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Current Pressure on the UK Imaging Workforce Deters Imaging Research in the NHS and Requires Urgent Attention

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Abbreviations:

IPEM: Institute of Physics and Engineering in Medicine

NHS: National Health Service

NIHR: National Institute for Health and Care Research

RCR: Royal College of Radiologists

SCoR: Society and College of Radiographers

Abstract

Medical imaging is a multidisciplinary specialty, combining clinical expertise from medical physics, radiography and radiology and plays a key role in patient care. Research is vital to ensure the care delivered to our patients is evidence-based, and is a core component of clinical governance. However, there are pressures on the imaging workforce which are significantly impeding imaging research. This commentary presents a research gap analysis pertaining to the multidisciplinary imaging workforce by the workforce working group on behalf of the National Institute for Health Research (NIHR) Imaging Group. Data were summarised from membership surveys of the Institute of Physics and Engineering in Medicine, Society and College of Radiographers and Royal College of Radiologists; national reports; and feedback from NIHR Clinical Research Network Imaging Champions meeting in 2020/2021. Common barriers to delivering research were found across the multidisciplinary workforce. The key issues were lack of staff, lack of time and lack of funding to backfill clinical services. Given the ongoing workforce shortages and increasing clinical demands on diagnostic radiographers, medical physicists and radiologists, these issues must be tackled with a high priority to ensure the future of clinical research within the NHS.

Key words

Imaging; Research; Workforce; Radiologist; Radiographer; Medical Physics

Introduction

Research is one of the seven pillars of clinical governance (clinical effectiveness and research) for multidisciplinary care in the National Health Service (NHS) (1). For healthcare organisations across the United Kingdom (UK), there are expectations with respect to research-active staff set out by the Care Quality Commission, Care Inspectorate, Regulation and Quality Improvement Authority, or Care Inspectorate Wales alongside specific Quality Standard for Imaging requirements for research (2). Imaging is a cross-cutting, multi-disciplinary field, of critical importance to patient care, with a key role in the majority of patient pathways. Imaging is also a crucial component of many clinical trials of new therapeutics and interventions, and the UK plays a leading role globally in developing new imaging techniques. Imaging is also at the forefront of scientific developments in rapidly developing areas such as artificial intelligence, with multiple established academic-industry partnerships.

The National Institute for Health Research (NIHR) is a key UK organisation working with patients, health and care professionals, researchers and industry to accelerate the development, evaluation and clinical translation of novel imaging science, ensuring that innovations in imaging bring benefits to patients (3). Between 2017 and 2018, over 250 studies involving imaging were supported by NIHR Biomedical Research Centres and Clinical Research Facilities. Each year, the NIHR Clinical Research Network supports more than 2000 studies in which imaging plays a crucial role. Since 2016, the NIHR Academy has awarded 54 fellowships involving imaging research from a range of disciplines and fellowship programmes. In the same period, multiple NIHR Programmes funded over 90 primary imaging research studies or studies where imaging was a key research component (£17.5m

through Efficacy and Mechanism Evaluation; £9.3m through i4i; £41.8m through Health Technology Assessment; and £2m through Research for Patient Benefit Programmes).

Yet, despite this, there are significant barriers facing the imaging work force in delivering research on the ground. In order to tackle these issues, the NIHR Imaging Group was formed in 2020. Overseen by a steering committee, the group consists of three working groups: imaging science; research delivery and workforce supported by patient and public representation (4). With respect to the imaging workforce, the NIHR Imaging Group's aims are to:

- Support the development of the imaging research workforce, with a particular focus on those working in the NHS.
- Work with NIHR-funded imaging researchers, patients and key stakeholders to develop a strong NIHR multidisciplinary community of practice for imaging research.
- Collaborate with key national partners, including UK research and innovation (UKRI), the major medical research charities and patient groups.

The aim of this commentary is to describe a gap analysis for the multidisciplinary imaging workforce including radiologists, radiographers and medical physicists, performed by the NIHR imaging workforce group. Having defined the gaps facing the workforce, potential remedies to bridge these gaps are discussed.

Defining the barriers for research in medical imaging

Data for this gap analysis were collated from existing membership surveys of the Royal College of Radiologists (RCR), Society and College of Radiographers (SCoR) and Institute of Physics and Engineering in Medicine (IPEM); national reports including the '2020 Diagnostics: Recovery and Renewal (Richards) report' (5) and '2020 Getting It Right First Time national specialty report in Radiology' (6); as well as feedback from attendees of a national NIHR Clinical Research Network Imaging Champions meeting in 2020/2021.

Workforce shortages

Over the past 5 years, imaging use has increased. For example, use of CT and MRI in England has increased by, on average, 7%, exceeding workforce growth, e.g., of 4% per year for consultant radiologists (7). There is simply too much clinical work and not enough people to do it. This applies to all of the imaging workforce. The RCR 2020 workforce census (8) demonstrated there were 433 consultant radiologist vacancies across UK hospitals, equating to 1-in-10 unfilled posts. The number of consultant vacancies remaining unfilled after a year has doubled since 2015 and stands currently at two-thirds of vacancies. There is an estimated 33% shortage of the current radiologist workforce, equating to 1,939 consultant radiologists. This is forecast to rise to a 44% shortfall of 3,600 consultants by 2025. Additional government funding for 100 extra trainee places in 2022 will likely have marginal impact.

Similar challenges have also faced radiographers and medical physicists. The SCoR 2020 workforce census (9) of 65 providers of medical imaging found an ongoing high vacancy rate of 11% in diagnostic radiography; 80% of vacancies existing for 3 months or longer. The 2021 Medical Physics Diagnostic Radiology and Radiation Protection Workforce

survey (98% response rate from 55 physics services across NHS England covering 440 full-time equivalent posts) showed a 9% vacancy rate. Although the 395 full-time equivalent posts were an increase compared to the 2018 survey (335 full-time equivalent posts), the desired number of full-time equivalent posts to meet current demand is actually 580 (or ~670 based on the European Federation of Organisations for Medical Physics criteria).

The NHS 2014 MRI Physics workforce reported that 60% of departments stated they were not routinely adequately staffed (10), rising to 70% of departments in the 2019 Medical Physics Nuclear medicine workforce report (11). Workforce shortages across medical physics mean that allocating resource and backfilling posts to support research (particularly for fellowships) is hugely difficult. This will be exacerbated by the increase in equipment that will require medical physics support as a result of government investment (as recommended in the Richards' report).

Lack of time

Lack of time for research is a direct consequence of an overstretched clinical workforce. The clinical pressures have increased significantly with the imaging backlog created by the COVID-19 pandemic. For consultant radiologists, the RCR recommends that the direct clinical care element of a full-time consultant radiologist's job plan should not usually exceed 7.5 programmed activities and be balanced with 2.5 supporting professional activities, used to undertake research, audit and quality improvement amongst other activities for professional development and appraisal/revalidation.

The RCR 2020 workforce census revealed full-time NHS consultants were contracted, on average for five hours more than the RCR recommended maximum and, with on average two hours less supporting professional activities than the RCR recommended minimum. This shift in job planning to clinical service inevitably leaves insufficient time for research, and contributes to excessive working hours. Many full-time consultant clinical radiologists do not have enough time to complete their core activities for appraisal/revalidation, let alone take on additional research roles. This contributes to a downward spiral of lack of time and motivation to supervise radiology trainees to undertake and complete research projects, negatively impacting on the research skills of the next generation. It may also, in part, contribute to other specialties with more job planned non-clinical time taking the lead in conducting imaging-based research, rather than radiologists themselves.

There is also pressure at grassroot level. For example, a recent survey of radiology trainees (12), distributed via the United Kingdom training programme directors and Radiology Academic Network for Trainees (RADIANT, (13)) representatives, identified lack of time as a barrier to research in 61% (136/224) of respondents. Similar findings were reported in an RCR survey on consultant radiologists' supporting professional activities; less than 50% of consultants were supporting research activities, mainly due to lack of time (14).

A gap analysis conducted by the Society and College of Radiographers, drawn from research (15) and discussion with their Research Advisory Group members, also found perceived lack of allocated research time as a key barrier to research. There are clinical research radiographers who are employed in a variety of roles to enable research trials in clinical imaging departments; and who provide professional leadership and support to

research staff working within diagnostic radiography, clinical imaging, and radiography research (16, 17). There are similar expectations of consultant radiographers with respect to research, with research forming one of the four pillars of the multi-professional consultant -level practice capability and impact framework (18). Surveys of consultant radiographers in 2018 (19) and 2020 (9) demonstrated a rise in from 88% to 99% of participants who were research active but many still reported barriers to participation in research, of which, the main barrier was time.

Lack of experience or research support

The RADIANT led survey found that 46% (103/224) and 38% (84/224) of radiology trainees cited limited experience in research statistics and composing or submitting a research manuscript respectively, both cited as key barriers to research (12). The SCoR gap analysis also identified staff confidence in research skills as a common barrier but also detailed issues with support infrastructure, lack of inclusion of research in job descriptions/job plans and lack of support from line managers; suggesting general issues with research culture.

Lack of mentorship

A specific form of research support that warrants highlighting is the lack of research mentorship. Whilst the large majority of radiology trainees are interested in research (88%, 196/224), the stated motivation by 64% (143/224) was curriculum vitae improvement for consultant applications (12). Importantly, busy and/or disinterested consultants were identified as a barrier to research by 28%, 62/224). This highlights the vicious circle of trainees wanting/needing to do research to get a consultant job but consultant radiologists

having no time or motivation to conduct research to facilitate trainee training and experience.

Tackling the barriers to medical imaging research

Without the ability to engage with and evaluate new diagnostics and treatment strategies, the imaging workforce is at risk of falling behind in developing and delivering evidence-based healthcare. The UK has an outstanding reputation in imaging research, giving the world both CT and MRI (20, 21), but this reputation is under severe threat. Tackling the barriers to research in medical imaging is key priority for the NIHR Imaging Group. A co-ordinated strategy involving all stakeholders is required to resolve the many issues (Table 1). These include:

- Improving the imaging workforce shortages
- Fostering a stronger imaging research culture in the NHS
- Improving the dedicated infrastructure (people and processes) required to deliver imaging research within the NHS
- Enabling time for research at all levels, from trainee to consultant
- Increasing imaging research training and opportunities for supporting and undertaking research

Building workforce capacity and capability

While there are no “quick-fixes” to the imaging workforce crisis, the professional bodies have co-ordinated efforts to increase the number of filled clinical posts. For example, the RCR have lobbied for more radiology trainees and introduced schemes to bring more radiologists to the UK from abroad. In terms of supporting research capability, there is a

need to free up more time for research activity and to exploit existing resources. For example, the RCR have proposed to fund new flexible fellowships allowing NHS radiologists to free up a proportion of clinical time to focus on research activity.

This need has also been emphasized in the SCoR 2021-2026 research strategy. The three key aims of this are: 1) to embed and enable research at all levels of radiography practice and education, 2) to raise the impact of and profile of radiography through high quality research focussed on improving patient care and service delivery and 3) to expand the UK radiography research capacity through development of a skilled and motivated research active profession.

SCoR recommendations to achieve the first aim include: 1) job plans for all levels of practice that incorporate time for research, proportionate to their role; and 2) research should be a standing item on staff meeting agendas in all imaging departments. To achieve the second aim, SCoR states that: 1) all submissions to College of Radiographers Industry Partnership Scheme research funding must match one of the SCoR research priorities; 2) individual radiographers should be encouraged to join key multi-professional/multi-agency research-related committees; 3) the number and quality of grant applications across the profession should be increased by ensuring members use the CAHPR network, NIHR resources and training, and other mentorship and support schemes including the SCoR Formal Radiography Research Mentorship (FoRRM) programme (5). To achieve the third aim, SCoR highlights: 1) developing pathways for final year pre-registration students who demonstrate high academic competence to move straight to doctoral level study; 2) encouraging applications to the NIHR bridging programme as a ‘stepping stone’; 3) exploring

opportunities for pump priming research practitioner posts with recognition that these individuals will ultimately become self-funding through research income; and 4) encouraging those in research or clinical academic radiographer posts should provide support to clinical colleagues to engage more fully in research activities.

A priority for increasing the research active medical physics workforce is to better capitalise on their existing research skills. Importantly, the NHS Medical Physics Clinical Scientist Training Programme, which leads to professional registration, already includes an MSc research project. A sizeable proportion of medical physicists already obtain a PhD. For example, approximately 30-50% of NHS MRI physicists enter the profession with a PhD, yet few continue their research careers, citing a lack of opportunity to be involved in meaningful research – this has to be addressed.

It has been proposed that hybrid models of working should be developed to encourage physics-led research within the NHS, whilst still offering the stability and more front-line 'relevance' of a clinical career. Interestingly, those MRI physicists who come onto the Clinical Scientist Training Programme without a PhD often leave the NHS to complete one – ensuring that these opportunities are made available to increase the pool of research active clinical medical physicists should be a priority through better visibility of the NIHR fellowship programmes and hybrid roles.

The Institute of Physics and Engineering and Medicine are developing a research community and working with the National School of Healthcare Science and Health Education England, as well as the NIHR, to promote and demonstrate the value of research

careers (relating to both research delivery and academic endeavours) within NHS Medical Physics departments. Ultimately the goal is to encourage translation and innovation to ensure quality improvement within imaging.

Improving research training

With rapidly evolving imaging technology, there is an obligation to prepare the future multidisciplinary imaging workforce, who will need to be able to appraise new technologies systematically, and utilise AI effectively as part of routine clinical practice. With the planned expansion of numbers for radiologists, diagnostic radiographers and medical physicists in line with the Richard's review there is an opportunity to integrate research more deeply into clinical training. If barriers to participating in research for all imaging workforce trainees are not addressed, there is a real risk that the desire and/or ability to engage in research will be potentiated for future generations.

From the radiology trainee perspective, one perceived solution to research participation revolves around more formal recognition of research and formal incorporation into training programs, together with dedicated time for research. 71% (159/224) of surveyed trainees felt that structured research training opportunities with a project with clear goals and a timeline was required, with 69% (154/224) requesting protected research time, and greater commitment to research training by training schemes. A dedicated point of contact for research projects was desired by 36% (81/224) and with 30% (68/224) recommending research involvement warranted formal inclusion in annual review of competency progression. In the immediate term, education of trainees about academic opportunities is important.

The Radiology Academic Network for Trainees (RADIANT, (13)) is a national trainee-led initiative that facilitates multicentre research and an excellent resource for trainees to engage in national research, even if there are no local research active supervisors. However, 46% (103/224) of radiology trainee respondents were unaware of RADIANT. In the short-term, there is a risk that uptake of engagement with RADIANT projects will come from traditionally research active regions/deaneries and work must be done to ensure all trainees are given the opportunity to participate.

More formal opportunity to lead and deliver research could come from increasing NIHR academic clinical fellow (ACF) and NIHR academic clinical lecturer (ACL) posts was suggested in 22% (50/224). There is an argument to lobby for a similar ratio of ACF/ACL posts per National Training Number to match that of other clinical specialities that have a tradition for delivering trainee-led research. However experience has shown that integration of ACF and CL posts within the highly structured and exam heavy radiologist training format is challenging and service commitments may take precedent over academic endeavours. Academic trainees require greater flexibility within their training program in order to meet their academic and clinical milestones. A formal survey of previous radiology NIHR ACFs and ACLs is planned which will capture data on their onward research trajectory. There is also work underway to facilitate academic expansion with the NIHR Incubator scheme. Any endeavours to expand the number of NIHR ACF and ACL posts in clinical radiology requires attention to the geographic distribution of the opportunities.

Indeed, there is well documented geographical heterogeneity in research output of trainees. Research publications are a metric of research activity. In a study of 913 publications (49% original papers), the largest proportion of publications came from the London deanery (*n*=354, 38.8%), followed by Eastern 86 (9.4%), Oxford and Yorkshire 70 (7.7% each) (22). Relative to the number of trainees within each deanery, Oxford had the highest number of publications per trainee (1.78). There was a significantly higher publication rate for those deaneries with academic radiologists. Without spreading opportunities across the UK, it is highly likely currently active sites will continue to conduct the vast majority of research.

Improving research mentorship

Each NIHR local clinical research network has appointed an 'imaging champion' from the multidisciplinary imaging workforce, raising awareness of research opportunities on a local scale and providing feedback to NIHR Imaging Group as to the national picture. To improve mentorship further, a stronger community of radiology, medical physics and radiographer researchers needs to be developed, across the country, to provide support–partnering with academics within NIHR biomedical research centres and clinical research facilities, for example. This is an area that will be progressed by the NIHR Imaging workforce group.

The RCR recognises the value of mentorship and already delivers an established mentorship scheme for final year Radiology trainees and new consultant Radiologists. However, it is vital that we promote our imaging specialties in general to individuals from widening participation backgrounds, who are under-represented in our professions. One

potential route to achieving this is by promoting and expanding RadReach (23). This is a unique collaboration between the RCR and the Widening Participation Medics Network, which was created to address under-representation within radiology and oncology by targeting final year medical students and foundation doctors. The three core principles are: mentorship, advocacy, and professional development. RadReach's ethos is to provide not only guidance and mentorship, but advocacy by promoting equity of opportunity, including opportunities to participate in research. Building on this model and broadening the remit to Radiographers and Medical Physicists has the potential to increase under-represented groups in our fields in general, and in research at the same time.

Conclusion

Imaging is crucial to many aspects of patient care in modern medicine. Conducting research is a key component of clinical governance. It is important to ensure that we are delivering the best care to our patients and conducting research activity in populations who need it most. In this gap analysis, the NIHR imaging workforce group has found a number of common issues across the multidisciplinary workforce, contributing to lack of research delivery within the NHS. The key issues are lack of staff, lack of time and lack of funded time to backfill clinical services. Increasing clinical demands on diagnostic radiographers, medical physicists and radiologists, increasing year upon year, combined with inadequate, and worsening, workforce staffing are creating a perfect storm for imaging research delivery. These workforce issues require urgent attention.

Imaging Workforce	Current State	Desired Future State	Remedies

• Radiologists and Nuclear Medicine Physicians
• Diagnostic and Therapeutic Radiographers
• Medical Physicists
	• Shortage of clinical & academic workforce
	• Additional imaging workforce requirements*
	  ○ Radiologists, 2,000
	  ○ Advanced practitioners, 500
	  ○ Radiographers, 3,500
	  ○ Physicists, 220
		• Increased clinical & academic workforce
		• Improved workforce diversity & inclusiveness
		• Equitable geographical distribution of academic workforce
		• Well integrated research in NHS clinical practice
			• Increase & retain clinical & academic workforce across UK
			• Increase visibility of imaging research
			• Support the imaging workforce to take ownership of studies involving medical imaging
			• Generate greater research opportunities for NHS workforce
			• Integrate research as a core part of clinical training
			• Grow next generation of clinical academics

** https://www.england.nhs.uk/publication/diagnostics-recovery-and-renewal-report-of-the-independent-review-of-diagnostic-services-for-nhs-england*			

Table 1. A summary of the imaging workforce current state and potential remedies to achieve the desired future state.

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