

COMMENTARY

THE NATIONAL INSTITUTE FOR HEALTH RESEARCH: MAKING AN IMPACT IN IMAGING

RESEARCH

ABSTRACT

Since the inception of the National Institute for Health Research (NIHR) in 2006, the landscape for the delivery of clinical research within the NHS has been transformed. Clinical Radiology has benefitted from funding opportunities for primary imaging research as well as improvements to the supporting research infrastructure to provide imaging for many clinical trials. However, in an increasingly challenging NHS environment, the NIHR and Clinical Radiology have to evolve an effective working partnership to ensure imaging research is sustainable and will make an impact. A number of initiatives have arisen from discussions between the NIHR, the Royal College of Radiologists (RCR) and stakeholders that will be discussed in this article. It is hoped that these initiatives will be embraced by the imaging community and create a more dynamic sustainable imaging workforce, driving and supporting research and innovation towards future sustainability.

Summary of initiatives:

- Developing imaging workforce capacity
- Improving collaboration between research groups and disciplines
- Increasing the number of academic leaders from clinical and allied health disciplines
- Creating new and more flexible NIHR fellowships
- Supporting new ways for research training e.g. via RCR/NIHR Clinical Research Network (CRN) trainee research networks
- Funding research sessions for portfolio activity
- Incentivising research activity e.g. via RCR/NIHR outstanding researchers' awards for clinical trainees and radiologists
- Developing national industry partnerships.

THE NATIONAL INSTITUTE FOR HEALTH RESEARCH

The National Institute for Health Research (NIHR) was established by the Department of Health and Social Care in 2006 in England to improve the 'health and wealth of the nation' through research (1). This was in response to the recognition that research in the NHS lacked a strategic focus and was being impeded by an increasing bureaucratic and regulatory burden, resulting in a lack of capacity and flexibility to generate the level of evidence crucial to deliver high-quality health services. It was also recognised that the National Health Service (NHS) was not exploiting its full potential as a research platform to support the country's international competitiveness.

Working in partnership with the devolved administrations, NIHR is now one of the most integrated clinical research systems in the world. This has been achieved in the following ways: 1) through the NIHR's funding of high quality research to improve health through programmes such as the Efficacy and Mechanism Evaluation (EME), Research for Patient Benefit (RfPB) and Health Technology Assessment (HTA), thus supporting early stage translational research through to later stage clinical trials in the NHS; 2) through the training and support of health researchers via NIHR doctoral, post-doctoral and other fellowships; 3) through the establishment of world-class research facilities and infrastructure embedded in the NHS, including the Clinical Research Network (CRN), NIHR Biomedical Research Centres (BRCs), NIHR Clinical Research Facilities for Experimental Medicine (CRFs) and Experimental Cancer Medicine Centres (ECMCs) co-funded with Cancer Research UK; and 4) through collaborations with the life sciences industry and charities to ensure patients gain earlier access to breakthrough treatments or innovative technologies as well as ensuring broader investment in health research and related resources.

The NIHR CRN provides the infrastructure that allows research to be undertaken throughout the NHS. There are currently 15 Local Clinical Research Networks (LCRNs) supporting the conduct of research across 30 clinical specialties. Each specialty is linked to one of five partner universities, who each lead a programme of work spanning more than one clinical specialty, including genomics, medical technology and imaging. Through the CRN, the NIHR has made it possible for patients and health professionals across England to participate in relevant clinical research studies within the NHS, supporting more than 725,000 participants to take part in 5,500 studies in 2017/18.

Importantly, the NIHR has involved patients and the public at every step, thus ensuring that clinical research is patient-focussed and driven by their needs. The NIHR has defined public involvement in research as research being carried out 'with' or 'by' members of the public rather than 'to', 'about' or 'for' them. This has included patients working with research funders to prioritise research, offering advice as members of a project steering group, commenting on and developing research materials, and undertaking interviews with research participants. INVOLVE , a national advisory group created in 1996 and part-funded by the NIHR, brings together expertise, insight and experience in the field of public involvement in research, with the aim of advancing it (2).

CURRENT CHALLENGES TO DELIVERING IMAGING RESEARCH

Imaging is a cross-cutting discipline that is of critical importance to the national research portfolio. However, there are currently a number of challenges to the successful delivery of imaging research within the NHS. While imaging underpins many medical decisions in the healthcare system, its utilisation has outstripped resources in many countries, including the

66 UK. For example, the 2016 Royal College of Radiologists (RCR) workforce census found that
67 97% of Radiology departments were unable to meet reporting requirements in contracted
68 hours (3). Given the capacity pressure on NHS imaging services and the central role that
69 imaging plays in clinical research, a strategy is essential to improve the efficient and
70 sustainable delivery of research within the NHS.

71 A number of key issues surrounding the delivery of imaging research were identified in a
72 NIHR CRN-led scoping workshop in February 2017 (4). Firstly, imaging plays a central role in
73 many clinical specialties and it is vital to co-ordinate the provision of imaging infrastructure
74 support. While the NIHR has invested heavily, infrastructure capacity has proven to be
75 challenging. For example, the NHS has one of the lowest number of high-end imaging
76 equipment per capita in Europe. The number of magnetic resonance scanners per million
77 people is 6.1, compared to 30.5 and 38.1 scanners per million for Germany and the US,
78 respectively (5). On average, magnetic resonance imaging (MRI) demand is rising by 13% per
79 year, which increases pressure on capacity for research (6). Additionally, despite portfolio
80 adoption, access to research nurses or co-ordinators for research support, e.g. due to the
81 limited numbers of such staff and the pragmatic need for them to prioritise the studies they
82 are involved with has been an issue for Radiology.

83 Secondly, the NHS imaging workforce, including radiographers, medical physicists and
84 radiologists, remains in flux, having to develop new roles and relinquish others in order to
85 adapt to chronic workforce shortages. Effective interdisciplinary research collaboration
86 requires a better understanding of the underlying challenges each discipline faces to
87 improve the quality of interactions.

88 Thirdly, NHS imaging services may be fragmented and variable in extent or quality, which
89 can make it challenging to deliver research consistently. The use of third-party commercial
90 imaging services detached from mainstream NHS delivery, for example to deliver positron
91 emission tomography (PET) imaging, or out-of-hours care, has introduced different drivers.
92 In some cases, this has reduced the ability to undertake research in certain geographical
93 areas due to limited availability of resources for activity outside of clinical endeavours.

94 Fourthly, the workshop also recognised the value of developments in data science and
95 artificial intelligence, which are increasingly prominent in imaging but not yet realised to
96 their full potential in the NHS. The cost of imaging technology remains a major
97 consideration. Research with high-end imaging platforms is considered relatively costly
98 compared to other types of medical research that may be mostly qualitative in nature.
99 There are also further issues with varying site costs within the NHS, and it is important to
100 have tariffs that reflect the actual costs of all related imaging (including advanced protocols)
101 at every site.

102 Finally, and crucially, the lack of research staff and limited protected time for research in
103 NHS job plans is a major constraint for imaging research. The UK has the third lowest
104 number of radiologists per population within the European Union with 7.5 clinicians
105 (radiology trainees and consultants combined) per 100,000 patients compared to the EU
106 average of 12.7 clinicians per 100,000 patients (5). With the continuing workforce crisis in
107 Radiology, with more than 1 in 10 posts unfilled, an increase in cross-sectional imaging
108 workload, up 30% in the last decade, and forecasts that over half the consultant workforce
109 will retire by 2029 (5), there is significant pressure on both specialist trainees and NHS
110 consultants to deliver primarily a clinical service.

This has reduced the time available for clinical radiologists to both instigate, perform and support imaging research during Supported Programmed Activities or NIHR-funded Research Programmed Activities - and in some cases, also reduced any aspirations. Whilst the NIHR has invested heavily in supporting academic training over the last 10 years through the Academic Clinical Fellow (ACF) and Clinical Lectureship (CL) posts, with 25% and 50% research funding support respectively, in addition to Fellowships, and opportunities for Radiographers through the Integrated Clinical Academic (ICA) Programme, there is still a lack of investment in the Radiology academic infrastructure. Integrated academic trainees and academic radiologists remain a very small percentage of the overall Radiology workforce.

OVERCOMING CURRENT CHALLENGES

There are considerable opportunities for the NIHR and the Royal Colleges to work together to make a greater impact in the current challenging environment. The RCR has long recognised the challenges for sustaining academic radiology (7). While the RCR has continued to foster research via the activities of the RCR Academic Committee including grant funding and a network of research mentors (8), closer collaboration with the NIHR is welcomed.

Following the NIHR CRN imaging workshop, an outline plan for action to address some of these challenges has been produced (3). Key focus areas include developing workforce capacity, improving research training opportunities, and the research infrastructure. The plan is overseen by a national steering group which includes senior RCR representation and

133 comprises a series of practical steps being undertaken in partnership with key national
134 organisations.

135 **Research Imaging Workforce Development**

136 Developing workforce capacity is a central element of the plan and an important long term
137 aim. Improving collaboration between research groups and disciplines, including better
138 coordination of access to research infrastructure and key resources alongside
139 standardisation of trials support functions is essential. Increasing the number of academic
140 leaders for research from the range of clinical and allied disciplines is also a key priority.

141 In terms of training following its strategic review, the NIHR is currently supporting new
142 approaches, including new and more flexible NIHR fellowships, after recognising the need
143 for ‘intelligent career models’. The new NIHR Academy will integrate all current academic
144 training and higher career personal awards, and also host all training and development
145 activity (9). Under the new arrangements, joint funding of research fellowships with partner
146 organisations is now possible, which could include Royal Colleges, charities and industry,
147 which will increase capacity and further promote strategic alignment. Working with
148 universities towards more allocated posts for Radiology would be a step in the right
149 direction to increasing the number of Radiology academics. Equivalent programs for Allied
150 Health Professionals will clearly bring concurrent benefits and are underway through, for
151 example, the HEE/NIHR Integrated Clinical Academic (ICA) Programme.

152 The RCR research certificate (10) already provides a framework for radiologist trainees to
153 achieve research training competencies. The RCR online training resources and joint
154 RCR/NIHR research day offer trainees hands-on research training and networking

opportunities. Building on the success of trainee research networks in anaesthesia, surgery and critical care (11), the RCR will set up a NIHR CRN trainee research network within Clinical Radiology in order to improve national engagement in research by medical trainees at an earlier career stage. This will also pave the way for more consistent mentorship of young radiologists by established clinical academics.

In terms of developing research capacity and research leadership, the RCR are working with the NIHR to develop a model for sustaining research capacity amongst clinical radiologists within the NHS beyond NIHR funded research sessions for portfolio activity. Both the RCR and NIHR have launched outstanding researchers awards for clinical trainees and radiologists, and they will work together to keep developing research leadership, for example via the NIHR leadership programme.

Research study delivery

In terms of improving research infrastructure capacity to support the delivery of imaging studies, NIHR CRN is in discussion with other elements of NIHR to develop a series of national industry partnerships intended to increase the capacity of the system for imaging research. The way in which imaging research activity is recorded on the NIHR Clinical Research Network Portfolio is also being revised, in order to ensure that the volume and type of imaging research is accurately monitored.

Imaging research will also benefit from new arrangements relating to the management of excess treatment costs (ETCs) introduced by NHS England on 1 October, 2018. The new arrangements in England, which are being delivered in partnership with NIHR and the Health Research Authority (HRA), introduce a streamlined approach for requesting and

178 agreeing ETCs (12). A threshold under which ETCs will need to be absorbed by non-primary
179 care providers participating in studies has also been established.

180 ETCs have been seen as one of the biggest barriers to imaging research (4). When a patient
181 is referred for clinical imaging, if they also then take part in a research study the cost of the
182 extra treatment related scans required for the study are attributed as ETCs. Researchers
183 have reported getting to the point where a study is ready to go ahead and then having to
184 stop because they are unable to get approval for ETCs.

185 NIHR LCRNs will help manage the excess treatment costs process on behalf of their local
186 Clinical Commissioning Groups (CCGs) in England and in collaboration with NHS England
187 Specialised Commissioning. A cost attribution tool has been created in partnership with
188 charity funders and research sponsors to underpin the new arrangements. Researchers will
189 be required to complete this new tool, known as a Schedule of Events Cost Attribution Tool
190 (SoECAT), as part of their funding applications. The tool captures and attributes the different
191 costs associated with clinical research, and attribution support is available for investigators,
192 study teams and their R&D offices through AcoRD specialists in the LCRNs and devolved
193 administrations. Completion of the SoECAT will be required for studies eligible for the NIHR
194 CRN Portfolio and access to the support this provides. NIHR CRN support will now include
195 access to ETC payments under the new arrangements. The ETC value from the SoECAT,
196 alongside recruitment activity in the NIHR Central Portfolio Management System, will be
197 utilised to inform the payments to NHS providers. Further details, including a researcher
198 routemap, are available on the NIHR website (13).

199 For commercial contract studies, additional work by NHS England supported by NIHR and
200 HRA is working towards a standard, binding process for assessing and determining contract

201 values for commercial contract studies in England. From 1 October, 2018, revisions to the
202 NHS Standard Contract mandate the use of an unmodified model site agreement and the
203 use of the standard costing methodology (the NIHR Industry Costing Template) from 1
204 October 2018. The concept of a single contract review process via the use of a suite of
205 standard mandated templates, will be further developed for future implementation. As part
206 of this work a new UK tariff was also launched, including a more comprehensive list of
207 investigations, which will be helpful for studies with an imaging component. All new tariff
208 costs, along with annual updates to values, are discussed in detail with nominated provider
209 service support departments to ensure that values and items remain both relevant and
210 consistent.

211 **LOOKING TO THE FUTURE**

212 As in all others branches of medicine, technological advances will continue to happen,
213 evolve and impact on practice in Clinical Radiology. Imaging is a superb example of the value
214 and impact of strong inter-disciplinary partnerships between basic and applied scientists
215 and clinicians. Advanced computing and computer-assisted approaches are increasingly
216 encroaching into Clinical Radiology practice, with applications such as 'remote' optimisation
217 of image acquisitions and online workflow optimisation, and reporting tools ranging from
218 computer aided detection to clinical decision support systems.

219 With the rise in applications benefitting from data science (DS), machine learning (ML) and
220 artificial intelligence (AI), the need for large well-documented and well-curated clinical
221 datasets; staff training on systems using DS/ML/AI within the NHS to address the skill-gaps
222 of our current workforce; and better inter-disciplinary working will be addressed jointly by

the RCR, NIHR and other national bodies; of course, accounting for patients' wishes and preferences about the collection and use of their data,.

The emphasis on multi-disciplinary research in the newly created UK Research and Innovation (14) offers significant collaboration and funding opportunities. In particular, Clinical Radiology is in a very strong position to evaluate and harness the related developments in data science (e.g. ML and AI), working in partnership with industry and national bodies, including Health Data Research UK and Innovate-UK.

This opportunity for health care and the UK economy, has been logically reflected in the recently announced Industrial Strategy Challenge Fund competition, in which, Innovate UK, on behalf of UK Research and Innovation, will invest up to £50m to create a network of centres in digital pathology, imaging and AI (15). The creation of strong collaborations between industry, academia and the clinical community is imperative to unlocking the UK's potential.

As imaging research becomes increasingly complex the challenge for its future sustainability is the need for a cultural shift in the NHS. Creating the right culture and incentives for academia is an important driver (16). Working together with the NIHR is an important step forward for Clinical Radiology.

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