WHERE WE WOULD LIKE TO BE AND HOW TO GET THERE" - AN OPTIMINAL INTERVENTIONAL RADIOLOGY SERVICE

INTRODUCTION

Medical imaging services in Northern Ireland

1.1 Medical imaging is an integral part of modern healthcare. It can be described as the production of images of the internal structure of the human body that enables the diagnosis and staging of disease and monitoring of the effectiveness of treatment. It therefore plays an increasingly vital role in the diagnosis and screening for virtually all major illnesses and contributes to the planning of treatment for patients of all ages.

1.2 Imaging is primarily carried out in radiology departments in hospitals which deliver a range of services, including imaging used purely for diagnostic purposes through to interventional radiology. Imaging services are also provided in other clinical settings such as cardiology and obstetrics.

1.3 Medical imaging is a clinical service which requires the expertise of imaging clinicians, either medically trained radiologists or specialist trained radiographers (or in most cases both) who are increasingly making decisions about the management of patient care.

1.4 **Interventional radiology** (IR) involves the use of minimally invasive image-guided procedures to diagnose and treat diseases in nearly every organ system.

1.5 Interventional radiologists are specifically trained radiologists who have pioneered the minimally invasive use of X-rays, CT, ultrasound, MRI, and other imaging modalities to obtain images which are then used to direct interventional instruments throughout the body. These procedures are usually performed using needles and narrow tubes called catheters rather than by making large incisions into the body as in traditional surgery.

1.6 These innovative, evolving and often complex techniques have revolutionised patient care in a wide range of diseases and produced major improvements in safe, patient focused care. Because of these advances many conditions that once required surgery can now be treated non-surgically by interventional radiologists. By minimizing the physical trauma to the patient, peripheral interventions can reduce infection rates and recovery time, as well as shorten hospital stays.

1.7 Interventional radiology is increasingly recognized as a vital component of hospital medicine, providing lifesaving care both in and out of hours. It became a separate subspecialty of Radiology in 2010.

Context and background of review

1.8 In December 2013 the Minister for Health, Social Services and Public Safety approved the establishment of a review of imaging services in Northern Ireland. The aim of review is to develop recommendations for service development and configuration which will form the basis of a 10-year strategy for imaging services in Northern Ireland.

1.9 In doing so the review will consider the full spectrum of imaging services provided by Health and Social Care, including radiological, obstetric, cardiology and paediatric imaging and has established workstreams to take forward the substantive work in each of the core areas.

1.10 Terms of reference for the review were formally adopted following the establishment of a project board of the imaging review and were subsequently approved by the Minister in April 2014.

Methodology

1.11 The project board has asked that each workstream produce papers according to a 4 phase approach. This aims to ensure consistency across each of the workstreams in its assessment of:

- **Current service**: *where we are* – analysis of the current service organisation and configuration, demand/capacity and other key service issues;
- **Optimal service**: *where we would like to be* – vision of what an optimised service would look like, including taking account of regional approach, professional role expansion etc.
- **Gap analysis:** *what we need to get us there*.
- **Future planning:** future proofing and strategic planning.

1.12 In fulfillment of that requirement this paper, which has been prepared by the interventional radiology workstream, is set into 3 sections which align with the key phases of the review.

1.13 Section 1 sets out an overview of the IR specialty and the scope of service provision across acute sites, including workforce, in NI. In section 2 the core service developments and investments required to support a quality service are discussed and a recommendation for a revised delivery model capable of delivering a safe, effective and patient centered service is made. In section 3 some emerging and potential new opportunities and challenges specific to IR are discussed and their impact considered.

1.14 This paper is underpinned by evidence drawn from a series of data collection and information analysis processes, including the dissemination of questionnaires to clinical experts across interventional radiology services. This engagement has been augmented by semi-structured interviews led by the Chair with key clinical colleagues and a regional conference with specialist IR practitioners. Where appropriate this has also been supplemented by demand, demography and activity trend information. These data, together with the range of clinical engagement, have driven the findings and recommendations of this report.

1.15 The key task for the workstream therefore has been to identify the important thematic issues facing interventional radiology services and to describe a strategic vision which will ensure that these services are safe, sustainable and effective in the long term.

1.16 The workstream has also, where appropriate, set out steps to address issues which would warrant immediate or urgent action by the Department or Commissioners.

1.17 The membership, terms of reference and other important supporting material are provided as annexes to this document.

SECTION 1: "WHERE WE ARE NOW": - AN ASSESSMENT OF INTERVENTIONAL RADIOLOGY SERVICES IN NI

Interventional Radiology – the specialty

2.1 The delivery of an interventional radiology service requires an extended team of expert healthcare professionals including consultants, nurses, radiographers and health care assistants. Effective team working with shared responsibilities is essential if the team is to deliver coordinated care with task inter-dependency and the best patient outcomes. The referring clinical teams and supporting anaesthetic services form the other axis of this team structure. Extensive clerical/administrative support is also required to facilitate the organisation of what are often complex processes.

2.2 IR procedures occur in both in-patient and day-case settings. Referrals are received from a wide variety of secondary care specialties with primary care interaction coming mainly in the form of follow-up and occasionally in long term tube or catheter management.

2.3 IR procedures often replace open surgical procedures as they are less invasive, reducing morbidity and mortality and allowing more rapid patient recovery and hospital discharge. Over 90% of procedures are undertaken through incisions less than 5mm and most procedures are performed under local anaesthesia, often allowing discharge from hospital the same day.

2.4 IR has expanded to play a vital role in both elective and emergency treatment. The examples included below are by no means exhaustive but illustrate the breadth of treatments available:

- **Vascular disease** – interventional radiologists are integral to the provision of endovascular aneurysm repair, angioplasty and stenting for the treatment of peripheral and aortic vascular disease. This has evolved to include both elective and emergency treatments.

- Currently excellent co-operation exists between vascular surgery and interventional radiology. The two services work closely together both in terms of regional Multi-disciplinary Team meetings and in undertaking joint cases. There is reciprocal training of trainees in aortic stenting. The evolution of the practice of vascular interventions will undoubtedly involve some areas of overlap. Both specialties are committed to ensuring that this evolves in a safe manner to ensure patients receive the highest quality of treatment possible. Issues have arisen in other jurisdictions due to a lack of discussion and planning. This should not be allowed to happen in Northern Ireland.

- **Haemorrhage control** – IR allows rapid control of haemorrhage by embolisation or stent grafting without the morbidity of an open surgical procedure. IR now plays a vital role in trauma and Gastro-Intestinal (GI) bleeding pathways. IR plays a role in the management of post-partum haemorrhage but this has been limited due to the current geographical location of maternity units in Northern Ireland.

- The establishment of level 1 trauma care in Northern Ireland requires 24/7 IR for haemorrhage control

- GI bleeding management requires 24/7 IR availability

- **Renal dialysis support** – now a major component of many IR units including complex venous access, fistuloplasty and fistula thrombectomy.

- **Interventional oncology** – ablative procedures such as radiofrequency ablation, cryotherapy, microwave ablation, high-intensity focused ultrasound and trans-arterial chemoembolisation provide minimally invasive targeted treatment options for patients with solid tumours. In addition, treatment of obstructive lesions in multiple organ systems including vascular, urological, hepato-biliary and GI systems can provide invaluable palliation for patients with advanced disease.

GI and hepatobiliary disease – palliation of obstruction due to tumors at many sites, including bowel and biliary tree, as well as direct access to the gut to provide nutrition as an alternative to parenteral nutrition.

- **Uro-intervention** – acute and chronic treatment of ureteric obstruction from stone disease and tumours to prevent renal damage.

Other conditions – with the established benefits of minimally invasive techniques in providing safe and effective care for patients there is an increasing usage of IR. These techniques are also being used to provide treatment of failing transplants (liver, pancreas and kidney), acute and chronic bowel ischaemia, vascular disease of the kidney and vascular malformations.

Emergency nephrostomy is exclusively provided by the IR service and as such the lack of a dedicated 24/7 rota is a major regional deficiency.

- **Interventional neuroradiology (INR)** is a separate but rapidly advancing and expanding field. It has revolutionized the treatment of intracranial aneurysms. It has provided treatment options for intracranial and spinal vascular malformations. INR has recently expanded to provide specialist intervention in the management of acute stroke. INR will continue to be practiced in specialist tertiary referral units due to its highly specialized nature.

Interventional neuroradiologists are specifically trained to provide these interventions and form a sub- group in terms of the RCR IR curriculum.

Interventional Radiology – service configuration

2.5 IR procedures are currently provided in 5 acute hospitals across all HSC Trusts with the exception of the Northern HSC Trust. The range of services available at each of these Trust sites is set out in tabular form in **Appendix 3**. However the general scope of available interventions is as follows:

Royal Victoria Hospital (RVH)

2.6 RVH provides vascular, haemorrhage control, oncological, hepatobiliary, gastrointestinal and vascular access. It also provides treatment of acute and chronic bowel ischaemia, thrombolysis both venous and arterial and emergency urological interventions.

2.7 The RVH also provides inpatient vascular interventions including complex and specialist interventions such as aortic stent grafting in conjunction with the vascular surgical team. Within this organisation further sub-specialisation is provided to perform fenestrated stent graft, flexible/complex stent graft insertions, carortid stent procedures (in conjunction with INR), endocrine interventions, oncological interventions and highly complex in-patient arterial recanalisations.

Belfast City Hospital (BCH)

2.8 BCH provides in-patient renal dialysis, uro-intervention, haemorrhage control, hepatobiliary, gastro-intestinal and oncological intervention services. It also provides day case vascular surgical interventions to a highly complex level (but excluding aortic stent services).

Altnagelvin Area Hospital (AAH)

2.9 AAH provides in-patient uro-intervention, hepatobiliary, vascular access, renal dialysis and some non-arterial vascular intervention.

Craigavon Area Hospital (CAH)

2.10 CAH provides in-patient and day case vascular interventions, renal dialysis, hepatobiliary, access and urological interventions. The majority of procedures are provided. Specific complex interventions are referred to Belfast. Aortic stent insertion is not currently routinely available.

Ulster Hospital, Dundonald (UHD)

2.11 UHD offers uro-intervention, renal dialysis, vascular access, hepatobiliary and limited vascular intervention. Limited haemorrhage control services also available.

Interventional Radiology – Workforce

2.12 Interventional radiologists are radiologists who have undergone additional specialist training in the practical elements of interventional radiology.

2.13 Most interventional radiologists undertake diagnostic work in addition to IR duties. This is the case with all IR consultants in Northern Ireland. The majority of IR consultants in full time posts in Northern Ireland provide 3 sessions per week in the IR suites

2.14 Diagnostic radiology remains a vital core element of interventional radiology. However, IR practice is significantly different than diagnostic radiology, requiring additional clinical responsibilities for pre-intervention assessment, consent and follow-up.

2.15 Most interventional radiologists work as part of a team of colleagues to provide a service to a hospital or number of hospital units. Working within both District General Hospitals and teaching hospitals they play a vital role in the support of a range of services across the hospital, including acute medical, obstetric and surgical specialties.

2.16 24/7 availability of IR services is a requirement for major centres specifically those with trauma centers, vascular centres and emergency surgical units. A minimum on-call rota of 1 in 8 is necessary to service a population of 1,000,000 people; a more rigorously manned rota may be required if full day time cover is to be maintained. This has been agreed in the job plans of the six interventional radiologists in post in NI.

2.17 Interventional Neuroradiology (INR) is a requirement for neurosurgical centers. If utilised in acute stroke INR will potential necessitate 24/7 cover with the resultant manpower requirements in all areas of this team. The current staffing complement across interventional and neuro-interventional radiology (as of August 2015) is set out below:

Interventional Radiologist Staffing Profile – Table 1

(Dedicated trained staff recommend by BSIR/RCR review)

Trust	**Funded Complement**		**Vacancies**	**Notes**
	FT	PT		
Belfast	6/8	0	1	1 staff currently on fellowship
Western	0	1	1	
Southern	0	1	0	
South Eastern	0	1	0	
Northern	0	0	0	

Interventional Nursing Staffing Profile – Table 2

(IR trained specific nursing team recommended by RCR/BSIR review)

Trust	**Funded Complement**	**Vacancies**
Belfast	RVH IR - Nurses 6.7 WTE; HCSW 1WTE RVH INR – Nurses 4.7 WTE RVH CT/day-ward/MR anaesthesia – from room compliment BCH – 6.2 ; HCSW 2	RVH 2.3 absent
Western	Departmental nurses available	
Southern	Departmental nurses available	
South Eastern	Departmental nurses available	
Northern	N/A	

Interventional Clerical Staffing Profile – Table 3

(Specific dedicated secretarial support)

Trust	FT	PT	Vacancies
Belfast	0	1 RVH	
Western	0	0	
Southern	0	0	
South Eastern	0	0	
Northern	n/a	n/a	

Out of Hours – Current Staffing Arrangements – Table 4

Trust	Radiology	Radiography	IR Nursing
Belfast	Ad-hoc	Dedicated cross site rota (from Aug 2014)	Dedicated cross site rota (from Aug 2014)
Western	None	None	None
Southern	None	None	None
South Eastern	None	None	None
Northern	None	None	None

Interventional Neuroradiology (INR)

2.18 INR is a highly specialised discipline dealing with vascular diseases of the central nervous system. Conditions in the past that would have required surgical intervention such as aneurysms, vascular malformations, and tumors of the brain, spine, head and neck can be considered suitable for treatment by using an endovascular approach to reach the lesion. Interventional techniques such as thrombolysis are also useful in the management of patients with acute ischaemic stroke. These endovascular procedures can allow treatment of previously untreatable or difficult lesions.

2.19 The INR service is provided regionally, based at the RVH site and staffed by 5 interventional neuroradiologists. They are supported by a team of radiographers trained in the biplane angiographic suite. A sub-

set of the IR nursing team at the RVH provides specialist INR nursing support. Lists run from Monday to Friday 9am-5pm

2.20 Anaesthetic cover is provided for 5 sessions; with the emergency anaesthetic team utilising block A theatres also. Extensive INR specific consumables are available with referrals mainly via neurosurgery and neurosciences. The most common intervention includes intracranial aneurysm treatment and the recent evolution of acute stroke management has increased emergency workload dramatically. There are currently no services outside RVH, or out of hours. The number of procedures performed last year are set out below:

Interventional Neuroradiology Procedures 2014/2015 – Table 5

Procedures	Angio	Aneurysm Coiling/Stent	AVM treatment	Clot retrieval/lysis	Lumbar puncture
	270	200	25	40	14

Image guided interventions within general radiology service

2.21 A number of image guided therapeutic techniques, including for example drainage of fluid collections, tissue biopsies are undertaken by general radiologists throughout HSC Trusts, with specialist input from interventional radiology. These include (set out by Trust):

Belfast HSC Trust

2.22 In both the BCH and RVH ultrasound and CT guided biopsy/drainage is provided by general radiologists with specific interest and training, supported by IR when required for complex cases. Similar arrangements are in place in the Mater Hospital excepting complex/challenging cases which are referred to IR in the RVH/BCH. In Musgrave Park Hospital specific musculoskeletal (MSK) interventions are undertaken by specialist radiologists.

Western HSC Trust

2.23 In both Altnagelvin and South West Acute Hospitals ultrasound and CT guided biopsy/drainage is provided by clinical radiologists with specific interest and training; complex/challenging cases are referred to IR services in RVH/BCH.

Northern HSC Trust

2.24 Ultrasound and CT guided biopsy/drainage is provided by general radiologists with specific interest and training; complex/challenging cases are referred to IR RVH/BCH. These services are provided at Antrim Area Hospital with a more limited service at Coleraine/Mid Ulster/Whiteabbey.

Southern HSC Trust

2.25 In Craigavon Area Hospital ultrasound and CT guided biopsy/drainage is provided by general radiologists with specific interest and training; with complex/challenging cases being referred to IR RVH/BCH. There are more limited services available at Daisy Hill Hospital.

South Eastern HSC Trust

2.26 In Ulster Hospital ultrasound and CT guided biopsy/drainage are provided by general radiologists with specific interest and training; complex/challenging cases are referred to IR RVH/BCH.

2.27 At all units these procedures form part of routine weekly CT, fluoroscopy and ultrasound lists. They represent a large number of procedures, for example Southern HSC Trust performs 140 CT guided interventions and 1300 ultrasound guided interventions per year including ultrasound guided biopsy, aspiration and injections.

Waiting times

Elective procedures

2.28 It has been difficult for the workstream to acquire accurate data on the

precise waiting times for elective IR procedures. This is partly due to the complex pathways of referral, pre-assessment and booking involved through the process. However our estimates would indicate that for vascular interventions in Belfast, waiting times for day cases in BCH are approximately 2-3 months; and for day of surgery in RVH approximately 2-3 months.

In-patient procedures

2.29 There is a similar dearth of data in relation to inpatient waiting times however our estimates are that in-patient waits are 0-14 days in the RVH with longer waits representing less urgent cases from other hospitals, often repeatedly delayed due to lack of beds for transfer and displacement by emergency cases in RVH.

2.30 Further work with HSC Trusts and Commissioners will be needed to better understand the waiting times position.

Specialty training

2.31 As described earlier in this document IR is a recognized sub-specialty of clinical radiology. As such training is provided through the radiology training committee in the School of Diagnostics at NIMDTA – training is accredited by the RCR to Specialty Trainee year 6 (ST6) and award of Certificates of Completion of Training in Interventional Radiology. The first trainee to undertake this training commenced ST4 in August 2015

2.32 Similar to other medical specialties, recruitment to the IR specialty is through a competitive application process, using nationally agreed criteria.

2.33 Attrition rates in NI for IR are low. Since 1996 14 radiologists have received IR training whilst gaining a general radiology CCT – 10 remain working in Northern Ireland (2 on fellowships at present; 1 with limited IR commitment).

2.34 There is provision for a maximum of 4 ST4-6 trainees in IR. There is no distinct funding stream for IR training and as such additional training capacity would need to be met from within the current complement of 39 national training numbers available.

Equipment – provision and replacement

2.35 The two main IR centres based at the Royal Victoria and Belfast City Hospitals have currently a total of 4/5 IR facilities. The RCH suites and the BCH Cancer centre facility are within the PFI agreements that both Trusts have in place for the foreseeable future. The BCH main suite was installed in August 2013 and is not within the PFI program.

2.36 A large number of aortic interventions are carried out in conjunction with the vascular surgical service at the RVH site. The majority of these are performed in the vascular theatre using a mobile image intensifier. This is sub-optimal in terms of image quality, patient dose and staff radiation protection.

2.37 A business case for a dedicated endovascular theatre is underway. Increased utilisation of the third suite at the RVH site should also be considered as an interim solution, but this facility is not optimal in terms of undertaking open operative surgery. The ability to undertake two aortic image guided interventions at the same time is currently limited however the upward trend in aortic stent numbers will potentially require this type of procedure and would require both equipment and staffing resource.

2.38 Currently IR co-operation with the maternity service is limited due to the physical location of maternity services relative to IR suites. This may be address with a high risk unit located in the critical care building at the RVH site in the near future.

2.39 Altnagelvin hospital has a modern purpose built angiographic suite which is currently under-utilised. It would potentially require replacement in 8-10 years.

2.40 Craigavon has two multi-purpose fluoroscopic suites with angiographic capabilities – one suite is currently the subject of a business case for replacement. These rooms are not specific to IR and are not readily available for use in emergency cases during working hours. This has led to emergency transfer of patients to Belfast within working hours for intervention.

2.41 The Ulster Hospital has one high specification fluoroscopy room and one room under construction in its new hospital for IR use. A cardiac catherisation lab is also currently utilized for one day per week. These rooms are not specific to IR and are not readily available for use in emergency cases during working hours.

2.42 There is no IR facility is present at Antrim Area, South West Acute or any other facility in Northern Ireland. The provision of angiographic suites and high specification fluoroscopic units is reasonable in the hospitals that currently provide a service. The absence of an IR facility at Antrim Area with its renal and urological services is an obvious issue.

Audit, quality improvement and registries

2.43 Interventional radiologists, like all medical practitioners, have a duty to monitor and improve the quality of their work by regular audit of their practice. Registries offer a systematic way to monitor outcomes against peers and submission to appropriate registries.

2.44 The British Society for Interventional Radiology (BSIR) support a number of registries on specific areas of interventional radiology practice; iliac angioplasty and stent insertion (BIAS registry) (35), biliary drainage (BDSR) (36). In addition, there are several published quality standards that have been published for guidance by NICE, Royal College of Radiologists, Cardiovascular and Interventional Radiological Society of Europe and Society of Interventional Radiologists which units and operators should be aware of when assessing their practice.

2.45 Interventional radiologists carrying out iliac angioplasty and stenting procedures should note that the BIAS registry is an index procedure registry as defined by the RCR. Also interventional radiologists working within units that contribute to the abdominal aortic aneurysm screening programme (England) must submit the results of their endovascular aneurysm repair procedures to the National Vascular Registry (NVR).

2.46 The submission of data to registries is time-consuming but a vital component of monitoring performance. Registry submission can exceed available Supporting Professional Activities (SPA) time and employers should consider administrative support to ensure accurate and comprehensive submission.

2.47 The BSIR has developed a quality improvement programme for IR units that focuses on four key areas; (i) scope of services, (ii) providing good quality care, (iii) patient focus and (iv) service improvement. The BSIR Quality Improvement programme (www.bsir-qi.com) offers units the opportunity to self assesses against specific criteria and participation is recommended to all interventional radiology units.

2.48 The Belfast units have provided data to BIAS, carotid, EVAR, IVC and RIG registries. Local audit and QI programmes are on-going and form an integral part of departmental audit. Separate specific IR monthly team meetings with case review and audit in the Belfast Trust IR units on audit days.

2.49 The IR workstream has developed standards for the use of registries within a regional service and these are set out in section 2.

Medical physics support

2.50 Medical Physics support for IR is not specifically addressed in this document. However the Medical Physics issues outlined in the Radiology Workstream papers are equally applicable to the IR Workstream. The Medical Physics recommendations in Radiology

Workstream Paper 3 are summarised below:

- Workforce planning recommendations for Medical Physics Healthcare Science staffing need to be implemented to ensure that the increasing demand for Medical Physics services can be met. To ensure the sustainability of Medical Physics services a commissioning process for Medical Physics trainees needs to be put in place.

- To support improved governance of the use of medical imaging devices a regional service for quality assurance and scientific support for all ultrasound imaging devices should be developed and implemented.

- There should be regional implementation of an electronic patient dose management system to modernise and improve efficiency in patient dose management and enhance radiation governance.

Patient information

2.51 Patient information leaflets for common IR procedures are available on the RCR (www.rcr.ac.uk), CIRSE (www.cirse.org) and SIR websites (www.sirweb.org). No patient liaison group exists for IR in NI.

SECTION 2: "WHERE WE WOULD LIKE TO BE AND HOW TO GET THERE" - AN OPTIMINAL INTERVENTIONAL RADIOLOGY SERVICE

Key challenges

3.1 Section 1 of this report provided a description of the quantum of interventional radiology services in NI. From this data it is possible to identify a number of key issues within IR which need to be addressed if services are to be of high quality that is; safe, effective and sustainable. Similarly to other workstreams of the imaging review the causes of these issues have included an the expansion of the clinical scope of the specialty into all aspects of modern clinical practice, a resulting increase in demand for services and challenges in training and recruiting the workforce levels necessary to respond to this.

3.2 First and foremost in order to deliver high quality services in IR we will require a workforce in sufficient numbers with the appropriate levels of skills and training. How these services are designed and commissioned and how the workforce is planned follows from this.

3.3 It is important to recognise that there are no quick fixes to these workforce challenges. Whilst we recognise and support the recent DHSSPS decision to increase the number of radiology trainees for example, it will be several years before the service will benefit fully from this investment and in any case there is no guarantee, given the pressures across radiology as a whole, that these trainees will choose a career in IR.

3.4 Our response to the challenges must therefore be an innovative one. New models of working, both within Trusts and regional clinical network approaches, enhanced roles for nursing and radiographic staff, better links across programmes of care underpinned by robust referral guidance and pathways must accompany any additional investment in core capacity within IR.

3.5 The remainder of this section builds on these key concepts. It articulates key steps which can be taken to drive the necessary innovation in services.

Workforce

Radiology

3.6 The workforce position was set out in section 1. It is clear from this picture that in IR, as elsewhere, there remain longstanding difficulties in recruiting and retaining consultants.

3.7 In late 2014 a proposed Belfast interventional rota was developed which was anticipated for commencement in mid 2015. This is based on a 1 in 8 on call rota to allow maintenance of daytime work patterns and facilitate complete out of hours emergency cover. However at no time since then have there been the necessary 8 IR consultants in post to deliver this rota. In addition fluctuations across such a small consultant body make it difficult to adequately plan services. To illustrate this, the number of available consultants dropped to 4 in June and July though this is expected to increase to 6 consultants in post by late summer with one further consultant on a fellowship in an overseas institute until August 2016.

3.8 Outside Belfast services are patchy, with IR consultants offering only up to 3 weekly sessions each at Altnagelvin Area, Craigavon Area and the Ulster hospitals.

3.9 Likewise emergency and out of hours provision outside Belfast are not robust and are often not available at all. Where services are available these are unlikely to represent the full spectrum of IR procedures and it follows that maintaining expertise is not possible in small units where specialist procedures are performed infrequently.

3.10 This extends to practice both in and out of hours in peripheral units. Examples would include radiological insertion of gastrostomy tubes and mesenteric angiography/embolisation.

3.11 We can safely conclude from this analysis that the available workforce in IR is inadequate to meet current service needs. This underlines the urgent need for a strategy both to recruit and retain staff in the specialty and to maintain parity in terms of employment terms across the province.

3.12 Given the overarching radiology workforce position, the national shortage of radiologists and sub-specialty radiologists in particular, and considering the length of time involved with completing the training programme this strategy must build on maximizing the human resources we currently have available to us.

3.13 It is our view that the most effective method of doing this is to move forward on a regional basis which can support both regional and central services. The establishment of a regional service should ensure a comprehensive equitable high quality service for the province.

Radiography

3.14 The workstream recognizes the potential to expand the role of radiographic and nursing staff in IR and the resultant impact on patient care. The Belfast Trust has recently developed a specialist IR radiographic team which allows flexible cover across the sites undertaking IR. This must be supported and expanded in line with further service expansion.

3.15 Consideration should also be given to supporting the development of this team in, for example, supporting radiographic staff to undertake the postgraduate certificate in IR (Sheffield).

3.16 Given the challenges in providing the full spectrum of IR care outside of Belfast as well as the IR workforce challenges it is unlikely that this specialist team approach could be rolled out in these Trusts. In order to

avail of the training and development, consideration should be given to either training staff centrally to work in the district general hospitals or moving towards a situation whereby the central specialised team is expanded to allow the staffing of the peripheral list. This could mean that a team from the central pool would travel to facilitate the peripheral lists in the future. The availability of this core team for an on call rota must also be supported and maintained.

Nursing

3.17 IR differs from generally radiology in that the nursing team is an integral part of the team responsible for the safe delivery of patient care. As the service has expanded due to increased demand and improved therapeutic interventions, there has been no real service development or strategic planning for the nursing workforce.

3.18 Table 2 shows that the nursing compliment in Belfast, particularly at the RVH, is under significant strain at present. The third angiographic suite remains under-utilised due to a lack of nursing staff to staff the room and a business case is currently underway seeking 4.5 WTE nurses and potentially 1 Healthcare Support Worker (HCSW) to address this.

3.19 This illustrates that development and expansion of this core team is required. As with radiology and radiography, the relatively small size of the skill pool, whilst presenting challenges, does offer opportunities for regional approaches. We recommend that a regional plan for training and developing the nursing workforce is put in place as a priority.

3.20 This workforce plan should ensure that the standards set out in the joint RCR/RCN (guidelines for nursing care in IR, 2nd Edition (2014) are implemented in NI, including potential models for extended practice.

3.21 In addition the workstream notes that due to an increase in the use of general anaesthesia in IR, nurses are providing anaesthetic nurse support to anaesthetists. We recommend that this type of support should only be provided by suitably trained practitioners who have completed a

post registration course in anaesthetic nursing as recommended by the Royal College of Anaesthetists. There is a locally accessible level 3 module for anaesthetic nursing offered at Queens University as a standalone module or as part of the Perioperative Practice pathway.

3.22 Recent progress has been formally supported and commissioned to allow an externally provided bespoke anaesthetic training course to further train staff currently in post to underpin their practice in this area. This is due to be undertaken on Saturday mornings in January, February and March 2016).

3.23 IR nurses also administer pre-prescribed conscious sedation and analgesics to patients in some cases. Where this is practiced it should be supported by a sound knowledge in life support and resuscitation training. All nurses carrying out this activity should ideally be trained in Immediate Life Support (ILS) or Advanced Life Support (ALS). ILS courses are accessible through HSC Leadership Centre and have been undertaken. The opportunity to undertake ALS courses is being sought.

3.24 Overall it is our view that an IR specific training course should be developed locally if this service is to grow or access to a suitable alternative for all IR nurses should be made available.

3.25 The review also recognizes that it has proved difficult to recruit nurses into IR as this is relatively ‘new’ area of practice. The review recommends that the IR service on the RVH and BCH sites may benefit from the placement of nursing students to increase recognition of the area as a specialism and a potential place of employment.

3.26 Cognisance should be given to developing an extended role for registered nurses and health care support workers within an IR setting. The impact of these extended roles has been evidenced in a number of centres in England and Republic of Ireland. However any role extension should only be done oncetabilisation of current IR workforce.

3.27 IR nursing sits under the remit of imaging services and is managed by non-nursing managers. A clear senior professional lead for IR nursing must be identified and available to these nursing staff.

3.28 It is also important that the development of a service specification for the IR service should include IR nursing input.

3.29 The review also recognises that the evolving need for neurological IR (NIR) on an emergency basis for stroke intervention will likely require either a combined integration of all IR nursing teams in Belfast or the development of a separate or complimentary rota specific to NIR. The evolution of treatment of acute stroke with trans-arterial clot retrieval will have a major impact in terms of both in hours and out of hours interventions.

3.30 Specific paediatric sessions are now in place to service a session undertaken in RBHSC. This service requires monitoring to ensure it evolves as required. IR nursing is provided for this session from the current pool of IR nurses to compliment the local nursing provided by the RBHSC.

Anaesthesia

3.31 Further provision of anaesthetic services is required as detailed earlier – specifically for complex interventions in the central units.

Clerical/ administrative

3.32 Current clerical support is wholly inadequate for the complex service which continues to evolve. The organisation required to achieve the safe, economic and timely delivery of this service has been grossly underestimated and the current situation is neither fit for purpose nor sustainable.

3.33 If a regional service is to evolve then this will require adequate support in terms of administration. This will depend on the eventual structure of the service across NI. It is clear from section 1 that the current level of

support is inadequate. The extension and development of these roles must be reflected and supported.

Training

3.34 The Northern Ireland Medical & Dental Training Agency (NIMDTA) has a highly effective dynamic training programme in place for radiology training. Within this programme exists the ability to train IR consultants to the new IR curriculum (2012) leading to a CCT in Interventional Radiology and it will be possible to train up to at least 4 trainees at a time between ST4 and ST6. These trainee numbers may be expanded if the peripheral units can be further incorporated into this specialist training.

3.35 It would be possible to expand and train radiographic and nursing staff in IR if funding for such positions became available. This will be required to deliver a regional service for NI.

3.36 Radiographic training should ensure staffing of a core team particularly in the central units. To facilitate career progression and retention of staff support should be available in terms of specialised courses and qualifications such as those offered via Sheffield Vascular Institute. Skills mix should also eventually be available in this regard.

3.37 Nursing training should be supported to include conscious sedation and anaesthetic courses locally. Support for direct involvement with the British Society of Interventional Radiology nurses should also be in place. Further qualifications provided by centres such as Aberdeen and Dublin should be investigated and potential exists for financial support from industry partners given the costs involved. Future use of skills mix e.g. in a PICC line service must be advanced once a robust core team is established.

3.38 Section 1 made the case for 24/7 availability of IR services. Northern Ireland requires such a service. The proposed Belfast rota should provide this and it would seem likely that this will form a regional solution

as separate IR on call rotas outside of Belfast would not be sustainable or indeed feasible given the current staffing levels and the clear issues in terms of staff recruitment. Expansion of the service in Belfast will be required to staff and maintain this system when it commences.

Out of hours

3.39 Outside of normal working hours emergency patients would require rapid transfer to Belfast for IR interventions. Such interventions would include bleeding (traumatic/gastrointestinal/postpartum/iatrogenic) and life or limb threatening vascular emergencies. Clear pathways for the rapid assessment, resuscitation and processing of these cases will be required.

3.40 The potential for such a robust and adequately staffed system is clear. At present only those consultants practicing in the central units have the overall competencies to provide the full range of interventions required. It is not anticipated that those currently practicing in the peripheral units would take part in this rota. Dedicated radiographic and nursing rotas are now in place.

3.41 The issue of NIR out of hours must be planned and commissioned as evidence accrues for 24/7 stroke intervention. Again this must be taken forward in a safe and practical manner – issues are common with the general IR situation.

3.42 The length of time required to train an interventional radiologist in either general or neuro-intervention must be borne in mind. This now requires 3 years specialist training subsequent to 3 years in general radiology training.

3.43 To ensure high quality of training for future Interventional radiologists, consultants in training centers should have sufficient time and resources to ensure adequate supervision of training as well as sufficient workload and case mix for good exposure to a range of procedures. The BSIR and RCR propose that there should be development of an accreditation process for training centers. Specific dedicated time should be identified

in job plans for trainers to ensure the provision of high quality training programs in IR.

Service configuration: enhanced co-operation/regional service

3.44 Whilst the clinical scope of IR has expanded rapidly in the last decades, IR remains a relative small and highly specialist service. The precise workforce configuration that is required to support a good quality of service in NI is complex, drawing on extant clinical guidance, as well as being influenced by the configuration of major care centres and on what models and networks operate within and between them. What is clear from the data in section 1 however is that NI has reached the point where demand has exceeded capacity.

3.45 This increasing demand has resulted in an expanded requirement for adequate and timely access to IR services from all units across the province. As section 1 outlined some services are provided at Altnagelvin Area, Craigavon Area and the Ulster hospitals and these offer important interventions to those populations. There is a strong clinical need for them to be retained and protected.

3.46 A more complex and complete range of services is provided across the sites of the Belfast Trust with a re-organisation of other services most notably vascular surgery, having already led to a re-profiling of IR services centrally in Belfast.

3.47 Section 1 demonstrates that no service currently operates in the Northern HSC Trust and it is important that the needs and requirements of this population are identified and addressed, most urgently in terms of supporting its renal and urology services.

3.48 Generally speaking as a small, primarily rural and geographically isolated region, Northern Ireland has a difficult balance to strike in terms of meeting demand in a safe, accessible and responsive way within very restricted workforce levels.

3.49 It is our view that the most effective way NI can achieve this balance, and meet the demands and expectations of a modern healthcare system is through the establishment of a comprehensive regional IR service.

3.50 This regional service would present opportunities to mitigate or resolve the challenges of recruiting/retaining interventional radiologists peripherally, provide an acceptable on-call service and enhance regional service delivery through a co-operative model. There are a number of methods which could achieve this including:

a. Integrate and standardise the services offered across all IR sites; this would involve each existing site being facilitated to provide the full range of IR services within a regionally commissioned service:

b. Centralise all IR services to Belfast;

c. Develop a hub and spoke model with enhanced support for local DGH services provided through a Belfast based expanded central unit - including a regional out of hours service;

3.51 The clinical requirement for local dialysis, urology and oncology services coupled with the infrastructural issues of equipment and hospital admission facilities means that some form of IR service is required at several sites across the region. It would therefore be neither practicable nor from a patient experience point desirable to centralize all services in Belfast as option (b) recommends.

3.52 However given the demographics and number of clinical cases and the workforce capacity, the range of services at these peripheral sites is likely to remain limited.

3.53 A consequence of this is that only those consultants practicing in the Belfast units have continued to undertake the entire range of IR procedures and even within that group considerable individual specialisation exists. It would therefore require significant re-training to

allow all consultants currently practicing regionally to undertake the full range of IR procedures and it is questionable whether the number of patients presenting in peripheral sites would be sufficient to maintain these skills. Option (a) would therefore present challenges.

3.54 Whilst the challenges of this might be overcome it would be impossible within this model to deliver out of hours services in peripheral sites utilizing the clinical body employed there.

3.55 It is also worth noting that seeking to retain limited service capacity across multiple sites in the face of the demographic, clinical and workforce pressures have molded how service are currently delivered and shaped the model at present as was described in section 1. This is far from optimal, not least the reliance on single practitioners.

Preferred model - hub and spoke

3.56 Considering the arguments set out above and contrasting this with the evidence provided in section 1 it would be our professional view that the option best capable of facilitating retention of a level of core services in peripheral sites, whilst delivering effective regional cover is a hub and spoke model. This would move toward a central hub in Belfast initially supporting and eventually wholly, or in part, servicing the peripheral units as the optimal solution to provide a sustainable service regionally.

3.57 The goal would be to achieve 24/7 emergency cover, adequate daytime provision across the province and a suitable governance and quality assured service for Northern Ireland.

3.58 Within this model future we would envisage future appointments being made to the central Belfast service with specific commitment to service lists in the DGH's as necessary. Out of hours services would likely be provided solely in Belfast, whilst the increase in the number of consultants available on site through central appointment would make the rota less onerous and the service more safe and sustainable.

3.59 The centrally appointed consultant model would allow the IR consultant workforce to maintain competency across all aspects of the specialty, provide an appropriate out of hours service and support and gradually expand the services offered outside of Belfast.

3.60 It would also be possible to expand this centralisation to encompass the recruitment, training and deployment of radiographic and nursing IR staff. It would seem judicious to enact a regional clerical/administrative solution as such a service developed.

Describing the model

3.61 It is essential that any move toward a regionally commissioned service is supported by robust and effective integrated governance mechanisms as well as clear clinical care pathways. This accords closely with the direction set out in the strategic framework for imaging services.

3.62 Detailed work will be required to describe and implement this regional model and it our view that this would lend itself well as an early task of Imaging Board recommended by the Strategic Framework. This regionally agreed governance system should then allow regional audit, quality improvement and continuing professional development.

3.63 It is likely that within the revised regional model the provision of elective intervention procedures would occur on both day-case and as elective in-patient settings, dependent on the procedure and clinical/social circumstances of the patient.

3.64 Arterial vascular interventions for in-patient cases would likely be performed at the RVH site due to the presence of vascular surgery in-patient services. This requirement is compounded by the acute profile of RVH and the associated impact on in-patient bed facilitation. The use of day of surgery admissions via the day of surgery unit is currently facilitating these cases. This position must be maintained to prevent a loss of elective in-patient arterial intervention capacity.

3.65 The majority of day-case arterial interventions will likely be via the BCH unit. Pre-assessment of patients will need to be further refined to maximise available lists and protect day-case admission spaces. Facilitation of both day-case and elective renal, urological and hepatobiliary procedures must also be maintained.

3.66 As the complexity and variety of IR procedures continues to expand both electively and in the emergency setting the requirement for anaesthetic assistance increases. At present one half day of anaesthetic cover is provided on the RVH site. This does not meet current demand and will need to be expanded; providing elective IR anaesthetic cover at the BCH site would greatly benefit both the current provision and the future expansion of the service. These issues would need to be considered in the peripheral units also.

3.67 Consumables remain a significant issue. In IR these can be very expensive and are absolutely vital to the service. There is currently too much variation in the types, costs and quality of these consumables and a regional solution should be sought in terms of the acquisition of the large and diverse range of consumables used by the service to ensure a cost effective and rapidly responding system allowing safe practice and economically prudent service delivery.

3.68 Decisions to transfer workload to IR on a regional basis also need to both include IR services in such planning. Examples would include the provision of nephrostomy placement across the province which was devolved to IR without significant expansion to cope with the caseload.

3.69 The reorganization of the service should also provide a very valuable opportunity to consider scope within IR consultant job plans for clinic sessions and administration duties given the complex cases now undertaken. Likewise training which is currently organised locally must be supported to allow the integration of the new IR curriculum subsequent to the recognition of the sub-specialty status of the discipline by the GMC and RCR.

Service links

3.70 The expansion of many varied services has the consequence of placing a significant demand on IR resources. It is therefore important that a mechanism is designed to expand the available IR service to meet the needs of service expansion elsewhere. This has not happened sufficiently in the past. Examples would include the creation of new dialysis units or the expansion of dialysis units without any cogniscience of the increase in IR referrals to service such units. Such strategies need to be regionally applied.

Consumables

3.71 The inventory of consumables required to deliver modern IR therapy is extensive. Current processes provide for this in the main. However issues arise in terms of rapid replacement of standard items, sourcing and introducing new products, sourcing of highly specialized/bespoke devices and the updating of databases when product ranges are updated or expanded.

3.72 It is our view that a clear pathway between clinical and procurement services must be established with a clear path of communication between the clinical team and procurement teams so that issues can be highlighted and communicated effectively. The authorisation of orders is overly complex and not robustly regulated within some Trusts.

3.73 Contact has been made with procurement services to enhance co-operation and understanding of issues on both sides of this complex system. It is anticipated that a regional approach could be sought when the current framework tender is reviewed and updated in the coming years.

3.74 A process (CAG) will commence in January 2016 to review and refine procurement of IR consumables – leading to a new eventually regional tender.

3.75 Given the costs of these products and the increase in demand it is imperative that a cost-effective, dynamic system is in place which can respond rapidly to the needs of the service.

Governance, audit and quality improvement

3.76 There is a need for more cohesion between clinical, management, finance and procurement teams in delivering IR. Currently a combined meeting of the IR staff based at the Royal Victoria and Belfast City hospitals occurs on audit day each month.

3.77 No dedicated IR meeting occurs otherwise in the province. There is potential to widen the scope of this meeting to include all NI IR teams and this should be considered as part of the regional service. This could occur regularly on a monthly, bimonthly or six monthly basis. A yearly regional meeting should also be considered.

3.78 Expansion of audit to quality improvement projects in conjunction with referrers such as vascular surgery and hepatobiliary services must be undertaken.

3.79 A clear regional understanding of IR appraisal standards must be sought and implemented. Currently one research nurse is available at the Royal site and this permits entry of procedures across several National registries. The recording of IR procedures on the National Vascular database is anticipated shortly.

3.80 Interventional radiologists, like all medical practitioners, have a duty to monitor and improve the quality of their work by regular audit of their practice. Registries offer a systematic way to monitor outcomes against peers and submission to appropriate registries is required

3.81 The workstream has condensed a series of clinical governance standards which, in our view, should underpin the delivery of a regional IR service in NI. These are:

IR standards

- All vascular interventions including procedures performed in conjunction with vascular surgery will be recorded on the National Vascular Registry (NVR)
- Contribution to the various British Society of Interventional Radiology registries: iliac stent and carotid stent will be replaced by the NVR allowing continuing direct comparison to other contributing UK centres.
- Biliary intervention audits – bi annually
- Urology/nephrology complications audits
- Yearly audits of groin complications
- Audit of EVAR outcome
- Prostatic embolisation National registry (ROPE)
- SIRT case National registry
- Potential involvement in National multi-centre trials e.g. BASIL 3

3.82 These interactions will require considerable support in the form of a research/governance nurse to ensure adequate completion. Current issues in terms of immediate access to the database within the IR suites will require a solution. All such interactions should be reviewed annual at the Regional IR audit/QI meeting.

3.83 The BSIR quality improvement programme for interventional radiology is on-going. The BSIRQI programme (www.bsir-qi.com) offers units the opportunity to self assess against specific criteria and participation is recommended to all interventional radiology units – it is intended that Northern Ireland will engage with this programme but it would seem prudent to undertake this when the future structure of the service is agreed.

Interventional Neuroradiology

3.84 The current situation in neuroradiology intervention (NIR) has been detailed in section 1. This aspect of IR is based entirely at the RVH site along with the regional neurosciences service.

3.85 The current NIR consultant body consists of 5 WTE consultants who provide both diagnostic and NIR services. A further diagnostic neuroradiologist is in post. A 1 in 6 general non –IR neuroradiology rota is operational underpinned by specialist registrar cover for diagnostic work.

3.86 Currently the RVH has a biplane intervention suite (used solely by NIR) and a single planar suite shared by the IR and NIR services. NIR has a contingent of nursing staff integrated within the RVH IR nursing team. The team commenced on-call in parallel with the general IR nursing team from October 2015

3.87 NIR has expanded rapidly in the last decade. The service has evolved in line with clinical practice and has been largely commissioned centrally. Current expansion is most prevalent in the area of emergency stroke intervention. Recent studies have shown the value and excellent outcomes from early intervention in this area in specific suitable cases.

3.88 The unit remains at the forefront of this advancing treatment and will require evolution to provide out of hours cover in the short to medium care.

3.89 The evolution of modern stroke management will have imaging at its core and the initial results of intra-arterial early intervention demonstrates a need to plan for a 24/7 neuro-intervention service. In tandem with OOH IR this will require staff expansion and extension of 24/7 radiographic and nursing cover to facilitate the safe management of these patients. Significant anesthetic support will be required.

3.90 Neuro-interventional radiologists undertake a smaller number of cases compared to their general colleagues – some of which are very complex and may require two consultants operating in tandem. The smaller overall case numbers is an issue in expanding consultant numbers in that each consultant needs to undertake a suitable caseload to maintain and progress core skills. This must be balanced against the need to provide potential 24/7 emergency services and the development of a sustainable on call rota.

SECTION 3: FUTURE PROOFING INTERVENTIONAL RADIOLOGY SERVICES IN NI

4.1 In the previous sections we have discussed how interventional radiology has evolved as a service over the last decades in response to technical and clinical advances. The specialty now provides a vast range of procedures from the simple to extremely complex. IR now interfaces with multiple other services and is integral to the delivery of modern healthcare.

4.2 This fast pace of change has challenged extant models of service configuration, commissioning and resourcing. The net result is that the specialty now struggles to meet demand.

4.3 The pace of change is likely to continue with new procedures such as prostatic artery embolisation, pancreatic islet cell transplant in diabetes and advances in interventional oncology on the horizon.

Prostatic artery embolisation (PAE)

4.4 PAE is a non-surgical way of treating an enlarged and troublesome prostate by blocking off the arteries that feed the gland and making it shrink. It is performed by an interventional radiologist, rather than a surgeon, and is an alternative to a TURP (Trans urethral resection of prostate) operation. PAE was first performed in 2009, and since then over 200 men have had the procedure performed predominantly in Portugal and Brazil. University Hospital Southampton has been offering a PAE service from April 2012 and is the first UK centre to perform this procedure.

Interventional Oncology

4.5 The field of interventional oncology has emerged over the last decade to focus on the minimally invasive image-guided techniques for the treatment of cancer. Ablative techniques specifically have evolved in more recent years and garnered significant evidence supporting their

increased inclusion in standards of care and their novel use as curative or disease-modifying therapies, while still maintaining a large role in supportive or symptomatic treatment. Percutaneous ablation will more than likely continue to evolve because of the parallel innovations in imaging and engineered medical devices used in percutaneous interventions but also the improved understanding of cancer behavior and development of personalized cancer therapy.

Pancreatic islet allo-transplantation

4.6 Pancreatic islet allo-transplantation is a procedure in which islets from the pancreas of a deceased organ donor are purified, processed, and transferred into another person. Pancreatic islet allo-transplantation is currently labeled an experimental procedure until the transplantation technology is considered successful enough to be labeled therapeutic.

4.7 For each pancreatic islet allo-transplant infusion, researchers use specialised enzymes to remove islets from the pancreas of a single, deceased donor. The islets are purified and counted in a lab. Transplant patients typically receive two infusions with an average of 400,000 to 500,000 islets per infusion. Once implanted the beta cells in these islets begin to make and release insulin.

4.8 Pancreatic islet allo-transplantation is performed in certain patients with type 1 diabetes whose blood glucose levels are difficult to control. The goals of the transplant are to help these patients achieve normal blood glucose levels with or without daily injections of insulin and to reduce or eliminate hypoglycemia unawareness a dangerous condition in which a person with diabetes cannot feel the symptoms of hypoglycemia, or low blood glucose. When a person feels the symptoms of hypoglycemia, steps can be taken to bring blood glucose levels back to normal.

Neuroradiology

4.9 The rapidly evolving impact of interventional neuroradiology on stroke management has already been mentioned but must be borne in mind as an area which will continue to develop.

Addressing the challenges

4.10 The above narrative provides some background information on emerging procedures; however it is likely that the specialty will continue to be driven by changes in clinical practice. The crucial point is that as new procedures or practices roll out across the HSC the full consequences of them are mapped, commissioned and resourced appropriately.

4.11 As the demand for interventional radiology clinical services becomes ever greater the need for integration of the IR team into the planning and follow-up of patient treatments becomes more important. This is evident for example in co-operation in vascular clinics and enhanced support of multi-disciplinary teams which have become the cornerstone of modern clinical practice.

The expansion of IR consultant job plans to allow participation in clinics must be borne in mind in terms of future developments and job-planning.

4.12 This will have an impact most obviously on consultant IR job planning and the resourcing of covering other duties. Skills mix can play a part in the future of IR. The practice of IR radiographic and nursing professionals in the provision of certain core procedures is established. This would provide potential career progression and satisfaction leading to retention of highly trained specialist staff. However adequate and robust core teams must first be embedded.

RECOMMENDATIONS

1. The HSC should establish a regional hub-and-spoke IR service in NI with enhanced support for local DGH services provided through a Belfast based expanded central unit including a regional out of hours service.

2. The HSC should develop a commissioning specification for the regional IR service in partnership with the Imaging Board; this plan should include the impacts of developments in related specialties including renal, urology, vascular, maternity, hepatobiliary and oncology in particular.

3. IR should be represented on a regional imaging board.

4. IR representatives on the Imaging Board should work with HSC Trusts and commissioners to establish appropriate integrated governance and accountability mechanisms for the regional service.

5. The Imaging Board should develop pathways for 24/7 IR cover quickly including arrangements for rapid inward transfer of emergency cases in co-operation with the referring specialties.

6. A workforce plan should be developed for IR services regionally which matches consultant post expansion to recruitment of additional radiographic, nursing and clerical/administrative staff to manage the service.

7. The IR workforce plan should ensure that the standards set out in the joint RCR/RCN (Guidelines for nursing care in interventional radiology, 2nd Edition (2014) are implemented in NI including potential models for extended practice.

8. IR nurses who provide anaesthetic nurse support to anaesthetists should be suitably trained practitioners who have completed a post registration course in anaesthetic nursing as recommended by the Royal College of Anaesthetists.

9. IR nurses who administer pre-prescribed conscious sedation and analgesics to patients should have a sound knowledge in life support and resuscitation training. All nurses carrying out this activity should ideally by Immediate Life Support (ILS) or Advanced Life Support (ALS) trained.

10. IR services on the RVH and BCH sites may benefit from the placement of nursing students from universities to increase recognition of this area as a specialism and potential place of employment.

11. Consideration should be given to developing an extended role for registered nurses and health care support workers within an IR setting following stabilisation of current IR workforce.

12. A clear senior professional lead for IR nursing must be identified and available to nursing staff.

13. Training must be encouraged, supported and formalised. The potential for industry support should be fully considered.

14. Participation in regional audit, quality improvement project and National registries should be encouraged

15. Monthly regional clinical meetings should be established. The potential for securing industry support should be explored.

16. The systems, procedures and interactions in place for the acquisition of IR consumables needs to evolve to meet the needs of the IR service in an economically viable manner.

17. A clear mechanism for the introduction of new techniques to include their funding is required.

18. Neuroradiology intervention services require support and expansion.

Appendix 1: Membership of the Interventional Radiology Workstream Project Group:

Lead: Dr Anton Collins RVH

Dr Peter Kennedy (Lead IR Belfast trust)

Dr William Loan (BCH)

Dr Chris Boyd (UHD)

Dr Deirdre Campbell (ALT)

Dr Richard McConville (CAH)

Dr Ian Rennie (Neurointervention RVH)

Dr Barry Patterson (Antrim)

Dr Allam Adas (Altnagelvin/CD Northern Trust)

Sister Geraldine Chambers (Nursing)

Mr. Philip Frizzel (Radiography)

Mrs Ciara Gilmore (Clerical/ administrative)

Deputies:

Dr Peter Ellis (RVH)

Dr Raghu Sathy (RVH/BCH)

Dr Richard Lindsay (BCH)

Appendix 2: Terms of Reference for the Imaging Review – Interventional Radiology

- To evaluate and make recommendations on the configuration of interventional radiology services over next 10 years; taking account of advancements in technology, demographics and demand, and developments in clinical and professional practice and national and international best practice.

- To make recommendations to ensure that patients receive timely radiological interventions

- To make recommendations regarding the workforce needs of future service models having regard to:

    - to quantify the current position as regards staffing levels in terms of radiological, radiographic, nursing and clerical staffing
    - plan for safe and effective 24/7 IR services
    - implementation of IR radiology/nursing/radiographic rotas
    - highlight areas of potential future expansion and correlate to planned capacity
    - building effective working relationships and clear comprehension between imaging services and the wider clinical community
    - ensuring region wide service resilience with appropriate escalation arrangements.

- To make recommendations regarding the most efficient and effective use of available resources.

- To make recommendations regarding the necessary investment in imaging technologies to meet service configuration including:

- The replacement and upgrading of interventional facilities as required
- The provision of adequate staffing both in and out of normal working hours

- Ensure services are underpinned by effective governance and quality assurance mechanisms.

Appendix 3: Provision by units

Vascular		**Haemorrhage Control**		**Renal Dialysis**	**IR Oncology**	**GI**	**HPB**	**Uro-intervention**	**Mesenteric Ischaemia**	**Lysis**	**Vascular Malformation**	**Access**	
Arterial	**Venous**	**9-5**	**OOH**										
Y	Y	Y	Y*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Belfast
Y**	Y	Y	N	Y	L	Y	Y	Y	N	L	N	Y	S
Y**	Y	Y**	N	Y	N	Y	Y	Y	N	N	N	Y	SE
N	N	N	N	N	N	N	N	N	N	N	N	N	N
N	Y	N	N	Y	N	Y	Y	Y	N	N	N	Y	W
*ADHOC													
**SOME PROCEDURES ONLY													

Appendix 4: Unit Workload

RVH includes some ultrasound interventions performed by IR in day ward										
		Interventional Room 1 [INVE023] Seimens	**Interventional Room 1 [INVE023] Seimens Fluoro**	**Interventional Room 2 [INVE016] BIPLANE**	**Interventional Room 2 [INVE016] BIPLANE Fluoro**	**Interventional Room 3 [INVE009]**	**Mobile US Interventional**	**Ultrasound Room 1 [ULTR006]**	**Ultrasound Room 2 [ULTR008]**	**Grand Total**
Adrenal vein sampling		5								5
Aneurysm Embolisation (Neuro)		1		1						2
Aneurysm Embolisation + GA (Neuro)				67						67
Angio abdominal aortogram		5								5
Angio aorto-femoral lower limb Both		7		1						8
Angio arch aortogram		2								2
Angio carotid Lt				1						1

Angio cerebral		3		167						170
Angio coeliac & SMA & hepatic & IMA		20								20
Angio renal		1								1
Angio splenic		3								3
Angio subclavian Lt		1								1
Angio superior mesenteric artery		1								1
Angio upper limb Lt		1								1
Angio upper limb Rt		5								5
Angiography and G.A.		1								1
Angioplasty	2	14								16
Angioplasty iliac Lt		26								26
Angioplasty iliac Rt		21								21
Angioplasty infrapopliteal Lt		24								24
Angioplasty infrapopliteal Rt		23				1				24
Angioplasty popliteal Lt		11								11
Angioplasty popliteal Rt		15								15
Angioplasty subclavian Lt		1								1
Angioplasty subclavian Rt		1								1
Angioplasty superficial femoral Lt		32								32
Angioplasty superficial femoral Rt		36								36
Arterial stent abdominal aorta		1		1						2
Arterial stent carotid left		1								1
Arterial stent carotid Rt				2						2
Arterial stent femoral Lt		3	3							6
Arterial stent fermoral Rt		5								5
Arterial stent illiac Lt		21								21

Arterial stent illiac Rt		17				1				18
Arteriogram of Left Femoral Artery		1								1
Arteriogram of Right Femoral Artery		1								1
AVF/AVM Embolisation (Neuro)		1								1
AVF/AVM Embolisation +GA (Neuro)				24						24
Balloon Placement prior to Surgery				1						1
Basic Insertion of Caval Filter		2								2
Biliary bile duct calculus removal		1								1
Biliary bile duct dilatation		1								1
Biliary bile duct stent		39				1				40
Biliary dfrainage change		2								2
Biliary drainage		58		1		2				61
Biliary drainage change		4								4
Bronchial stent						1				1
Calcium Stimulated Pancreatic Sampling		1								1
Coil Embolisation				1						1
Complex Vascular Stent		12								12
Drainage catheter exchange		1								1
Drainage of Subphrenic Abcess		1								1
Duodenal stent insertion		1								1
Embolisation bronchial artery		2								2
Embolisation hepatic artery		4								4
Embolisation internal iliac artery		11								11
Embolisation mesenteric artery		14		1						15

Embolisation of hepatoma		10								10
Embolisation of liver mass		2								2
Embolisation of ovarian vein	1	6								7
Embolisation of testicular vein		1								1
Embolisation of uterine fibroid		3								3
Embolisation portal vein		1								1
Endo colerectal metal stent Fluoro Guiged		4								4
Femoral Angioplasty		1								1
Fluoroscopic guided drainage		7								7
Fluoroscopic guided embolisation		17		1						18
Fluoroscopic guided lumbar puncture				11	1	2				14
Gastrojejunostomy catheter replacement		6		1						7
Gastrostomy catheter replacement		55	1	1		5				62
Hepatic vein pressure measurements		10								10
Hepatic wedge pressures		1	5							6
Hickman line insertion		7				1				8
Hickman line removal		1								1
Iliac Angioplasty	1	7								8
Inferior vena cava filter permanent		2								2
Inferior vena cava filter removal		11				3				14
Inferior vena cava filter temporary		16		1		4				21
Inferior vena cavogram			1			1				2
Liver biopsy transjugular		4				1				5
Oesophageal Dilatation		7		1						8

Oesophageal stent insertion		1								1
Other Embolisation + GA		1		2						3
Pc Asp thrombectomy left lower limb		1								1
Pc Embolisation hepatic artery branches		8				2				10
Pc embolisation spinal tumour		1								1
Pc hepatic arterial brachytherapy		11								11
Pc insertion vein stent		2								2
Pc Mech thrombectomy right lower limb		1								1
Pc Mech thrombectomy right upper limb vessel		1								1
Pc Stent iliac vein Left		3								3
Pc stent renal artery Lt		1								1
Pc stent renal artery Rt		2								2
Pc stent subclavian artery Rt		1								1
Pc stent superior mesenteric artery		4								4
Pc Stent superior vena cava		2								2
Pc thrombolysis cerebral artery				1						1
Pc thrombolysis Inferior vena cava		1								1
Pc thrombolysis lower limb vien left		2								2
Pc thromobolysis lower limb Left		1								1
Pc thromobolysis lower limb veins Right		2								2
Pc transjugular liver biopsy		1								1
Percutaneous arterial chemo-embolisation		71	3	1						75

Percutaneous Nephrostomy		2								2
Percutaneous transhepatic cholangiogram			20							20
PICC Line insertion.		9								9
Popilteal Angioplasty		1								1
Stent graft illiac		8	1		1					10
Stent graft thoracic aorta		13								13
Stent Infrapopliteal Left		2								2
Stent Popliteal Artery Left		2								2
Stent Popliteal Artery Right		1								1
TIPS Stent		8		1						9
TIPS stent reduction		1								1
TIPS Stent tipsogram		3								3
TIPSS with stent graft		7								7
Ultrasound Biopsy of Lymph Node								3		3
Ultrasound Biopsy of Soft Tissue							1	1		2
Ultrasound Drainage of Abcess							8	1		9
Ultrasound Thrombin Injection							4	2		6
Ureteric stent antegrade Both		3								3
Ureteric stent antegrade Lt						1				1
US Guided aspiration abdomen							11	3		14
US Guided aspiration thorax							1	2		3
US Guided biopsy							16	23	11	50
US Guided biopsy liver							114	4	1	119
US Guided drainage abdomen							29			29
US Guided drainage thorax							35	2		37
US Guided radiofrequency ablation							15			15

US Guided thrombin injection							5			5
Venogram arm Rt			2							2
Venogram hepatic percutaneous		1								1
Venogram leg Left		1								1
Venogram leg Lt			1							1
Venogram leg Rt		2								2
Grand Total	**4**	**826**	**37**	**289**	**2**	**26**	**239**	**41**	**12**	**1476**

Aortic Stent grafts										148

BCH			
	ES	**MPI**	**Grand Total**
Angio Abdominal Aortogram	1		1
Angio Aorto Femoral LL Both	3		3
Angio Arch Aortogram	2		2
Angio Bronchial	1		1
Angio Coeliac	1		1
Angio Coeliac/SMA/Hepatic/IMA	2		2
Angio Inf. Mesenteric Artery	3		3
Angio Pelvic	5		5
Angio Renal	14		14
Angio Renal Transplant	4		4
Angio Splenic	1		1
Angio Sup. Mesenteric Artery	2		2
Angio Upper Limb Lt	3		3
Angio Upper Limb Rt	2		2

angio antegrade femoral Lt	19		19
angio antegrade femoral R	22		22
Angio lower limbs Lt	4		4
Angio lower limbs Rt	1		1
Angioplasty Brachial Lt	1		1
Angioplasty brachiocephalic vein left	3		3
Angioplasty brachiocephalic vein right	1		1
Angioplasty Iliac Lt	25		25
Angioplasty Iliac Rt	24		24
Angioplasty iliac vein left	2		2
Angioplasty Infrapopliteal Lt	1		1
Angioplasty Infrapopliteal Rt	2		2
Angioplasty of cephalic vein left	1		1
Angioplasty Popliteal Lt	1		1
Angioplasty Popliteal Rt	4		4
Angioplasty Renal Transplant	6		6
Angioplasty Subclavian Lt	3	1	4
Angioplasty subclavian vein right	1		1
Angioplasty subintimal leg left	1		1
Angioplasty Sup. Femoral Lt	15		15
Angioplasty Sup. Femoral Rt	18	1	19
Angioplasty Superior Vena Cava	1		1
Angioplasty venous central	4	1	5
anterior tibial angioplasty left	4		4
Arterial Stent Femoral Lt	7		7
Arterial Stent Femoral Rt	10		10

Arterial Stent Iliac Lt	27		27
Arterial Stent Iliac Rt	22		22
Arterial Stent Renal Lt	4		4
Arterial Stent Renal Rt	2		2
Biliary Bile Duct Stent	8		8
Biliary Drain Change	3		3
Biliary Drain Removal		2	2
Biliary Drainage	9		9
Biliary Int/Ext Drainage	10		10
Cutting Balloon Angioplasty Venous	1		1
Dialysis Catheter Exchange	13		13
Duodenal Stent Insertion	3		3
Embol. Bronchial Arteries	1		1
Embol. Int Iliac Art. Pre-EVAR	1		1
Embol. Of Testicular Vein	21		21
Embol. Of Uterine Fibroid	7		7
Embolisation	5		5
Embolisation Coeliac Artery	1		1
Embolisation Mesenteric Artery	5	1	6
Embolisation Of Hepatoma	1		1
Embolisation of ovarian vein	1		1
Embolisation Renal Artery Lt	4		4
Embolisation Renal Artery Rt	2		2
Femoral Line Insertion	3		3
Fistuloplasty	116	3	119
Fluoro Aspiration Drainage	1		1

Gastro/Gastrojejunostomy Conv.	1		1
Gastrojejunostomy	2		2
Gastrojejunostomy Cath.Replace	5		5
Gastrostomy Insertion	32		32
Hickman Line Exchange	6		6
Hickman Line Insertion	76	4	80
Hickman Line Removal	2		2
Inf. Vena Cava Filter Perm.	2		2
Inf. Vena Cava Filter Removal	7		7
Inf. Vena Cava Filter Temp.	9	1	10
Inferior Vena Cavogram	1		1
Injection Under US Control	1		1
Internal Metallic Stent	1		1
IV Foreign Body Retrieval	2		2
Jejunostomy	1		1
Jejunostomy Catheter Exchange	5		5
Liver Biopsy Transjugular	1		1
Naso-Gastric Feeding Tube		5	5
Naso-Jejunal Feeding Tube	3	1	4
Nephrostomy Both	42	4	46
Nephrostomy Catheter Exchange	165		165
Nephrostomy Lt	74	4	78
Nephrostomy Rt	57	1	58
Oesophageal Stent Insertion	1		1
Ovarian venography	1		1
PEG insertion/exchange	3		3

Percutaneous Thrombin Inject.	1		1
peroneal angioplasty	2		2
PICC Line Insertion.	11		11
pleurx drain-abdomen	23		23
pleurx drain-chest	1		1
Portacath Insertion	8		8
posterior tibial angioplasty left	4		4
posterior tibial angioplasty rt	1		1
PTC	9		9
Sialoplasty	3		3
Superior Vena Cava Stent	5		5
Superior Vena Cavogram	4		4
Thrombolysis ULimb Follow Up 1	1		1
Thrombolysis Upper Limb	1		1
T-Tube Cholangiogram	2	1	3
Tubogram		2	2
Tunnelled Dialysis Cath Place.	34		34
Ureteric Stent Antegrade Lt	39	3	42
Ureteric Stent Antegrade Rt	41	1	42
Ureteric Stent Retrograde Lt	3		3
Ureteric Stent Retrograde Rt	3		3
Urethrogram	1	2	3
US Doppler Renal	1		1
US Guided drainage abdomen	1		1
Venogram Arm Lt	1		1
Venogram Cavernogram	2		2

Venogram Leg Lt	4		4
Venogram Testicular		1	1
Venous Sampling	1		1
Grand Total	**1203**	**39**	**1242**

CAH	
Lower Limb angio	18
Iliac stent	10
SFA intervention	25
Popliteal angioplasty	7
Infra-pop angioplasty	5
Fistuloplasty	27
Central access	66
PTC	23
IVC Filter	4
Nephrostomy	55
	240