Delivering Imaging Research in the NHS: a network approach

Workshop Report

7 February 2017

It is important to note that the views expressed in this document are those expressed by workshop delegates and not necessarily those of NIHR or the Department of Health.

Preface

New medical imaging technologies and analytical techniques are driving significant advances in patient care and radiologically-informed medicine has significant potential to improve individual health and wellbeing.

The brief of the National Institute for Health Research (NIHR) Clinical Research network (CRN) is to provide effective and efficient support for the delivery of imaging research in the NHS. This support entails working closely with patients, researchers, funding partners and the life sciences industry to realise the potential of imaging research and implement findings in the UK healthcare system.

A workshop entitled *Delivering Imaging Research in the NHS* was organised by the NIHR CRN and held on 7 February 2017. Drawing on a discussion paper circulated in advance of the workshop, and a series of authoritative presentations on the future of imaging research, attendees addressed a series of challenges and opportunities aimed at better realising the potential of advances in clinical imaging science. This document summarises the workshop findings and includes a Roadmap designed to ensure that the shared aspirations of the contributors realised.

I am very aware that the real success of any workshop can only be measured by the subsequent changes which are made in practice. I am very grateful to all who contributed to the workshop and hope that the Roadmap, which provides the opportunity for all attendees to actively participate in delivering the outline plan, will advance the delivery of imaging research in the NHS.

Professor Stephen Smye OBE
National Institute for Health Research Clinical Research Network (NIHR CRN)
Speciality Cluster Lead
King's College London

Introduction

This report summarises discussions at the *'Delivering Imaging Research in the NHS: A Network Approach'* workshop organised by the NIHR CRN Imaging Research Steering Group and held in London on 7 February 2017. The workshop gave delegates an overview of the current status of, and opportunities for, imaging research in England. Speakers highlighted the challenges associated with delivery of stratified medicine research, of which imaging is an increasingly important element, ways to develop the imaging research workforce and how best to exploit big data to the benefit of imaging studies. Speakers from industry shared their perspective on new developments.

Delegates drawn from the following communities contributed.

- Imaging researchers – both clinical and academic
- Radiologists
- Radiographers
- Patients and public involved in research
- The life sciences industry
- Research funders
- UK Government
- Regulatory organisations

The overarching aim of the workshop was to develop a Roadmap that would set out a series of steps to improve the delivery of imaging studies in the NHS. The Roadmap combines suggestions from workshop delegates with steps suggested in a discussion paper developed by the Steering Group "*Delivering Imaging Research in the NHS*" and circulated to delegates in advance of the workshop.

The Roadmap sets out five areas for action:
- Workforce
- Infrastructure
- Science
- Industry
- Engagement and Patient and public involvement

This report provides an opportunity for all workshop attendees to join an NIHR CRN Imaging group and thereby contribute to the realisation of the Roadmap.

Summary of Workshop Discussions

Medical imaging is a rapidly developing science. Imaging has many established diagnostic tools but new technologies and analytical techniques are improving diagnostic accuracy and disease monitoring which is influencing new patient care pathways. There is a growing role

for image-guided surgery and therapeutic intervention and imaging biomarkers have potential importance in stratified medicine with increased relevance to individual patients.

Growing clinical demand for radiology is putting pressure on the capacity for image-related research in the NHS. This increase in NHS imaging activity is leading a shift away from the importance of research in clinical training pathways for imaging professionals (nuclear medicine physicians, nuclear medicine technologists, and physicists). A shortage of imaging professionals coupled with a high demand for their skills means that clinical trainees are more likely to gain a Consultant appointment without having done any research other than as an undergraduate.

The NIHR CRN role is to ensure effective and efficient support for delivery of high quality research in the NHS. Imaging is a cross-cutting discipline and is integral to all healthcare, for example: cancer, heart disease, neuroscience, dementia and many other clinical specialties. The combination of the pivotal role of imaging in modern medicine and the pressure on NHS imaging services means the CRN needs to find ways to increase the capacity of the NHS to deliver imaging research to ensure provision of the imaging services required by the patients in the future.

At the workshop delegates were asked to focus on two challenges for imaging research:

- developing workforce to deliver imaging research
- exploiting the opportunities provided by big data.

Other topics were also considered and this report summarises the presentations given by a series of invited speakers and subsequent delegate discussions. The discussion included a Q&A session with a panel invited from industry, before setting out a plan for action in the form of a Roadmap.

Developing the Workforce

Imaging research is highly multi-disciplinary; much imaging research is led by radiologists, radiographers, nuclear medicine physicians, medical physicists or consultants from other medical specialities. A large proportion of imaging research is undertaken by non-clinicians including computer scientists, chemists, engineers and mathematicians. These disciplines come together to work in a hospital setting in part because, like clinicians, they want to find new ways to improve patient care. Working together within the framework of the NHS enhances this focus on patients because of the potential to translate innovation into clinical practice.

Currently there is significant pressure on NHS imaging services which in turn has a significant impact on the existing imaging research capacity in the NHS. Protected time for research in job plans is limited and imaging research is delivered by staff who also have a full time clinical role but participate in research because they find research interesting. Access to imaging hardware and systems for research is limited in some regions.

Workshop delegates reported that it is challenging to encourage clinical trainees into research when more senior NHS positions may be secured without research training. Most university teaching hospitals have no radiology academics. On many occasions the principal or chief investigator of an imaging study is from another discipline or specialty.

Clinical radiologists, radiographers, physicists, technical staff and nuclear medicine physicians are the part of the workforce who will ultimately translate science into clinical practice. Evidence shows patients have better morbidity, mortality and comply better with treatment in institutions committed to research. Research training should ideally be incorporated in training courses provided by Health Education England, the Royal College of Radiologists, Royal College of Physicians and the Society of Radiographers. The message that research can be both beneficial and interesting should be purposefully included in these trainings and the above-named institutions are key in achieving the purpose. NIHR could build on existing support for imaging in academia, to help to build a stronger academic infrastructure for radiologists and nuclear medicine physicians, by inviting the universities associated with teaching hospitals to create honorary academic positions at little or no cost to the university. NIHR could partner with research charities or research councils to offer funding, with the aim of increasing the strength and number of academic radiology departments.

Delegates reported that a **dedicated research nurse** not only makes research more efficient but often makes it possible. A research nurse post is sometimes more cost efficient and effective than trying to buy out a radiologist's clinical time for research. Funding should be for a minimum of three years to make the posts attractive. A hub and spoke operational model for these staff has been developed by several local CRNs and has proved effective.

Delegates suggested designation of **regional imaging champions** who can coordinate and advocate research in their region and who would help support staff less experienced in research methodologies or who have not previously considered research as a career pathway. Whilst funding for these roles is not within the brief of NIHR CRN, other sources are available. The designated individual could also support grant applications and advise on costings and other technical issues relating to imaging studies.

Workshop delegates made reference to barriers relevant to supporting research; for example, radiographers working in small hospitals where the main clinical team is not research active causing a sense of isolation from research opportunities. A **virtual imaging network** for all those involved in research would create a potential source of expertise and support to the benefit of the whole imaging research community – the Network could be run using a Google site, LinkedIn group or other social media tool. The imaging network could hold regular workshops, locally and nationally, to bring people together to share skills and learning.

Delegates suggested that financial contributions to enable the creation of a research time fund could be discussed with the third parties who deliver some of the imaging services in the NHS and other industry partners. If such a fund were established the aim is that it would

5

be deployed nationally to buy-out protected time to enable consultants and other clinical staff to conduct imaging research.

Delegates described Excess Treatment Costs (ETCs) as one of the biggest barriers to imaging research. When a patient is referred for clinical imaging, if they also then take part in a research study the cost of the extra scans required for the study are labelled as ETCs. It is expected that these ETCs be met by the commissioning group associated with the patient. This is rarely possible, especially in smaller hospitals. If the researcher cannot gain approval for ETCs, the research does not take place. Researchers report getting to the point where a study is ready to go ahead and then having to stop because they are unable to get approval for ETCs. It was suggested that if the additional requirement was defined as a research cost rather than a treatment cost it might eliminate this barrier.

Exploiting the Potential of Big Data

Medical image analysis is increasingly combined with research which uses robotic pattern recognition and other analytical algorithms permitting visualisation of tissues in both 2D and 3D. This has the potential to transform the way imaging is used in medicine. For example, camera augmentation images which are overlaid on a patient's body to help guide orthopaedic surgery.

It is crucial to remember that big data is patient data and there remain issues around consent for data sharing. Workshop delegates agreed that it is important to share examples of progress made using patient data with a wide audience to help build public trust.

The industry sessions at the workshop emphasised the exploitation of big data with a focus on image repositories and analytics. Industry is building the technology that will allow imaging data collected in research, or in clinical practice, to be securely stored and analysed for other researchers to use for data mining or other research purposes.

Delegates supported the creation of an image repository linked to cognate clinical data across a range of specialities that uses existing NIHR, UK Biobank and Cancer Research UK infrastructure. The NIHR Health Informatics Collaborative could contribute to this programme and the utility of the existing XNAT platform used in cancer imaging was noted. Cognate data are crucial to enable the proper use of imaging data sets and at present the predictive power of imaging could be further enhanced. Trained clinical and non-clinical staff are required to manage data and it was recognised that there is a current capacity and skills gap in the NHS workforce in this area, which is being addressed by the NIHR Academic Clinical Fellowships through competition posts.

The workshop noted that informatics governance frameworks need to be further developed to make the most of the potential of big data to transform both imaging research and imaging-led medicine. There are particular challenges to overcome in standardisation, data sharing, consent to share anonymised data, coding of clinical data and in creating the means to share large data sets.

Successful exchange of digital information is the key to imaging research. In reality, different studies gather data on different machines, captured by different operators according to different standard operating procedures. We need to develop ways to improve harmonisation to make data meaningful. This may mean performing additional scans to feed data up, or down, to **standardise acquisition**. To be able to share data common databases are required. Researchers need to share the algorithms they use to help benchmark and analyse new algorithms.

Researchers report that there are barriers to sharing information with teams in other locations or even with neighbouring hospitals due to different data governance rules in different NHS trusts. For example; password length, how often you must change it, or which bits of patient information may be permissible to share all seem rather variable. Lack of harmonisation means that it is difficult to exchange and link data sets between organisations. **Harmonising data governance** would help with healthcare, for example if it were easier to share patient information between local hospitals.

Roadmap

The Roadmap comprises a series of tasks designed to improve the delivery of imaging studies in the NHS and is grouped into five areas for action: workforce, science, infrastructure, industry, new providers, engagement and patient and public involvement. It combines ideas proposed at the workshop with those already outlined in the initial discussion paper. There are two types of actions proposed; those on which NIHR CRN takes lead responsibility and those for which NIHR CRN plays a supporting role.

- **Workforce**

    Objective: to increase the capacity and capability of the NHS and academic imaging research workforce.

    Workstream Lead: Prof Vicky Goh and Dr Beverly Snaith
    Anthea Mould (CRN support)

    Outline plan

    − Support for national schemes designed to increase research time for NHS staff; for example, a possible **Associate Professorship scheme** with the RCR and NIHR CRN.
    − Publicize opportunities for **NIHR Fellowships** in imaging research.
    − Contribute to review of NIHR Integrated Academic Training programmes, including greater flexibility in NIHR Academic Clinical Fellowship and Clinical Lecturer schemes. For example, continuation as a Clinical Lecturer concurrent with NHS Consultant appointment.
    − Embed research training into the training pathway for clinical radiology and for radiographers.
    − Include a series of questions on research in the Royal College of Radiologists workforce survey and equivalent exercises with other professional bodies.
    − Roll out NIHR CRN Research Literacy materials. Discuss support for existing initiatives with the James Lind Alliance, Royal College of Radiologists, other professional organisations and the CRN.
    − Deliver a campaign using research literacy materials (noted under Engagement), share examples of new health benefits enabled by use of patient data in research.
    − Use the **Royal College of Radiologists Research Certificate** as a competency framework.
    − Contribute to the Royal College of Radiologists and Society of Radiographers imaging survey accreditation scheme administered by the UK Accreditation Service.
    − Explore replication of the model developed by the National Institute for Academic Anaesthesia Research and Audit Federation of Trainees to increase trainee

engagement in research. This includes securing external funding for a large-sample CRN portfolio study.

− Appoint **local imaging champions** by nominating an imaging lead in each LCRN and develop a cadre of leaders who promote and develop imaging research roles, and promote opportunities provided by the NIHR.

● **Infrastructure**

Objective: to improve the efficiency of the use of existing imaging systems in the NHS for research.

Workstream Lead: TBC

Outline plan

− Review NIHR CRN Central Portfolio Management System (CPMS) fields to ensure that 'imaging' is recorded for all studies (Interventional and Observational)
− Work with research funders and NIHR CRN Attributing the costs of health and social care Research and Development (AcoRD) user group to review service support and research funding models for imaging studies, including Excess Treatment Costs.
− Review support processes for research set-up, including model contracts; to ensure imaging research is fit for purpose.
− Review possible solutions to addressing Extra Treatment Costs (ETCs) including contributing to University of Sheffield review.

● **Science**

Objective: to support the development of improved methods of delivering imaging research studies including research element of rapid, secure shared access to large imaging datasets linked to cognate clinical data.

Workstream Lead: Prof Fiona Gilbert and Prof Stephen Keevil

Outline plan

− Establish an **image repository** linked to cognate clinical data by working with the NIHR Biomedical Research Centres, the NIHR Health Informatics Collaborative, CRN Accelerating Digital project, CRN Medical Informatics and Data Linkage project, and the XNAT platform.
− Encourage academics to publish their algorithms to help with benchmarking and analysis of new algorithms.
− Develop ways to harmonise standard operating procedures in image analysis and data acquisition drawing on the existing PET imaging network model.

- Harmonise information governance standards.
- Work with Clinical Trials Units and NIHR Research Design Service to explore the possibility of **Imaging Trials Units**.

● **Industry**

Objective: to improve the NHS as an industry partner for imaging studies.

Workstream Lead: Dr Richard Graham

Outline plan

- Work with the NIHR Office for Clinical Research Infrastructure (NOCRI) and the Clinical Research Network to secure new partnerships with industry.
- Support existing work with the European Organisation for Research and Treatment of Cancer (EORTC) and the European Institute for Biomedical Imaging Research (EIBIR) to develop designated imaging sites.
- Discuss the possibility of new partnerships to create a research-time fund for NHS staff.
- Improve the use of NIHR CRN as a platform for the multi-centre studies that are a priority, including increased efficiency of research approval and set up process.

- Improved access to imaging data sets.

● **Engagement and PPI**

Objective: to increase awareness of NIHR in the NHS clinical imaging community and to involve patients and the public in imaging research.

Workstream Lead: Anthea Mould and Dr Beverly Snaith

Outline plan

- Create NIHR CRN Imaging network.
- Improve NIHR awareness, through series of presentations to key Royal Colleges professional societies (including Society of Radiographers, British Nuclear Medicine Society and Institute of Physics and Engineering in Medicine), research funders and industry.
- Develop a presentation pack for wide distribution, including to NHS senior leaders, that explains the importance of, and opportunities in, imaging research.
- LCRNs and other cognate elements of NIHR infrastructure to coordinate a series of regional and national workshops along with other initiatives aimed at improving collaboration in imaging research.
- Deliver a campaign using research literacy materials, share examples of new health benefits enabled by use of patient data in research

Conclusion

Each of the workstreams described in the Roadmap will be led by a member of the NIHR CRN imaging steering group and a detailed implementation plan will accompany the workstream. We intend to hold a follow up workshop in 2018.

If you wish to join the NIHR CRN Imaging Network please complete the form below:

https://goo.gl/forms/OT6wr5pBEfbfHBSp2

Appendix

CRN Imaging Steering Group Members

Joanne Ashcroft, NIHR CRNCC/King's College London
Prof Fiona Gilbert, University of Cambridge
Dr Richard Graham, Royal United Hospitals Bath NHS Foundation Trust
Prof Vicky Goh, King's College London
Prof Stephen Keevil, Guys and St Thomas NHS Foundation Trust/ King's College London
Anthea Mould, NIHR CRNCC
Prof Reza Razavi, King's College London
Prof Stephen Smye, NIHR CRNCC/ King's College London
Dr Beverly Snaith, Mid Yorkshire Hospitals NHS Trust

NHS
National Institute for Health Research

Clinical Research Network
National Specialty Hub
King's College London
Addison House
London SE1 1UL

Tel: 020 7848 8370
Email: crnspecialtyclusterc@nihr.ac.uk

Web: www.nihr.ac.uk