Imaging Review

Paediatric Workstream

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INTRODUCTION

Medical Imaging Services in Northern Ireland

- 1.1 Medical diagnostic 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 to enable the diagnosis and staging of disease and monitoring of the effectiveness of treatment. Imaging 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 (minimally invasive treatments performed while imaging the patient). Imaging services are also provided in other clinical settings such as cardiology and obstetrics.
- 1.3 It is important to recognise from the outset that diagnostic 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 The focus of this paper is on the aspects of those clinical services which are provided to infants, children and adolescents. This is known as paediatric medical imaging.

Paediatric Medical Imaging

1.5 Paediatric medical imaging services, as with paediatric services generally, face particular clinical, environmental and medico-legal challenges which are not routinely faced by adult services.

- 1.6 Clinically, the presentation of disease in children and its underlying pathology differs from adult practice, and is often age dependent. The body size differences are paralleled by maturational changes, with the smaller body of an infant or neonate substantially different physiologically from that of an adult. In recognition of this the facilities and equipment to image children must be suitable on a spectrum of tiny infants weighing as little as 500g, to adult-sized teenagers.
- 1.7 Congenital defects, genetic variance, and developmental issues are of greater concern than they are to adult physicians and exam techniques must be tailored to the individual patient and the clinical question to be answered.
- 1.8 Children are also more radiosensitive than adults, and it is imperative that examinations performed for children are clinically justified and follow the 'ALARA' ('as low as is reasonably achievable') principle. When at all practicable, paediatric radiologists will also aim to utilise imaging modalities that do not involved ionising radiation, and such techniques may be more labour intensive, operator dependent and time consuming.
- 1.9 Paediatric imaging services must also deal with the problem that children, unlike most adults, cannot always understand / comprehend the nature and purpose of an investigation or treatment and on occasion this can cause significant distress. Parental restraint, sedation or anaesthesia may then be necessary for some procedures. Very young children cannot vocalise symptoms or the genesis or chronology of injury or advocate for themselves. In these circumstances issues of guardianship, privacy, legal responsibility and informed consent are of paramount concern.
- 1.10 In a general sense then, paediatric specialists often have to treat not only the child but the parents and the family within the context of a wider societal responsibility for the welfare and guardianship of children.
- 1.11 Currently in NI, paediatric imaging services encompass children ranging from premature infants until the time of their 14th birthday. Those children with

chronic disease under the long term care of a paediatrician or paediatric surgeon will usually be transferred to adult services at around the age of 18 years; any imaging they require up until such time also falls within the remit of a paediatric radiologist.

- 1.12 The remainder of this paper seeks to draw out how these clinical, environmental and medico-legal challenges manifest themselves in the design, configuration and delivery of paediatric imaging services in Northern Ireland and to articulate a vision for how those services could be more effectively delivered to benefit patients.
- 1.13 In doing so, it will draw on the work of the other workstreams of the review, particularly the adult radiological imaging workstream as well as the overarching strategic approach taken in relation to the project.

Context and Background

- 2.1 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.
- 2.2 In doing so the review will consider the full spectrum of imaging services provided by the health and social care (HSC) system, including radiological, obstetric, cardiology and paediatric imaging and has established workstreams to take forward the substantive work in each of the core areas.
- 2.3 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. These are attached in **Appendix 1** of this report.

Methodology

- 2.4 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.
 - Blue sky/horizon planning: future proofing and strategic planning.
- 2.5 In fulfilment of that requirement this paper, which has been prepared by the paediatric workstream chaired by Dr Annie Paterson, is set into three sections, which align with the first three key phases of the review.

- 2.6 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 secondary and tertiary paediatric services. This engagement has been augmented by semi-structured interviews led by the chair with key clinical colleagues and supplemented with additional demographic and activity trend data on paediatric imaging. These data and clinical engagements have driven the findings and recommendations of this report.
- 2.7 It is however recognised that any data can only ever represent a position at a point in time. The key task for the workstream therefore has been to identify the key thematic issues facing paediatric imaging services and to develop a strategic vision which will ensure that these services are safe, sustainable and effective in the long term.
- 2.8 Notwithstanding this strategic approach the workstream has, where appropriate, set out steps which should be taken to address issues which would warrant immediate or urgent action by the Department or commissioners.
- 2.9 Finally the membership of the paediatric workstream is set out in Appendix 2. Terms of Reference for the paediatric workstream have been developed and are attached in Appendix 3 of this report.

SECTION 1: "WHERE WE ARE NOW": - AN ASSESSMENT OF PAEDIATRIC IMAGING SERVICES IN NI

Demographics

3.1 Paper 1 of the adult radiology workstream set out a number of key demographic challenges facing healthcare services generally and imaging services specifically in Northern Ireland. One such trend is set out below.



Figure 1: Population of Northern Ireland, actual and projected, 1981-2037.

- 3.2 It can be noted from the graph that the population of Northern Ireland is projected to continue to grow by approximately 10,000 people each year. NI has the fastest growing population of any region in the UK.
- 3.3 Within this overall growth the analysis by NISRA shows that the number of children in Northern Ireland is projected to increase from 382,000 children in 2012 to 401,000 children in 2022. Over the decade (2012-2022), this represents a 5% increase in the number of children (aged under 16), with the population aged 16-64 remaining relatively static.
- 3.4 This is not an insignificant increase and is likely to have an impact on demand for paediatric services and associated imaging requirements. Furthermore this

growth is not likely to be uniform across NI and therefore has the potential to impact on demand and capacity planning at Trust level.

Morbidity

- 3.5 The NI paediatric strategy set out key morbidity data for children in NI. While most children spend most of their childhood without much contact with paediatric services, it is worth noting that the Health and Social Care Board (HSCB) estimate that around a quarter of all children will be admitted to hospital during their first year of life. Within the context of the rising number of births set out above this is likely to mean increased pressure on paediatric services over the next ten years.
- 3.5 Since imaging plays an increasing role in almost all healthcare diagnosis and intervention, morbidity will drive how these services develop. This will be particularly relevant in some key conditions which will have significant impact on imaging requirements.

Cancer

- 3.6 On average around 60 children aged 0-17 years are diagnosed with cancer each year. These patients are managed in the RBHSC by a team that includes two paediatric oncologists, one paediatric haematologist and one specialty doctor. There are close links between the RBHSC radiology department and the paediatric oncology team.
- 3.7 At the end of 2010 there were 441 children (aged 0-17) living who had a diagnosis of cancer at some point. Treatments are improving and around 80% children diagnosed with cancer now survive. There are around 10 deaths from cancer among 0-17 year olds each year in Northern Ireland. The most common type of cancers in the 0-17 year olds are leukaemia, brain, lymphoma and kidney cancer.

Imaging consequences

- 3.8 Children require imaging at the outset to confirm their diagnoses and to stage their disease; diagnostic exams may be performed at the presenting hospital outside of the RBHSC. Further (regimented chronologically) imaging is required to monitor treatment response and complications. Access to paediatric MR is therefore vital to ensure safe and effective patient care.
- 3.9 Presently there are concerns about the rapid availability of access to MR, with children often staged with CT exams as an alternate. This situation should be improved if sufficient additional MR sessions are commissioned on the RBHSC dedicated MR scanner (2 new MR body sessions have been added to date), however they are unlikely to be alleviated fully.
- 3.10 Feedback from paediatric oncology colleagues indicates a very high degree of satisfaction with paediatric imaging services, although notes that workforce constraints in this service have the potential to impact on patient care.
- 3.11 There are also challenges in facilitating paediatric radiology input into the oncology MDT and it has not been possible to facilitate radiology attendance at the MSK oncology MDT in MPH, the Northern Ireland/Scottish teleradiology MDT or the commencement of a TYA (teenagers and young adult) oncology MDT.

Paediatric cardiology and paediatric imaging services

3.12 Paediatric cardiology has developed dramatically over the past 50 years in the diagnosis and understanding of congenitally malformed hearts and their treatment. The past two decades have seen emerging treatment opportunities for the entire range of congenital heart disease. The major emphasis at present is to define the best investigative and therapeutic management approaches to these lesions in order to achieve best possible long-term outcome at the lowest morbidity and mortality.

- 3.13 The last decade has also seen an explosion of knowledge and understanding of the genetic basics of cardiovascular development and adaptation and the experimental use of stem cell therapy. These developments may over the decade lead to the development of more targeted drug or cell therapy, possibly aided by specific interventional catheter techniques.
- 3.14 RBHSC is the regional paediatric cardiology centre and sees children up to the age of 16 years prior to their transition to adult services. Many investigations are performed and reported by the cardiology team of the Clark Clinic including transthoracic and transoesophageal echocardiograms, diagnostic and interventional cardiac catheter studies. One of the consultants has an interest in cardiac MR and has one non-GA session in MIH per week, where children > 8 years are imaged. In January 2016 a GA cardiac MR session has been commissioned.
- 3.15 The cardiology team in RBHSC have expressed concerns regarding the provision of GA and non-GA MR imaging for their patients within the current configuration. They estimate significant further growth suggesting that the number of patients could double between 2012 and the publishing of this report in 2016.
- 3.16 The RBHSC radiology department also perform CT angiographic exams, with an increasing number being requested each year. This service began over a decade ago, with intermittent requests on carefully selected patients. As clinician confidence in the service increased, so too has the scope of the work. There has not been formal commissioning support for this service. The work is reliant upon the presence of a single consultant radiologist to technically protocol the exams (individually for each child) and report them. The majority of study requests require individual discussion with the referring cardiologist, and almost all patients have their exams performed under general anaesthesia.
- 3.17 The workstream also recognises that approach outlined by the Minister for paediatric cardiology and paediatric cardiac surgical services in NI will have an impact on the imaging needs of paediatric cardiology patients. The realignment

of cardiac surgical services in Belfast will mean that interventional cardiac catheter studies may need to take place in another centre. By economy of scale, it is likely that the same will apply to diagnostic cardiac catheter studies. Demand for non-invasive imaging, particularly cardiac CT and cardiac MRI, within the Belfast Trust is likely to increase as a consequence.

3.18 As part of any future network arrangement within the island of Ireland for paediatric cardiac surgical services, it is possible that paediatric cardiology referrals from the border counties of Republic of Ireland may be assessed in Belfast with a resultant increase in total patient numbers and thus volume of patients requiring imaging.

Paediatric Interventional Radiology

3.23 Paediatric interventional radiology services are not currently specifically commissioned or fully funded. This includes the costs for consumables. The service that has grown up in the RBHSC is currently supported on an ad hoc basis by either the RBHSC consultants or (increasingly) by the IR team based in the RVH. One of the IR team has specific paediatric training, though his skills will atrophy if he does not routinely practise. Most of the other IR consultants are prepared to assist with paediatric IR cases. There is an increasing need for minimally invasive IR work (e.g. feeding tube replacement, vascular access) that requires funding for NI's children. The business case is as yet unsupported.

Unintentional injury

- 3.24 Unintentional injury, defined as injury that is not caused on purpose and there is no intent to harm, is one of the leading causes of morbidity and mortality in childhood. Unintentional injury is one of the most common reasons for children and young people to present to hospital services.
- 3.25 They range from minor cuts, bruises and fractures to serious life threatening trauma. A significant proportion of these presentations will require an image to be made, primarily plain x-ray.

Non-accidental injury

3.26 Non-accidental injury includes injuries deliberately inflicted on the child by themselves or others. This includes deliberate harm to children which raise safeguarding concerns. At present it is not possible to produce figures relating to the number of children presenting to Emergency Departments (EDs) as a result of non-accidental injuries as information is collected under referrals under the safe-guarding policies.

Acute childhood illnesses

- 3.27 Successful childhood vaccination programmes mean that diseases such as diphtheria, tetanus and measles are now extremely rare among children in Northern Ireland. However, infection is still the most common reason for attendance at an ED or admission to hospital in the 0-17 age group.
- 3.28 The vast majority of these infections are upper respiratory tract infections. Meningococcal disease and other life threatening infections account for a relatively small proportion of hospital admissions. In 2011 there were 60 cases of meningococcal disease notified to the Public Health Agency. The majority of these cases were in the 0-17 age group.

Acute surgical conditions

3.29 Children can present with conditions that require assessment and treatment by a surgeon. The most common acute surgical presentation requiring an operation is appendicitis. There are some surgical conditions which mainly present in younger children. These include intussusceptions (a condition where one piece of the bowel slides into the next and the bowel folds over itself). For every child who needs an operation many more will be admitted with abdominal pain for observation and investigation to rule out an acute surgical problem.

Children with Complex Physical Needs

3.31 Advances in the management of children suffering from a range of life limiting problems mean that more children with these complex problems now survive longer. However, in some cases they have very complex issues including breathing difficulties that need to be managed. There are around 500 children in Northern Ireland with complex healthcare needs. At the most complex end of the spectrum there are around 25 children living at home who are ventilator dependent (on life support machines). A further 120 children living at home require some sort of help with their breathing.

Configuration of Acute Paediatric services across HSC sites

- 3.32 All HSC Trusts deliver acute paediatric services. These services are mainly located within the current hospital configuration although some other paediatric services are delivered in other settings, for example in community care and treatment centres or as part of a community team, or specialist paediatric outreach service delivered by the main hospital into local settings. Acute paediatric services delivered by HSC Trusts mainly relate to:
- emergency/urgent care as delivered through Emergency
 Departments, Urgent Care and Treatment Centres, and Minor Injuries
 Units;
 - paediatric medicine both unscheduled and planned care, for example, via rapid response units, inpatient, outpatient services, intensive care units and community teams, especially for long term conditions;
 - **paediatric surgery** both unscheduled and planned, for example, inpatient, day case, and outpatient services.

Tertiary Paediatric Services

3.33 The Royal Belfast Hospital for Sick Children (RBHSC) acts as the principal centre for tertiary paediatric services in NI. Most paediatric specialities are located in the RBHSC including: paediatric and infant surgery, cardiology, haematology, oncology, nephrology, neurology, orthopaedic surgery, plastic surgery and burns, child psychiatry, intensive care and radiology.

- 3.34 Paediatric medicine and its subspecialties are also represented in the hospital, along with a busy emergency department. The RBHSC currently has 87 inpatient beds, although this varies throughout the year. The hospital admits patients up to their 14th birthday, but some children who require long-term care will remain patients until their 18th birthdays and beyond. RBHSC also serves as the local children's hospital to west Belfast.
- 3.35 The RBHSC has a total of 41 consultant paediatricians and surgeons, with a further 12 paediatric anaesthetists and 9.75 WTE specialty doctors. Smaller units exist in all other Trusts. All of these clinicians utilise paediatric imaging services.
- 3.36 As would be expected, the number of inpatient beds and outpatient clinics is far greater in the RBHSC than in the remaining Trusts. Furthermore, many specialist paediatric teams practise in the RBHSC, each with outpatient clinics, and many enlisting the support of a MDT meeting with the radiology department.

Paediatric Imaging

Tertiary

- 3.37 Paediatric imaging services in NI are concentrated in the radiology department of the RBHSC, which acts as both a primary referral centre for the children of Belfast, and a tertiary centre for more complex patients being cared for by clinical colleagues within the Belfast Trust. The radiologists in the RBHSC also provide a service for the infants in the RJMH. Paediatric neuroradiology services for the Belfast Trust are almost entirely reported by the Neuroradiology consultants based in the Royal Victoria Hospital (RVH).
- 3.38 The main RBHSC radiology department has 1 plain film (DR) room, 2 fluoroscopy rooms, both equipped with plain film equipment also (both Siemens systems DR capabilities installed 2012 and 2014), 2 GE US machines and

1 GE portable laptop US system (all 2014), DEXA scanner, and GE twinheaded gamma camera (with SPECT capabilities).

- 3.39 A satellite radiology department is located in the emergency department and comprises: 1 DR plain film room and a 128-slice GE CT scanner (installed 2014). There are 2 image intensifiers in the operating theatre suite and 3 portable x-ray machines also. In acute settings outside of the RBHSC paediatric radiologists utilise the adult equipment.
- 3.40 Currently, MR examinations are performed in the RVH and images loaded onto the NIPACS system for viewing in the RBHSC. The RBHSC 1.5T MR scanner became operational in November for non-GA cases, with anaesthetic provision for cases from January 2016.

Workforce and Capacity in Paediatric Imaging

- 3.41 The imaging workforce is both the most important and most valuable asset of the service. Within radiology departments, it includes radiologists (who are medically qualified), radiographers, assistant radiography practitioners, nurses and radiology support staff. In different settings, it includes staff such as other medical specialists, medical physicists, clinical technologists, vascular technologists and clinical physiologists. Specialised support from medical physics and pharmacy staff is provided in areas such as radiation protection, quality assurance and radiopharmacy, while general support is provided by portering and administrative staff.
- 3.42 Diagnostic imaging teams work together to deliver services that are technically sophisticated and increasingly dependent on information technology. The service is reliant on the availability of imaging equipment, which can be expensive, complex and subject to rapid development.
- 3.43 In April 2013 the HSCB established a Modernising Radiology Clinical Network (MRCN) which was initially tasked with driving forward the recommendations outlined in the RQIA Review (Phases 1 & 2) and to address the Phase 2

recommendation that "all relevant HSC organisations should consider the establishment of a Northern Ireland Managed Clinical Network for Radiology".

- 3.44 The Network functions as a clinical advisory and implementation network, with the overarching objective to identify and address key local issues pertaining to radiology services. It is also tasked with identifying key clinical indicators in quality care measurements, ensuring implementation of service improvement opportunities and prioritising practice development needs within specific clinical areas. It provides a solution-focussed approach to the provision of radiology services and promotes a culture of continuous improvement and collaboration to ensure robust and consistent provision of radiological services fit for the future.
- 3.45 Paper 1 of the radiology workstream set out work undertaken by the MRCN to stocktake staffing levels of Consultant Radiologists and Radiographers and the position at August 2014. This is summarised in Table 2 below.

Consultant Radiologists				Radiographers			
	Funded Staffing	Staff In Post			Funded Staffing	Staff In Post	
	Level (FSL)	(SIP)	Variance		Level (FSL)	(SIP)	Variance
SHSCT	20	17	-3	SHSCT	101	113	12
BHSCT	52.45	43.61	-8.84	BHSCT	209.28	192.51	-16.77
NHSCT	20.32	19.35	-0.97	NHSCT	113.37	103.2	-10.17
SEHSCT	20.6	17.8	-2.8	SEHSCT	95.38	95.38	0
WHSCT	22.9	16.8	-6.1	WHSCT	113.425	114.425	1
REGION	136.27	114.56	-21.71	REGION	632.455	618.515	-13.94

Table 2: Staffing Position at August 2014

Radiologist Workforce

3.46 As can be seen from Table 2, there were 136.27 WTE consultant radiologists in Northern Ireland at time of sample. There are approved and funded, unfilled posts in all Trusts, with long term vacancies in most. At August 2014, this equated to 21.71 WTE funded vacant posts. This has expanded significantly since 2014, with approximately 40 vacant posts as of January 2016. All Trusts are utilising internal waiting list initiatives to bridge part of the reporting gap and some are using external reporting services; however it is clear that the deficit is also leading to reduction in capacity and subsequently, an increase in waiting times and responsiveness from imaging departments.

- 3.47 The role of the clinical radiologist has evolved significantly in response to new and improved imaging techniques and progress in acute and elective medicine. The widespread availability and use of CT and MRI in our hospitals has greatly increased the numbers and complexity of imaging examinations. The huge increase in reporting time required for complex studies has resulted in significant changes to job plans and seen plain film reporting being increasingly undertaken as additional core work.
- 3.48 Improvement in imaging quality due to advances in acquisition, processing and demand from specialist clinicians in all HSC Trusts has allowed for earlier, more complex and more accurate diagnoses to be made, particularly in specialist areas. This has resulted in all Trusts needing to employ radiologists with higher training in diverse speciality areas to support their specialist clinicians. It would be expected and required in most acute Trusts to find radiologists with special interests in paediatric radiology, neuroradiology, specialist body imaging, musculoskeletal radiology, breast radiology, nuclear medicine, interventional radiology and others depending on local needs.
- 3.49 The need for radiologists with specific special experience is a further challenge for radiology departments. At present paediatric radiology and interventional radiology are particularly pressured, with growing pressure in breast imaging predicted to become more acute within the next 18-24 months due to declared retirements.
- 3.50 Clinical radiologists have been increasingly taking a central role in and often leading, multidisciplinary team discussions (MDTs) on individual care pathways of particular patients. Although the need for such meetings was formalised by the Cancer Plan, similar interactions with clinical teams were already occurring and has meant that this has now become commonplace outside the field of cancer as well as within cancer pathways.

3.51 The time committed to MDTs has increased greatly over the last decade, with 15-20% of radiologists clinical time now spent preparing for and attending these crucial meetings.

Radiologists with an interest in Paediatrics / HSC Trust						
	BHSCT	SEHSCT	SHSCT	NHSCT	WHSCT	Total
Funded	4.9	3.0	4.0	2.0	4.0	17.9
Staffing						
Level (FSL)						
Staff in post	3.9	3.0	4.0	1.0	4.0	15.9
(SIP)						
Vacant	1	0	0	1.0	0	2.0

Paediatric Radiology workforce

3.52 The above table shows the number of clinical radiologists with a sub-speciality interest in paediatrics across HSC Trusts at the time of writing. It is important to emphasise however that it is only staff in the RBHSC who will work exclusive in paediatrics radiology. Therefore each of these 13 DGH posts will spend a significant proportion of their time in adult practice. It should also be noted that in addition to the profile above, Northern Ireland is set to lose two of its most senior and experienced paediatric radiologists over the next two years to retirement, including the only paediatric skilled practitioner in the NHSCT. In general however the table shows the challenges in maintaining suitable staffing levels in such a small sub-specialty across multiple sites especially out of hours.

Training for a career in paediatric radiology

3.53 Historically, those with an interest in paediatric radiology have represented a small group of practitioners with no formal recognition of sub-specialty training required beyond the listed core competencies in the Royal College of Radiologists (RCR) curriculum. However in September 2014, the Royal College of Radiologists (RCR) issued a short paper outlining the case for a new service model for imaging services in the UK. In it they proceeded from the position

that patients must have access to the expertise of a radiologist with appropriate skills and sub-specialisation where appropriate. As imaging has increased in its complexity, it found that it was not feasible in most hospitals to deliver the range of specialist support in a timely fashion across all clinical presentations. This is particularly evident in relation to paediatric services.

- 3.54 The British Society of Paediatric Radiology (BSPR) act as the Special Interest Group (SIG) to the RCR and recommend 12-months training in the specialty to practise at tertiary level full-time or 6-months focused paediatric radiology training for those who wish to have an interest in paediatric radiology working at DGH level.
- 3.55 In NI as of January 2016, there are 39 radiology trainees divided across 5 training years. All trainees must spend time in the RBHSC (recognised as the primary centre for paediatric radiology training in NI) prior to commencing 'on-call, usually at the start of their 2nd year, having obtained their FRCR part 1 examination and passed a local emergency radiology assessment set by the year 1 Educational Supervisor. Most trainees will spend one month in paediatric radiology during 1st year, though this time may be interrupted by study, annual and exam leave. A further one or two months in the RBHSC usually takes place during the 2nd or 3rd year of training. Unless specifically requested, postfellowship 4th and 5th year trainees do not rotate through the RBHSC, but continue to cover whilst on-call.
- 3.56 A variable number of sessions are allocated to paediatric radiology training outside of the Belfast Trust, the precise amount of time being dependent upon the availability of paediatric trained Consultant Trainers, the enthusiasm of the individual trainee and the availability of paediatric studies on a given (mixed adult/paediatric) modality work list. There is a local willingness for trainees to gain additional RBHSC paediatric radiology experience (weekly sessions) when rotating through other trusts, and as of June 2015 one person had availed of this opportunity.

- 3.57 Outside of the Belfast Trust and Ulster Hospital (UHD) there is a generalised lack of consultant supervision for paediatric emergency work and this may not be permitted to trainees whilst they are on-call, even if they have previously provided the service on Belfast-based rotations. Trainees do participate on the on-call rota in the Western Trust (Altnagelvin), Northern Trust (Antrim and Causeway sites) and Southern Trust (CAH based, DHH remote). Many CT exams are reported from the closest NIPACS terminal to their home; they do not need to travel to the hospital where the exam is performed. SET on-call is linked (historically) to the BT hospitals.
- 3.58 It is theoretically possible for any trainee wishing to complete 6-9 months of paediatric radiology training to remain in NI and complete this time at the RBHSC. Should trainees wish to specialise in paediatric radiology full-time, they are currently advised to obtain 3-12 months focused paediatric radiology training outside of the NI scheme, either in the UK or abroad, to increase the breadth of their experience and learn new imaging techniques. Applications for training periods greater than 3 months are usually for paid fellowship posts undertaken in an additional 6th year of training. The consultant radiology staff in RBHSC are supportive of this approach and will utilise their colleague-contacts outside of NI to help facilitate trainees. In total therefore, it takes 5-6 years to train a newly appointed radiology trainee to become a consultant paediatric radiologist.
- 3.59 The RBHSC medical staff committee is currently in the process of setting up 2 clinical fellow posts, which year 6, post CCT radiology trainees may competitively apply for. Precedence exists for senior trainees from outside the NI scheme to spend time in the RBHSC if they have funding from their local deanery.
- 3.60 There is both a pre-fellowship (years 1-3) and post-fellowship (years 4 and 5) training document for paediatric radiology in the RBHSC that broadly follows the RCR curriculum. However, the NI paediatric radiology network has agreed that it is not possible to fully meet the core competency requirements of the

specialty when up to half of paediatric radiology training in NI occurs during 1st year, and indeed may take place as early as the 4th month.

- 3.61 Many trainees do not have any experience of paediatric patients and their disease, and little general radiology training when they have their first paediatric radiology attachment. This first month is spent learning basic paediatric US and fluoroscopy techniques in preparation for on-call; it is not possible to teach complex imaging techniques or interpretation when there is little or no underlying theoretical knowledge. The latter comes with the acquisition of the FRCR 2A paediatric module (1 of 6 modules that constitute the exam), which occurs during year 2 or 3, by which time the trainee is no longer guaranteed further time in the RBHSC.
- 3.62 Trainees may be discouraged from specialising in paediatric radiology if they perceive the subject comprises their narrow experience during 1st year and little else. Paediatric radiologists require a broad knowledge of embryology, congenital conditions, acquired paediatric diseases and adult pathology, much of which is beyond the scope of the final FRCR exam obtained in year 4. Ironically, later realisation of how much post-fellowship knowledge acquisition is required in years 4 and 5 by the trainee interested in the specialty may in itself be off putting.
- 3.63 Paediatric radiology studies are very much "hands on" especially in the emergency scenario when US and fluoroscopy predominate, particularly in younger children. The emergence of new technology and its increased availability over the past two decades (predominantly CT and the use of PACS) have not altered this fact. This is in contrast to the practise of emergency adult radiology which relies heavily on CT. Paediatric emergency exams require the on-site presence of the on-call radiologist far more frequently than adult radiology where CT exams may be reviewed and reported remotely. It is not uncommon for general radiology on-call rotas to be amalgamated between Trust hospitals or for exams to be outsourced elsewhere within the UK-mainland or abroad. The RBHSC on-call rota is currently 1-in-5 with prospective cover; the tightest rota in NI (this is normally 1-in-15 or more for

some adult radiology rotas in NI). For some trainees, this is not an enticing prospect.

- 3.64 Outside Belfast, paediatric radiology trained colleagues participate in the general on-call rotas based in their local Trusts, covering both adult and paediatric emergency work.
- 3.65 A major anxiety amongst RBHSC consultant staff at present is the ability to provide and maintain training opportunities whilst there are so many vacancies in the department the clinical workload notwithstanding. SPA time previously dedicated to teaching is often subsumed by clinical work in an understaffed department. Literature from the USA has shown that an enjoyable paediatric attachment during training and mentorship from a paediatric radiologist are favourable conditions to attract trainees into the specialty; protected time to maintain these relationships are vital to the future of paediatric radiology in NI. Concerns are in part mitigated by the training opportunities offered working alongside the experienced and knowledgeable radiographic staff in the RBHSC, the paediatric radiology teaching commitment of radiologists outside of the BT and the regular attendance of trainees at paediatric MDT meeting (RBHSC and elsewhere).
- 3.66 To date, with the exception of one of the recognised paediatric radiology consultants from the Western Trust, no consultant radiologists currently in post in NI has requested refresher training in paediatric imaging techniques in the RBHSC.

Paediatric Radiography Workforce

3.67 In the introduction to this paper a number of key paediatric specific issues were outlined including clinical, environmental and medico-legal. These issues significantly affect the practice of radiographers. The workstream notes that considerable improvements in paediatric radiography have been achieved over recent years. In 2011 in response to concerns about the quality of imaging children in DGHs, the Society and College of Radiographers (SCoR) set up a

Children's Taskforce with the support of members of the Association of Paediatric Radiographers (APR). From this work, an action plan was developed to improve the standard of imaging of children throughout the UK. An update is available here: <u>http://www.sor.org/practice/hot-topics/children</u>

- 3.68 The SCoR also produces guidance for practicing radiographers in relation to paediatric care including:
 - The Child & the Law: The Roles & Responsibilities of the Radiographer
 - Practice Standards for the Imaging of Children and Young People
 - Guidance for Radiographers Providing Forensic Radiography Service
 - Imaging for non-accidental injury (NAI): use of anatomical markers Imaging Children; immobilisation, distraction techniques and use of sedation
- 3.69 However paediatrics is not currently recognised as a sub-specialty by the College of Radiographers and there is currently no formalised training or career structure for radiographers wishing to pursue a career in paediatrics. Full-time practice is usually only possible in tertiary centres (that is, children's hospitals). Students of radiography have limited exposure to paediatric services during their undergraduate degree course.
- 3.70 Utilising radiographer skills outside of the RBHSC is an important way to support paediatric imaging services. The radiography staff within the RBHSC are extremely supportive of the extended role of the radiographer, with many having additional post-graduate training in imaging modalities such as US, nuclear medicine and CT. There are currently 4 MR radiographers. The majority of the radiographic staff have their 'IV' certificates and two radiographers have passed the plain film reporting course, and assist with extremity film reporting (a third radiographer is currently training).
- 3.71 In addition, local training has led to radiographers in the RBHSC performing MCUG examinations (a basic paediatric fluoroscopic study) and providing fluoroscopy support to Speech and Language Therapy colleagues during swallow studies and cleft palate clinics. Radiographer led evening US lists are

scheduled regularly, to support the hip screening service for infants within the Belfast Trust. Radiographers involved in providing the latter service report the examinations they perform. The radiology consultants within the RBHSC are always available to support radiography colleagues for more challenging patients and are responsible for reporting all fluoroscopy examinations and almost all non-hip ultrasound examinations performed by the radiographers. Regular audit is important to support this work.

- 3.72 Whilst currently the RBHSC has a highly skilled radiography team, it is critical that the Belfast Trust continues to support enhanced radiographer training, as new members of staff join the team. The department could not run the current (albeit under-resourced) US service without the radiographers, who lead in this modality.
- 3.73 Extension of radiographer training in centres outside of the Belfast Trust could be an important way to improve paediatric imaging provision. This needs to include additional training in plain film radiography (as necessary) with the recognition of those staff in larger departments who are available to perform paediatric examinations.
- 3.74 Increased radiographer reporting for extremity examinations is crucial to decrease the delays some hospitals currently have in reporting their plain radiographs, and would also help to decrease the reliance on outsourcing to the private sector. The RBHSC department is willing to provide support in training radiographers to perform MCUG examinations and to help train radiographic sonographers to update their paediatric skills.
- 3.75 Some Trusts have already made use of this training. However, such training would need to be repeated to allow staff to continually improve their skills and learn new techniques as they are developed. This cannot be achieved without additional funding to RBHSC to support their role in this training. Such funding needs to be recurrent and to the local trusts to remunerate the radiographers with enhanced skills in paediatric imaging. In addition, backfilling of the radiographers regular work to allow for such additional training and an

extended role is crucial to allow the non-paediatric work within radiology departments outside of the Belfast Trust to continue to work to capacity.

In hours Activity and Waiting Times

- 3.76 The data snapshot collected from HSC Trusts in 2014 showed a considerable range of variation in the waiting times for key imaging investigations across HSC Trusts. It was notable that challenges exist for procedures requiring general anaesthetic, especially MRI and particularly in the Belfast Trust which are much more common in children. The Northern and Southern Trusts also faced considerable challenges relating to the staffing capacity with knock on effects on waiting times.
- 3.77 Generally whilst the numbers show high levels of paediatric activity for all Trusts the majority of exams performed, as would have been expected, are plain radiographs.
- 3.78 Whilst these data provide a useful guide to demand, care must be taken in their interpretation. As was noted in the earlier papers of the radiology workstream the way in which investigations are recorded is not wholly consistent across, or within, HSC Trusts. A single booking for a radiographic study may simply represent an ED extremity exam i.e. wrist x-ray; whilst elsewhere it may represent a full skeletal survey with up to 25 separate images which is significantly more onerous to conduct and report upon.
- 3.79 The method of booking examinations shows great variability across the Trusts. For example, in the RBHSC an x-ray of the upper limb is one exam, in another Trust this may be booked in as 5 separate exams.
- 3.80 Similar challenges exist in US booking, where both grey scale and colour Doppler exams are performed. Centrally these count as one exam. Portable exams (on sick patients) are not differentiated from departmental studies, though the time taken to perform and report them varies enormously especially

when they may require transport of the US machine to a separate building on the hospital site.

- 3.81 In essence the point made is that the complexity of any modality study is not accounted for when simply reviewing numerical data. This is particularly pertinent in all cross-sectional modalities such as CT or MR and in interventional studies which are often recorded as simple US or fluoroscopy exams, further skewing data.
- 3.82 In terms of individual modalities, the number of studies will also reflect paediatric practice in each institution, and the balance between inpatient and outpatient care. The tertiary practice within the RBHSC is reflected in the large volume of cross-sectional imaging studies performed in comparison to Trusts outside Belfast. Almost fifty per cent of US exams, more than half of non-neuro CT exams and nuclear medicine studies and two thirds of fluoroscopy studies performed on children in NI are done in the RBHSC. The vast majority of both neuro and body MR exams are performed in the Belfast Trust.
- 3.83 It should be appreciated that paediatric radiology investigations may take longer to perform than a corresponding exam in a co-operative adult patient; more complex exams take proportionally more time, cases requiring sedation or general anaesthesia longer still, with additional time for the logistical problems arranging such studies.
- 3.84 Overall, and despite the limitations of the data the evidence indicates substantial increase in demand particularly in MRI (both in GA and non GA) and in US across the region.

Paediatric Imaging Services: Out of hours

3.85 In common with many specialist services there are significant challenges associated with maintaining a full spectrum of paediatric imaging across multiple HSC Trust acute sites out of hours. Whilst all Trusts are commissioned to provide 24/7 paediatric-imaging services, in practice there are challenges in achieving this uniformly outside the regional tertiary centre.

- 3.86 The staffing position set out earlier means that it is not possible to maintain A paediatric radiology consultant presence at each acute site out of hours or on an on-call basis. The RBHSC is unique in that it will have radiology registrar cover as well as a specialist radiographer on site at all hours about 50% of whom will be able to perform basic US exams. In addition the consultant paediatric radiologist will cover an on call rota, though this represents a significant burden given the current staffing numbers.
- 3.87 Elsewhere each acute site may have registrar cover alongside a consultant radiologist on call that will be responsible for the imaging care pathway of children presenting to the hospital where appropriate. In some areas this works effectively.
- 3.88 The SEHSCT will have a consultant on call who may contact a paediatric radiologist if required, though this is variable. In the Western Trust to date general radiologists have performed some paediatric investigations, although there are concerns that some locums without substantive paediatric experience may be more reluctant to do so. Out of hours the service in the SHSCT and NHSCT are less robust.
- 3.89 The strength or otherwise of these arrangement however is dependent on the confidence of the on-call radiologist to perform specialist paediatric procedures. There is evidence that the RBHSC acts as a defacto out of hours referral centre for paediatric imaging where the on call consultant or locum is not confident to perform the investigation, particularly in US.
- 3.90 It is important to emphasise that there is no commissioning or clinical arrangement to support these views. More importantly such informal referral pathways, especially out of hours, are not conducive to good patient care.

3.91 The workstream notes that the Department has recently published its strategy for paediatric services, in which it is recommended that paediatric services should only be available on a site where there is an appropriate volume of cases and the relevant expertise available to deliver care safely and provide appropriate urgent cover.

Interaction with primary care

- 3.92 An analysis of responses from HSC colleagues has indicated a variation in direct access arrangements for GPs across the province. However all departments allow a degree of open access to imaging services for local GPs. All NHS staff in NI currently have access to the iRefer guidelines produced by the RCR through the HSC Business services intranet.
- 3.93 Developments to the NI ECR are underway which will allow GPs to directly view radiology imaging and reports. Through the ECR it should also be possible for GPs to select, which radiology department they would prefer their patients to attend, though along with strict referral guidelines, this would need to be agreed with the commissioners.
- 3.94 At the present time paediatric radiologists vet the majority of GP requests to the department. Any requests deemed 'not justified' will be returned to the GP with a letter of explanation. If an alternative imaging examination that does not utilise ionising radiation is available, then the request will be redirected as appropriate. Co-ordination of scheduled appointments in radiology with outpatient appointments is encouraged.
- 3.95 With respect to abnormalities detected upon examinations requested by GPs, the RBHSC will either redirect the patient to an appropriate paediatric consultant should the problem require emergency or specialist treatment; alternatively the GP practice will be telephoned to inform them of the result if there is less urgency (e.g. pneumonia requiring antibiotic therapy). When telephone calls to GP surgeries are made, a note is dictated to the report on NIPACS recording the fact.

Information and Communication Technology

- 3.96 Unlike general radiology services, paediatric radiology services in Northern Ireland, with the exception of paediatric MR in the Belfast Trust at the time of writing, are located in hospitals which are linked through NIPACS. With the advent of the MR service in the RBHSC in late 2015, the situation is likely to improve further. Interventional neuroradiological procedures performed in the RVH will continue to be recorded on the i-site system until a truly unified Northern Ireland PACS exists.
- 3.97 Images obtained during portable US examinations, for example in the NICU when performed by a neonatologist, are not stored on NIPACS, merely as paper images in the patient's medical chart. Paediatric ECHO and cardiac angiographic studies are not all routinely stored on NIPACS.
- 3.98 The workstream does recognise that the reliability of NIPACS requires continued improvement. A 24/7 technical support service would greatly assist with this.
- 3.99 There are also limitations regarding NIPACS' ability to recognise double reporting or cross Trust reporting of images, with only one of the consultants being credited with having reported the examination.
- 3.100 For those consultants who utilise a 'home link' access to PACS out of hours, the speed and reliability of this service is of concern. Additionally, it is not possible to voice dictate reports via this system, which means radiologists have to review the images again when they are next in the hospital (time consuming duplication) and issue a formal report on the system.
- 3.101 The RBHSC radiology department utilises the IEP to securely transfer images to children's hospitals on the mainland when they are being transported out of the Province for further treatment. Likewise, the IEP is helpful when the RBHSC consultants wish to liaise with colleagues in England for help with difficult

cases. This system is currently working well, and works in reverse to allow the RHBSC to access, for example, peri-operative images of children who have returned home to Northern Ireland.

3.102 At present transfer of paediatric images from the private sector to NIPACS occurs only when images are uploaded from a CD.

Key findings

- 4.1 This report began in its introduction by defining paediatric radiology with respect to general radiology imaging and proceeded to identify issues specific to children which made it distinct. It is recognised that from these distinctions, and others, a unique service configuration model for paediatric imaging services in Northern Ireland should evolve.
- 4.2 The paper then proceeded, in section 1, to outline in a broadly qualitative way, the key issues and challenges facing this service model. The methodological approach to this analysis was set out.
- 4.3 The need to address and resolve these challenges and deficits leads us to section 2 "where we want to be" with paediatric radiology. Finally then, section 3, outlines potential models to achieving this is practice.

Workforce and training:

- Vacancies in consultant paediatric radiology across NI are contributing to services which are not safe and sustainable across all acute sites in the medium to long term. This problem is particularly acute out of hours.
- There is insufficient paediatric-specific training for radiographers outside the RBHSC. Taken with the lack of sub-specialty recognition for paediatric radiographers this inhibits the provision of the highest possible quality of clinical care to children outside Belfast Trust.
- The current medical training model is not working as effectively as it could to influence and prepare radiology trainees for a sub-specialty career in paediatric radiology.

Commissioning

- How paediatric MR, IR, nuclear imaging and US are funded needs urgent regional consideration.
- workforce challenges across the HSC are leading to increase in demand for imaging services at RBHSC and this is not currently recognised within commissioned activity.

Networks and pathways

- There is a need for enhanced networks of care in children's imaging services to allow sharing of best practise and of tertiary level clinical skills.
- Urgent work is needed to standardise imaging algorithms for children.

SECTION 2: "WHERE WE WOULD LIKE TO BE" – A SAFE, EFFECTIVE AND SUSTAINABLE PAEDIATRIC IMAGING SERVICE FOR NI

- 5.1 Section 1 of this report identified a series of issues and deficits within paediatric imaging services which must be addressed if they are to be made safe, effective and sustainable. As the adult radiology workstream of the review found it is inevitable that the needs of the modern health service will require more medical imaging, performed faster and available for many more hours per week. We need to find solutions to this and also ensure that it does not happen at the expense of service quality, patient safety and public confidence.
- 5.2 First and foremost any strategic approach to addressing this in paediatric radiology will require a workforce in sufficient numbers, suitably job planned, and with the appropriate levels of skills, training and professional and technical support to deliver first class care to the children of NI. Commissioning and workforce planning processes will need to better understand and reflect clinical need and practice within a modern radiology department.
- 5.3 We also need to be realistic about how much is achievable and how quickly. The review team are under no illusions at the scale of the financial pressures facing the HSC. Any potential investment in imaging services will therefore need to be firmly evidence-based and demonstrate exceptional value for money.
- 5.4 In acknowledging this however it must be noted that finance is not the only, or in many cases, even the primary rate limiting step to service improvement. Whilst the workstream recognises and supports 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 that any of these trainees will chose a career in paediatric radiology.
- 5.5 Our response to the challenges facing paediatric imaging must therefore be an innovative one. New models of working, clinical network approaches,

expansion of the role of radiographers, better links with primary care, and the development of regional referral guidance and pathways must accompany any additional investment in core capacity within paediatric imaging services. The remainder of this section builds on these key concepts. It articulates key steps to drive the necessary innovation in services.

Unscheduled care/out-of-hours

- 5.8 Each acute hospital site in NI has associated with it a radiology department within which a quantum of paediatric imaging must be made and reported upon. Within this hospital network the RBHSC acts as a regional centre, providing both DGH services to Belfast and tertiary paediatric imaging services.
- 5.9 In order to fulfil the vision set out in the Department's paediatric strategy it is imperative that children are able to access appropriate imaging which supports their care needs.
- 5.10 The particular issues in sustaining services in Trusts outside of Belfast were set out in section 1. Briefly it is the case that many departments outside of the RBHSC are heavily reliant upon a small (and diminishing) number of consultants with an interest in paediatric imaging, with services otherwise delivered by general radiologists and radiographers. It can therefore prove difficult for paediatricians to access the required level of specialist imaging to support patient care.
- 5.11 The review has considered these issues in detail and in particular the principles set out in the recent Departmental strategy for paediatric services, in which it is recommended that paediatric services should only be available on a site where there is an appropriate volume of cases and the relevant expertise available to deliver care safely and provide appropriate urgent cover.
- 5.12 It is clear from this analysis that a sustainable model is required for out of hours paediatric radiology services across NI. Finding a model that can be sustained involves consideration of a range of factors including the numbers of patients

involved, the sub-specialist skill mix within the NI radiology consultant body and appropriate underpinning pathways to surgical intervention, when required.

Out of Hours acute abdominal investigations

5.13 The tables below set out some key data on the numbers of abdominal paediatric US and Fluoroscopy procedures performed out of hours in NI over the last 3 years. This is not a completely exhaustive list of all relevant acute paediatric OOH investigations, but it serves as a very useful proxy indicator for the patient population we are considering.

<u>Ultrasonography</u>

Paediatrics 0-5 years Mon - Fri 6pm - 9am (US Abdo, US Abdo & Pelvis, US Abdo & Renal Tracts, US Intuss red)

Patients Age at Examination	(All)
Examination Code	(All)

	Examination			
Sum of Total Examinations	Year			
				Grand
Trust	2013	2014	2015	Total
В	51	46	34	131
Ν		2	1	3
S	1	1	2	4
SE		1		1
W	7	7	3	17
Grand Total	59	57	40	156

Paediatrics 0-5 years Sat & Sun (US Abdo, US Abdo & Pelvis, US Abdo & Renal Tracts, US Intuss red)

Patients Age at Examination	(All)
Examination Code	(All)

	Examination			
Sum of Total Examinations	Year			
				Grand
Trust	2013	2014	2015	Total
В	29	60	50	139
Ν	1	1	1	3
S	2	1	3	6
SE	3	5	1	9
W	10	15	11	36
Grand Total	45	82	66	193

Fluoroscopy

Paediatric 0-5 years Mon-Fri 6pm – 9pm (BA Meal & FT swallow & FT, Fluro abdomen

Patients Age at Examination	(All)
Examination Code	(All)

Sum of Total Examinations	Examination Year			
				Grand
Trust	2013	2014	2015	Total
В	9	11	16	36
SE	1			1
w	1		2	3
Grand Total	11	11	18	40

Paediatrics 0-5 years Sat & Sun (Ba Meal & FT, Swallow & FT, Fluoro abdomen)

Patients Age at Examination	(All)
Examination Code	(All)

Sum of Total Examinations2	Examination Year			
Trust	2013	2014	2015	Grand Total
В	3	12	17	32
Ν	2			2
S			2	2
SE	1	1	2	4
W			1	1
Grand Total	6	13	22	41

- 5.14 The data suggests that the number of investigations requested out of hours is small, averaging approximately 400 per year with the overwhelming majority (about 90%) performed in RBHSC. The data would appear to support the findings set out earlier in the report that, given workforce challenges, the defacto position in recent years has been that acutely ill children presenting out of hours with suspected acute surgical abdominal conditions such as intussusceptions/small bowel malrotation and volvulus/other abdominal surgical condition, in NHSCT and SHSCT have been referred to RBHSC.
- 5.15 It would also seem to suggest that the integrated specialist registrar cover between RBHSC and UHD is effectively directing children into appropriate pathways. Only the WHSCT would seem to be conducting a significant (in relative terms) number of out of hours investigations and these numbers are very small. It may also be true that paediatricians outside of Belfast are more likely to postpone the request for an investigation until the next day.
- 5.16 Nevertheless, we must bear in mind when considering these numbers that the patient cohort under consideration are acutely ill children and therefore may be at significant clinical risk; both intussusceptions and small bowel

malrotation/volvulus for example, are conditions with a high associated mortality and morbidity if not promptly diagnosed and managed.

- 5.17 There is a range of date available from the RBHSC which shows the number of confirmed cases of intussusceptions. A study showed that from 2007-12 there were 85, and from a 2.5 year window in 2012-14 there were 33. In 2015 there were 9 children with confirmed diagnosis of intussusception. In the first month of 2016 there were 2 cases.
- 5.18 Other data from RBHSC PACS shows that for the last 2 years there were 196 US exams requested using search term 'intussusception' with approximately 20 of these being positive and requiring radiology +/- surgical intervention. Given the small numbers involved in any one given year there may be significant variation however a consideration of the numbers across multiple years, utilising a range of search parameters would give a rough average of 15 confirmed cases per year. This is broadly in keeping with population-based episode estimates.
- 5.19 Essentially then, and recognising the inherent uncertainties in small data volumes, we can nonetheless make a conservative estimate that approximately 10% of relevant US investigations will result in a positive and that child requiring urgent surgical intervention. Additionally other acute conditions other than intussusceptions would require treatment at RBHSC and therefore the number of children eventually treated at RBHSC may well be higher than this.
- 5.20 The challenge for the HSC is therefore how we can put in place appropriate models of service delivery for this small, but vulnerable patient cohort, bearing in mind that despite the current small figures, any service model needs to accept that the cover provided must be available 365 days per year.
- 5.21 The workstream has considered a number of potential solutions to these challenges, and at the core of all of them is the ability to have on site consultant support for these specialised investigations. These proposed solutions have included; providing additional training for general radiologists in paediatric US

and fluoroscopy; expanding roles and skills of radiography staff to include these investigations where possible; and regional or cross trust consultant on call rotas were all considered.

- 5.22 Our considered view is with the workforce challenges, a single NI wider rota out of hours to cover the whole of NI would not be achievable. Likewise, for the specialised US and fluoroscopy studies a consultant radiologist is required and therefore these cannot be performed fully by upskilled radiographers.
- 5.23 The review considered the potential for dedicated training for general adult radiologists to contribute towards a solution. The review sought advice from the RCR who confirmed their view that it would be impractical to expect all consultant radiologists to maintain paediatric skills post certification as the volume of specialist paediatric imaging is relatively small. As a College, they strongly support the development of networks, which give equitable access for patients to specialist expertise in areas such as paediatric radiology and these networks have to cross traditional organisational boundaries.
- 5.24 The current activity figures for each Trust in NI support the college's conclusions. The data reveals that more than 50% of all paediatric US and greater than 66% of all paediatric fluoroscopy examinations are currently performed in the RBHSC. That is, less than 50% of paediatric US and less than one third of paediatric fluoroscopy exams in NI are done across the 4 Trusts outside Belfast with by far the vast majority of such studies being scheduled cases performed by the named paediatric radiology consultants within each Trust.
- 5.25 We find that there are simply not enough cases for consultant and radiographic staff outside of the RBHSC to learn from and maintain clinical competencies in the areas of paediatric US and fluoroscopy. This is a question of patient safety, equity of radiology service provision for children when compared to adults, and an issue of clinical governance for individual consultant radiologists

Medical and radiographic workforce

- 5.26 Section 1 of this paper set out the challenges in workforce across the subdiscipline of paediatric radiology within NI. This narrative will not be repeated, however it is worth reiterating the pressures faced not only in DGH sites but in the RBHSC where substantive vacancies exist in the consultant body and will require to be filled just to maintain – not enhance current service provision.
- 5.27 In light of these pressures both in sub-specialty and specialty we join with the radiology workstream in their recommendation of the urgent need for the development of a robust regional workforce plan. As that report points out this will need to consider further increases in the number of training places for radiology as well as more innovative ways of recruiting potential candidates for vacant consultant radiologist posts and the need to work collaboratively with the Royal College to optimise opportunities.
- 5.28 The radiology workstream correctly notes the growing recognition of the value and need for skill mix across imaging and that this should not just be about saving money.
- 5.29 In order to facilitate this in paediatric radiography it will require that radiographer training numbers are planned and balanced against the needs of an increased demand upon paediatric radiology services. Supporting radiographers to obtain higher qualifications in ultrasound and extremity reporting is vital and funding backfill to allow the time for this to take place is equally essential. There is a need to recognise that many of the US trained paediatric radiographers in RBHSC are within a sharply defined age bracket which will be approaching retirement over the course of the next decade. The programmes must be put in place to allow newer radiographers to be trained.
- 5.30 Training radiographers who work with children to perform routine MCUG examinations would also deliver significant gains. For any facet of skill mix/the extended role of the radiographer to be successful, then the on-going support of consultant colleagues both within radiology and paediatrics will also be

required and teaching, mentoring and audit need to be incorporated into consultant job plans.

- 5.31 With respect to undergraduate and newly qualified radiographers, an increase in the amount of time spent within the paediatric environment would be of benefit both to tertiary paediatric radiology services and to trusts outside of the RBHSC. This could serve to increase the interest in junior radiographers applying for posts with varying levels of paediatric work.
- 5.32 We would therefore strongly recommend the development of training and career development pathways for radiographers with an interest in paediatrics as part of a wider workforce analysis. The RBHSC could continue to support this development regionally.
- 5.33 In order to encourage more trainees to pursue paediatric radiology and thus ensure sustainable services we would recommend that all trainees be rotated through the RBHSC department for a minimum of 3 months during their 5-year training programme. Importantly, they need to spend time in the department not only as junior trainees, but also in the later years of their training, when they have mastered basic radiology skills and also have passed their theory examinations (FRCR part 2A) to allow them to appreciate primary and tertiary paediatric imaging in practise.

Paediatric Radiology reporting times

- 5.34 It is important not to lose sight of the fact that at the end of every image there are patients often coping with pain, stress or worry. Patients therefore have a right to expect that their investigations will be accurately reported as quickly as possible. It is essential that imaging departments support the patient and their care pathway by providing the reporting of images in a timely and high quality manner.
- 5.35 In the radiology workstream report they recognised that a balance needs to be found between quality and timeliness of reporting and that clinical teams should

be able to demonstrate 'end to end' imaging investigation turnaround times (i.e. from time of referral to report being available) including the reporting turnaround times from image acquisition to report availability to referrers. The report identified minimum data measurement points required to do this are:

- Date of referral
- Time of image capture
- Time of report dictation
- Time of verification
- Time of report issue (dispatched, not printed)
- 5.36 Ideally, paediatric inpatient and ED radiographs should be reported in less than 24 hours irrespective of where they were taken. NIPACS can assist with this either in the workplace or by providing true reporting workstations for consultants in their homes.
- 5.37 Cross sectional imaging studies should be reported the day they are performed (inpatients and emergencies). Outpatient CT and MR studies may be reported on the next working day if necessary.
- 5.38 It is important that times from examination to report are underpinned by robust standards which support effective clinical decision making and improve flow across the whole the patient pathway. It is important that this includes the use of the Independent Sector.
- 5.39 Trusts, commissioners and clinical professionals must embrace the opportunities presented by technological advance to improve patient care. Where technology underpins our service we must also have a quantum of redundancy and have access to technical support 24/7.

Radiology clinical networks

5.40 In September 2014, the Royal College of Radiologists (RCR) issued a short paper outlining the case for a new service model for radiology in the UK. The key thrust of the paper was to ensure that patients have access to the expertise of a radiologist with appropriate skills and sub-specialisation where appropriate. The RCR concluded that it was increasingly unfeasible in most hospitals to deliver the range of specialist support in a timely fashion across all clinical presentations. This is particularly evident in relation to paediatric "out of hours" services.

- 5.41 The RCR proposed that existing radiology services should collaborate to form networks of expertise serving much larger populations. The vision was that in future most radiologists will work in a distributed network fulfilling a dual role as generalists to their local healthcare community and as an expert resource to a wider network in their specialist areas of practice.
- 5.42 The adult radiology workstream of the review set out in its second report the merits of a network approach to address key challenges facing the imaging service in NI today. It was noted that co-operation between imaging departments is crucial to supporting patient care within the health service as recruitment / retention of radiologists as well as the need to optimise the skills of all imaging staff, and in using the equipment base and technology in ever more innovative ways to deliver the imaging service of the future.
- 5.43 These links are important for various reasons including building understanding of service issues being experienced across trusts, regional learning and the sharing of good practice as well as more clinical and patient care focussed actions including cross Trust reporting of specialist cases and 2nd opinion reading of difficult cases especially in specialist areas for example.
- 5.44 It is evident from the focus of this paper to date that paediatric imaging is a key area which could benefit from this regional networked approach. Whilst some important and innovative work has been taken forward to date there is a desire and willingness from amongst the NI paediatric imaging community to deepen and develop this into networks of care.

- 5.45 Paediatric radiology has a significant advantage over adult services in this regard as they are, in the main, united under a single RIS PACS system. We are also in agreement with our review colleagues in that reduction in local variation across the five HSC Trusts via achievement of ISAS accreditation could enhance and facilitate the opportunities for regional collaboration as well as delivering local improvements.
- 5.46 Therefore we recommend that regional paediatric radiology network arrangements are put in place to support the operation and development of the service regionally. These network arrangements should consider the benefits of "hub and spoke" models of care and pathways for out of hours acute care.
- 5.47 Network models have significant benefits including added resilience, consistency and sharing expertise and the sustainability these afford. It should be noted that the promotion of multicentre paediatric radiology audit and multicentre radiology discrepancy meetings are both essential to establishing radiology networks.

Regional referral guidelines and pathways

- 5.48 The radiology working group set out in their second report that the development of regional referral guidelines and pathways should be an important function of radiology specialist and non-specialist networks. The report noted that standardised guidelines across NI are useful in ensuring uniformity of radiology practice across the region and the advantages of this have been realised with the adoption of iRefer (RCR online referral advice) by all Trusts in NI and the availability of the same on the Trusts' intranets.
- 5.49 One of the primary aims when setting up the (currently informally constituted) NI paediatric imaging group was to standardise imaging algorithms for children across NI. This has to date already been instituted with respect to skeletal surveys in suspected non-accidental injury. Likewise the NICE/BSPR trauma guidelines have been accepted as best practise.

- 5.50 Current research and audit is underway to develop guidance for the imaging of cervical spine trauma in children, the follow up of antenatal hydronephrosis and the investigation of familial VUR. Further discussion is also underway with the RBHSC nephro-urology team regarding the NICE guidelines for the investigation of UTIs in children and also how best to follow up children with a neonatal diagnosis of MCDK.
- 5.51 Through further audit work, communication with clinical colleagues and reference to both NICE guidelines and the RCR's iRefer booklet, it ought to be possible to standardise imaging guidelines for children in NI. We recommend that this standardisation should become a key aspect of future network approaches to paediatric imaging.

Interaction with primary care

- 5.52 It is essential that interaction between radiology departments and primary care colleagues is optimised at all stages. To ensure this a significant piece of work is required to determine with GPs the level and extent of direct access they would wish and how necessary pathways can be established to give effect to this. This will require primary care colleagues to have clear guidance in order to use iRefer to best effect.
- 5.53 We concur with the findings of adult radiology workstream that patients should be able to obtain imaging as close as possible to their home and that this could be best achieved through a 'choose and book' system for radiology appointments directly from primary care. Introduction of advanced booking systems in radiology departments offering choice would be a reasonable step towards this.

Streamlined, responsive commissioning

5.54 The paediatric workstream has no strong views on the commissioning model in NI. It is recognised however that volume/activity or tariff based systems would be likely to work well in driving developments and incentivising productivity in diagnostic services. Of much greater importance than the model is that services

are planned and recurrently resourced adequately to meet demand. There must be clear and transparent processes for achieving this.

- 5.55 It must be recognised that service development in other clinical specialties will almost certainly result in imaging consequealia and this is not being reflected in increased investment in radiology departments at present. For paediatric radiology this means that future commissioned paediatric posts and services must reflect the demands any new consultant will make upon imaging from requesting examinations to clinical care in MDTs.
- 5.56 The workstream does not support the outsourcing of paediatric radiology examinations to the independent sector where they may be reported upon by non-paediatric trained radiologists. The implications for patient safety and standards mean this is not of clinical benefit. The potential for a centralised NI paediatric imaging network model to report on these images is greatly preferred and would represent a safer and more effective service. We recommend that the requirement and potential for this model be explored and that the necessary investment is made to support it.
- 5.57 Future developments within the specialty of paediatric radiology include an expansion of paediatric PET/CT, the continued development of PET/MR, a wider use of both fetal and post-mortem radiology (principally MR and a combination of MR and CT for the latter), alongside technical developments in US and CT will all require additional funded capacity into NI paediatric radiology services in the next decade.
- 5.58 There will also need to be recognition of the growing demand for paediatric interventional radiology. This should be considered as part of the development of the regional IR network and the commissioning specification underpinning.

Safeguarding and clinical governance

5.59 Adequate training of both radiographic and radiology consultant staff, and the provision of child friendly waiting areas are important for the safety and

wellbeing of children attending for imaging investigations. Implicit too, is the need to have modern equipment that utilises radiation dose reduction technology, such as automatic exposure control (kV and mA), organ dose modulation and iterative reconstruction during CT examinations. RBHSC staff will share any paediatric CT protocols requested by other trusts.

5.60 All staff working with children must have regular training in child protection to be cognisant of issues around paediatric consent and also and non-accidental injury training. The NI paediatric radiology group will continue to work together to develop regional guidelines for imaging children and to collaborate with cross trust audit projects. Protocols adopted by the BSPR, RCR, ESPR and NICE should be referenced by this work and adapted as necessary to local needs. Individual trusts must recognise the need for audit, discrepancy meetings and MDT meetings in consultant job plans.

ICT in medical imaging

- 5.61 The reliability of NIPACS requires continued improvement; technical problems out of hours can prevent work being completed. A 24/7 service should be instituted to fix any faults without delay.
- 5.62 It should be recognised that radiologists spend a great deal of time at their workstations and greater consideration should be given to their ergonomic design to protect the health of radiologists who spend many hours in front of computer screens every working day.
- 5.63 For those consultants who utilise a 'home link' access to PACS out of hours, the speed and reliability of this service is of concern and consideration should be given to optimising this. In particular general PC monitors are not sufficient to report all clinical circumstances and reporting terminals should be provided. The provision of voice recognition software at home is also vital to support home reporting.

Maximising imaging resources

- 5.64 As outlined above the establishment of paediatric radiology networks, an extension of paediatric MR provision within the RBHSC and funding the running of a second US machine in the RBHSC would assist in utilising the skills and equipment that already exist.
- 5.65 Continued scrutiny of paediatric radiology referral forms with careful protocols for complex imaging mean any exams which are performed are justified and are of a high standard. This takes time for a consultant to do and requires job plan recognition.

Medical Physics

- 5.66 Medical Physics support for Paediatric Imaging is not specifically addressed in this document. However the Medical Physics issues outlined in the Radiology Workstream papers are equally applicable to the Paediatric Imaging. 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.

Recommendations

- there should be an immediate and sustained increase in the number of NI radiology trainees to address increases in demand;
- the HSC should put in place enhanced network approaches to support the operation and development of paediatric imaging services regionally;
- standardisation of paediatric radiology clinical guidelines should become a key function within these network arrangements;
- operations and systems from examination to report should be underpinned by robust standards which support effective clinical decision making and improve flow across the whole the patient pathway;
- the HSC should utilise network approaches to vire resources from the independent sector to support and develop core capacity at the regional centre;
- all staff working with children must have regular training in child protection and non-accidental injury and to be cognisant of issues around paediatric consent;
- services must be planned and recurrently resourced adequately to meet demand. There must be clear and transparent processes for achieving this;
- further commissioned paediatric posts and services must reflect the demands any new consultant will make upon imaging from requesting examinations to clinical care in MDTs;
- where technology underpins service we must also have a quantum of redundancy and have access to technical support 24/7;

- work should be undertaken to improve the speed and reliability of 'home link' access to PACS. Reporting terminals should be provided at home. Voice recognition software should be provided on home stations;
- HSC Trusts should recognise the need for audit, discrepancy meetings and MDT meetings in consultant job plans;
- middle grade pre-fellowship radiology trainees should rotate through the RBHSC to increase exposure to and experience of paediatric radiology;
- promotion of the extended role of the radiographer regarding reporting of paediatric extremity radiographs, (some) paediatric US exams and the performance of MCUG examinations;
- there should be recognition of staff training requirements, increased MDTs within consultant job plans
- the HSC should promote the use of the ALARA principle and ensure that radiology equipment utilises the best in manufacturer introduced dose reduction technology

SECTION 3: "HOW WE GET THERE" – A SAFE, EFFECTIVE AND SUSTAINABLE PAEDIATRIC IMAGING SERVICE FOR NI

- 6.1 The workstream has considered the issues and challenges outlined within the previous sections with care. It is our view that the current structure and service configuration of paediatric imaging in NI is unsustainable and that it is not delivering the levels of care we wish or expect for children in Northern Ireland. This is particularly evident outside Belfast and in out of hours care.
- 6.2 In section 2 we considered the type of service we would wish to deliver and made an initial consideration of the direction of travel towards this, recognising that this was likely to involve a range of different measures. These were the subject of a number of subsequent recommendations.
- 6.3 The purpose of section 3 of this report is to make an analysis of "how to get there", e.g. what are the gaps between the service currently in place and the service that we would wish and that is achievable in NI. Arising from this analysis we then make a series of proposals for the development and reconfiguration of paediatric imaging in NI.

Model of Out of Hours care

- 6.4 The potential for the sustainable provision of a local out of hours paediatric radiology service in each Trust, staffed by the appropriate clinicians, has been considered. We have concluded that given the current and likely future staffing position both in paediatric and general radiology, the volume of clinical cases both in and out of hours necessary to maintain professional competence and the increasing specialisation and subspecialisation of practice, that this was not achievable within a reasonable timeframe.
- 6.5 In response to this finding, which has been shared with the project board of the imaging review, the project director of the review and the Deputy Chief Medical Officer convened a meeting with clinical representatives from across paediatric services. Invitations were issued to the clinical director/leads in each Trust for

paediatric medicine, clinical radiology, paediatric radiology, and from representatives from BHSCT in paediatric emergency medicine and paediatric surgery.

- 6.6 There was clinical consensus on the urgent development of an effective clinical pathway for US/Fluoroscopy investigations of acute abdominal pain in young children and infants out of hours. It was further agreed that the nature of the clinical conditions, the associated investigation modalities, clinical volumes and workforce meant that would be centred in RBHSC.
- 6.7 It was important to note however that the expectation would be that the other out of hours imaging needs of children, for example CT, radiographs etc would continue to be met locally. The NI paediatric radiology group have developed guidance on the range of investigations which should be performed locally in hours in DGH acute units.
- 6.8 The recommendation of the workstream is therefore that NI develops a regional out of hours (acute) paediatric ultrasonography and fluoroscopy service based in the RBHSC. We recognise that detailed clinical pathways will need to be developed jointly with colleagues in paediatric surgery, paediatric medicine and paediatric emergency medicine along with NIAS. We also recognise that any new model may require investment. However our focus is to ensure a safe and effective service for children.

Model of in-hours care

- 6.9 As discussed in section 1, all hospitals in NI which have an acute paediatric unit are expected to provide diagnostic paediatric imaging including, MR, CT, US, Fluoroscopy, and radiographs. The challenges to providing this range of services has been already discussed at length, although it is accepted that the challenges are not as extensive in hours as out of hours services.
- 6.10 The workstream has considered a detailed account of the numbers in the paediatric consultant body, current waiting times and the range of paediatric

imaging services etc provided in each of the HSC Trusts. On the basis of this evidence as well as the wider methodological approach outlined in section one, the clinical and professional body of paediatric radiologists have made a similar assessment of the steps required to put in-hours services on a long term sustainable footing.

- 6.11 Section 2 of this report outlined where we want to be with regard to our services in NI. Briefly this involved more regional working, better skills mix, regional specialty developed guidance and robust clinical pathways, enhanced clinical networks underpinned by commissioning which is better aligned with clinical need.
- 6.12 It is our view that, given the range of challenges and opportunities that a key element of achieving this broad strategic vision for paediatric imaging necessitates, in part, a shift toward a hub and spoke model of care. This is likely to mean a shift toward more central co-ordination of services within the RBHSC hub to make services more sustainable. This is a long term vision which we expect to be able to evolve over the coming years.
- 6.13 However in the short term it has become increasingly apparent within NI that there are geographical regions which are struggling to provide the range of imaging services which are required to support acute paediatric services. In large part this is due to difficulties with training, recruitment and retention which is, to a large extent, beyond the ability of individual Trusts to control and is a national and international phenomenon.
- 6.14 We have considered these circumstances carefully. If we are to adopt a standards based approach to the provision of services; one driven by clinical evidence, patient need and care experience then this is likely to mean that how we deliver services will in some cases need to change.
- 6.15 In particular, should it become no longer possible to sustain of in-hours services which meet the necessary standards of care, and where it is clear that urgent

action is therefore required, then in our view there should be an immediate shift toward the implementation of a hub and spoke model of care.

- 6.16 Detailed clinical pathways and contractual arrangements will need to be put in place before this can be achieved and the detail of these can be addressed outwith this paper, however within this vision it would be anticipated that consultant appointments could be made centrally to RBHSC, where the workload, clinical case mix etc make these posts more sustainable. A full range of clinical diagnostic support would then be provided to spoke Trusts. To illustrate:
 - plain film / CT /MR reporting could be conducted remotely at hub via NIPACS;
 - advice would be available to spoke paediatricians from hub via phone or ICT (or directly with on-site visiting radiologist);
 - dedicated US/Fluoroscopy lists could be performed in spoke site by visiting radiologist;
 - Regular MDT meetings could also be held.
- 6.17 The benefits of this model would be immediately felt. DGH Trusts would likely benefit from a more responsive plain film reporting service, have better and easier access to specialist advice, have access to regular MDTs, US and flouroscopy lists and they would benefit from the inherent resilience afforded by a central provider as opposed to isolated practitioners. The hub meanwhile would benefit from the "out of hours" on call component of the radiologist time, reducing the on-call rota, strengthening resilience and therefore making consultant posts move attractive to trainees and applicants.
- 6.18 An overall benefit for the service as a whole would be improved communication and clinical interaction between paediatrics and radiology across the region.
- 6.19 The patients in the spoke Trusts will see only a positive difference in service availability with services provided locally (in hours) and the region as a whole would benefit from enhanced resilience. When combined with regional

networks and the development of enhanced clinical guidance and pathways this has the potential to greatly improve services to children regionally.

- 6.20 It is also our view that future "joint appointments" should be managed within this model as opposed to two or more trusts entering into more complex governance arrangements.
- 6.21 Following a detailed assessment of the current challenges in volumes and consultant numbers in each Trust and based on a balance of these issues and challenges against the standards identified we believe that this model should be rolled out immediately in the NHSCT.

Relationship with the Independent sector

- 6.22 Our narration of the model for the use of the independent sector in paediatric imaging is not lengthy. As stipulated in section 2, the workstream does not support the outsourcing of paediatric radiology examinations to the independent sector where they may be reported upon by non-paediatric trained radiologists. The implications for patient safety and standards mean this is not of clinical benefit and not in keeping with the standards set out above.
- 6.23 It is furthermore the overwhelming preference and advice of the paediatric radiological clinical community that all independent sector paediatric imaging be discontinued. The resources currently expended on this should be veered to the RBHSC who will provide the necessary reports. This is doubly advantageous as it reinforces and supports the strategic vision outlined above. It is our view that an immediate start could be made with regard to plain x-ray reporting regionally and this should be piloted as soon as possible.

Fulfilling the vision

6.24 The third stage of the pathway outlined for this section was the definition of a set of key enablers that would be necessary for the fulfilment of our vision. The greater part of these enabling actions are set out in the recommendations at the

end of section 2. These should augmented by the further work which is required to fulfil the models set out in the section above. These key enablers include:

Commissioning & Investment

- investment to increase capacity at RBHSC to provide hub services, including virement of resources from use of IS and realignment of commissioned posts

Clinical/Professional

- Development of robust clinical pathways for patients out of hours US and fluoroscopy;
- Strengthening in-hours services and improving regional resilience;
- Defining hub and spoke models within job plans.

HSC Trusts

- Effective governance arrangements underpinning hub and spoke and out of hours models.

Conclusion

- 7.1 It is our view that the recommendations and findings of this report offer the best chance for a generation to set paediatric radiology on a safe and sustainable footing. Much further detailed work will be required to analyse, scope and define how the models outlined within this report will operate.
- 7.2 Extensive clinical engagement will be required to develop the clinical pathways which will support and facilitate these. New ways of working including regional networks will create challenging governance issues which also must be resolved. The way we commission and invest will also need to flow from these. This report therefore is just the beginning of the process of reform, a vision for how services can and should be delivered to the children of NI.
- 7.3 Finally, the workstream would like to offer its thanks to everyone who has contributed to this report and the work of the review team. We would not have been able to proceed without it.

Appendix 1

REVIEW OF IMAGING SERVICES IN NI

Aim and Terms of Reference

Aim

To produce a 10 year strategic framework to underpin the delivery of timely and effective Imaging Services to the people of N. Ireland.

Terms of Reference

- To evaluate and make recommendations on the configuration of imaging 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 investigation with prompt reporting to enable accurate diagnosis and treatment;
- Make recommendations to decrease inappropriate patient investigations thereby reducing unnecessary exposure to radiation.
- To make recommendations regarding the workforce needs of future service models having regard to:
 - extant professional, clinical and Departmental guidance;
 - clinical roles and limits of professional competence;
 - building effective working relationships 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.
- Agree a strategic approach to the replacement of existing imaging technologies/equipment and the introduction of new technologies
- Ensure services are underpinned by effective governance and quality assurance mechanisms, with particular reference to tele-radiology, and in the independent sector.

Paediatric Workstream members

- Anne Paterson RBHSC (BT)
- Niall MacKenzie Altnagelvin Area Hospital (WT)
- Jenny McKinstry Radiographer RBHSC (BT)
- Nigel Wethers (Imaging Services Manager) (BT)
- Joanna Turner UHD (SET)
- Anne Carson CAH (ST)
- Patricia Higgins Antrim Area Hospital (NT)
- Radiographer DGH (Janet Eagle, CAH, ST)

Co-opted members (input as required)

- Members of the NI Paediatric Radiology Group
- Dr Brian Grant Paediatric Cardiologist RBHSC (BT)
- Dr Anthony McCarthy Paediatric Oncologist RBHSC (BT)
- Mr Alistair Dick Paediatric Surgeon RBHSC (BT)
- Dr Paul Jackson Paediatrician RBHSC (BT)
- Dr David Sweet Neonatologist R-JMH (BT)
- Dr Owen McNally Nuclear Medicine Radiologist RVH (BT)
- Dr Anton Collins Radiology training programme director (NIMDTA) & Interventional radiologist RVH (BT)
- Dr Steven McKinstry Neuroradiologist RVH (BT)
- Mr Adam Workman Medical Physicist

Paediatric Objectives/Terms of reference

- To evaluate and make recommendations on the configuration of imaging 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:
 - With respect to paediatric imaging services, must respect the wide range of ages that paediatric radiology services encounter, and especially the proposed increase in age from 14 years to 18 years to be cared for by paediatric radiology specialists.
- To make recommendations to ensure that patients receive timely radiological investigation with prompt reporting to enable accurate diagnosis and treatment:
 - Paediatric radiology exams must be performed and reported by radiographers and radiologists appropriately trained in paediatric radiology per BSPR/RCR/Association of paediatric radiographers guidelines.
 - Maintain this service provision 24 hours a day, 7 days per week.
- To make recommendations to decrease inappropriate patient investigations thereby reducing unnecessary exposure to radiation:
 - Continue to support the ALARA principle and follow IR(ME)R, with all exams being justified and imaging protocols optimised.
 - Ensure access throughout the Province to imaging modalities, which do not require the use of ionising radiation.
- To make recommendations regarding the workforce needs of future service models having regard to:
 - o Immediate, medium term and long term service provision
 - Planned new regional paediatric and maternity hospitals
 - Equity of imaging screening protocols/services throughout NI
 - Extant professional, clinical and Departmental guidance
 - Clinical roles and limits of professional competence
 - Building effective working relationships between paediatric imaging services and wider paediatric clinical service providers
 - Ensuring region wide service resilience with appropriate escalation arrangements.
- To make recommendations regarding the most efficient and effective use of available resources
 - Including the redistribution of resources (both monetary and of staff) as paediatric radiology services care for older children and adolescents.
- To consider the potential for joint initiatives both nationally and internationally including on a cross-border basis:
 - Including continued promotion and support for technology to achieve this aim (the use of the Image Exchange Portal [IEP]/"Burn Bank").
 - To ensure where possible, that children have their imaging investigations performed locally, even if they require to go elsewhere for treatment or

surgery, and for children to have their post-procedure imaging studies performed here in NI.

- To make recommendations regarding the necessary investment in imaging technologies to meet service configuration including:
 - The replacement of existing imaging technologies and the introduction of new technologies.
 - The imaging and communication technology platform underpinning imaging services (PACS and other storage systems)
 - Avoid the outsourcing of paediatric radiology reporting.
 - Joint paediatric MDTs between Trusts within NI and with paediatric centres outside of the Province.
- Ensure services are underpinned by effective governance and quality assurance mechanisms, with particular reference to tele-radiology, and reporting in the independent sector.
- To consider the role of imaging services in support of clinical research.

Particular considerations for paediatric workstream:

- To obtain a balance between central and DGH paediatric radiology service provision so that clinicians working with children have ready access to imaging services and reports, and can utilise tertiary radiology expertise, for example via regular MDTs/"hub & spoke" provision of services between DGHs and regional children's hospital or joint appointments/the use of NIPACS and the IEP. Such a service must be available to children, their carers and the local paediatrician 24/7.
- An increase in the (currently considered) out of hours paediatric radiology provision through increase use of the extended working day and routine weekend work.
- To ensure that children are imaged in a paediatric "friendly" environment, with separate provision for adolescent patients.
- $\circ\,$ To improve access to services providing for sedation/GA if necessary for imaging examinations.
- Equality of imaging service provision for NI's children not just acutely but for example with respect to screening services and chronic conditions. Aim to provide investigations locally, even if they are reported centrally.
- Organise appointment schedules with the aim of co-ordinating clinical visits and imaging investigations.

Appendix 4

GLOSSARY

MRU	=	MR Urogram
DMSA	=	Static isotope scan chiefly used to evaluate for renal scans
MAG3 Renogram	=	Dynamic isotope renal scan chiefly used to evaluate for
	possib	le renal obstruction
PUJ	=	Pelviureteric junction
VUJ	=	Vesicoureteric junction
FB	=	Foreign Body
SUFE	=	Slipped Upper Femoral Epiphyses
AXR	=	Abdominal X-ray
CXR	=	Chest X-ray
US	=	Ultrasound
СТ	=	Computed Tomography
MRI	=	Magnetic Resonance Imaging
IVU	=	Intravenous urogram
NAI	=	Non-accidental injury
SUDI	=	Sudden unexplained death of an infant
CTA or MRA	=	CT or MR angiography
OPG	=	Orthopantomogram (view of mandible & teeth)
FTT	=	Failure to thrive
GI	=	Gastrointestinal
GOR	=	Gastro-oesophageal reflux
VUR	=	Vesico-ureteral reflux.
SBS	=	Small bowel series
CF	=	Cystic fibrosis
DIOS	=	Distal intestinal obstructive syndrome

ABBREVIATIONS

ALARA – 'As Low As is Reasonably Achievable'

BCH – Belfast City Hospital

BSPR – British Society of Paediatric Radiology

BT - Belfast Trust

CT – Computed Tomography

CXR – Chest x-ray

DGH – District General Hospital

DHH – Daisy Hill Hospital

ED – Emergency department

FRCR – Fellowship of the Royal College of Radiologists

GA – General anaesthetic

GP – General practitioner

IR – Interventional radiology

IR(ME)R – Ionising Radiation (Medical Exposure) Regulations

MCUG – Micturating cystourethrography

MDT – Multidisciplinary team meeting

MIH – Mater Infirmorum Hospital

MPH – Musgrave Park Hospital

MR – Magnetic Resonance (Imaging)

MSK - Musculoskeletal

NI - Northern Ireland

NIPACS – Northern Ireland Picture Archiving and Communication System

NT - Northern Trust

PA – Programmed Activity (equates to 4 hours or a morning or afternoon 'session' during the normal working week)

RBHSC – Royal Belfast Hospital for Sick Children

RCR - Royal College of Radiologists

R-JMH – Royal-Jubilee Maternity Hospital

RVH – Royal Victoria Hospital

SET - South-eastern Trust

SIG - Special interest group

SPA – Supporting Professional Activity

ST – Southern Trust

VUR – Vesico-ureteric reflux

WT - Western Trust

WTE – Whole time equivalent

UHD - Ulster Hospital, Dundonald

US - Ultrasound