COMMENTARY

Radiotherapy physics research in the UK: challenges and proposed solutions

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ABSTRACT. In 2011, the Clinical and Translational Radiotherapy Research Working Group (CTRad) of the National Cancer Research Institute brought together UK radiotherapy physics leaders for a think tank meeting. Following a format that CTRad had previously and successfully used with clinical oncologists, 23 departments were asked to complete a pre-meeting evaluation of their radiotherapy physics research infrastructure and the strengths, weaknesses, opportunities and threats within their own centre. These departments were brought together with the CTRad Executive Group and research funders to discuss the current state of radiotherapy physics research, perceived barriers and possible solutions. In this Commentary, we summarise the submitted materials, presentations and discussions from the meeting and propose an action plan. It is clear that there are challenges in both funding and staffing of radiotherapy physics research. Programme and project funding streams sometimes struggle to cater for physics-led work, and increased representation on research funding bodies would be valuable. Career paths for academic radiotherapy physicists need to be examined and an academic training route identified within Modernising Scientific Careers; the introduction of formal job plans may allow greater protection of research time, and should be considered. Improved access to research facilities, including research linear accelerators, would enhance research activity and pass on developments to patients more quickly; research infrastructure could be benchmarked against centres in the UK and abroad. UK National Health Service departments wishing to undertake radiotherapy research, with its attendant added value for patients, need to develop a strategy with their partner higher education institution, and collaboration between departments may provide enhanced opportunities for funded research.

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Radiotherapy is a highly effective deoxyribonucleic acid-damaging agent with precise and selective effects on tumours, and is one of the most potent and cost-effective curative treatments for cancer [1]. It is a technology-led treatment modality, and scientific advances provide real improvement in outcomes for patients, with developments such as intensity-modulated radiotherapy (IMRT), image-guided radiotherapy (IGRT) and stereotactic ablative body radiotherapy (SABR, formerly stereotactic body radiotherapy; SBRT). However, a lack of investment in radiotherapy research over the past 20 years provides an important aspect of the context for current activities, as our UK community seeks to rebuild a world-class service.

The process of development and clinical implementation of new techniques in radiotherapy is very different

from that of new pharmaceuticals. Pharmaceutical agents undergo extensive pre-clinical development, early phase trial work demonstrating proof of clinical efficacy followed by late-phase development in multicentre clinical trials, establishing benefit over the current standard of care with associated cost-effectiveness analyses. However, once this work has been conducted, international routine clinical application, delivery and expansion to other clinical scenarios is relatively straightforward. In contrast, radiotherapy developments are often initially conducted using computer modelling and require a similar level of early-phase trial activity to assess efficacy and toxicity. The critical difference is the complexity of routine application of radiotherapy within each centre, and the need for repetitive developmental work for different tumour sites. Innovation and implementation require significant additional expertise within each centre, as well as higher levels of research expertise within leading centres.

In 2008 the National Cancer Research Institute (NCRI) undertook a rapid review of the status of radiotherapy

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research in the UK [2], which identified areas of need for research development. One outcome of the rapid review was the refashioning of the previous NCRI Radiotherapy Clinical Studies Group into a multistream working group with a substantially broader remit. This new NCRI group, the Clinical and Translational Radiotherapy Research Working Group (CTRad), was launched in July 2009 [3, 4]. CTRad has an executive group and four workstreams, focusing on the science base, Phase I/II trials, Phase III trials and methodology, and new technology, including physics and quality assurance (QA). The group was launched with a 10-point plan, including a focus on physics and radiotherapy support for trials [2].

CTRad had previously organised two meetings for clinical oncologists to address academic career development and UK National Health Service (NHS) clinical oncologist engagement in research. Insufficient radiotherapy physics manpower to support clinically relevant research and development (R&D) activities was ranked second of 14 key barriers to development of academic clinical oncology in the UK. Several factors have an adverse impact on the ability of radiotherapy physicists to carry out research, including a lack of research infrastructure, difficulties identifying an entry route into training, a lack of career pathways and the perception that radiotherapy is not a priority for research funding. Many of these problems are familiar ones in other countries and have been eloquently reviewed by Bortfeld and Jeraj [5]. These authors highlighted that a poorly structured and resourced medical physics community will result in considerable delays in the implementation of new technologies and techniques into clinical practice, with obvious negative consequences for patients.

CTRad organised a meeting in July 2011 to address the issues affecting radiotherapy physics research in the UK. 23 departments were represented, including 16 centres with Cancer Research UK (CR-UK) centre status and 7 additional centres considered to have recognised physics strengths. Prior to the meeting, each centre was asked to supply simple metrics on its research capacity and infrastructure in radiotherapy physics, to provide a strengths, weaknesses, opportunities and threats (SWOT) analysis, and to identify key research themes. The responses were reviewed by members of the CTRad Executive Group, and seven centres were shortlisted to present at the meeting. This paper reviews the results of the pre-meeting evaluation, summarises the presentations and discussions, and proposes some potential solutions and approaches to increasing radiotherapy physics involvement in research.

Pre-meeting evaluation of capacity, strengths and priorities

All 23 participating centres supplied pre-meeting information on their research capacity and infrastructure, and a SWOT analysis. The research capacity varied widely between centres, in terms of junior and senior research staff, research-based grant funding and the level of integration with higher education institutes (HEIs). It is notable that 18 out of the 23 departments had ≤ 2 whole time equivalent academic staff. Out of the centres

with more than two, only one had substantive professorial posts with a HEI. However, 20 departments listed honorary appointments with HEIs and all but 5 had PhD studentships ongoing in their departments.

Departments were asked about research facilities and to specify the research time available on the most crucial piece of equipment, their linear accelerators (linacs). Out of 23 departments, 16 had no dedicated access to a linac for research, many commenting that research was conducted “out of hours” and fitted around a clinical service running at full capacity. Out of the seven departments that had reserved time for research, six had less than one accelerator, although one centre stood out, having access to two full-time research linacs.

Table 1 summarises the results of the SWOT analyses. It emerged that departments vary greatly in their size, structure, equipment, availability of dedicated research time on equipment, clinical caseload and staffing. This is exemplified by three items (equipment/access to equipment, funding and academic links) listed by some centres as strengths and by others as weaknesses. A key theme to emerge from the SWOT analysis is the need for dedicated time within their own centres for radiotherapy physicists to conduct research. Different departmental models to support this were discussed at length at the meeting and are presented below.

CR-UK centre status was also highlighted as a common strength in the SWOT analysis, but interestingly it was noted that, although 16 of these centres had CR-UK centre status, only 5 (Belfast, Manchester, Oxford, Liverpool and University College London) had radiotherapy listed as an active research area in their centre strategies.

Each centre was asked to identify the two topics they considered priorities for radiotherapy research. These fell into 13 broad topics (Table 2), the top 3 of which were image guidance (including functional imaging), verification of complex treatments and radiobiological modelling. Overall, it seems that there are several areas that could form the basis of radiotherapy research by collaborative groups.

Meeting discussion themes

The research and development process for radiotherapy physics

The process of technical innovation and implementation was discussed, and a model of R&D was proposed, referred to as the arrow of radiotherapy physics research (Figure 1). This describes how *ab initio* physics research enables new discoveries that, in combination with a clear clinical goal, can lead to a new treatment solution. There are a number of steps from the design of a potential development to clinical treatment, and the inclusion of the physicist in the multidisciplinary team is seen as crucial. Close interaction between the research physicist and the clinic is essential [5].

The UK has a strong track record in practice-changing radiotherapy clinical trials [6–13]. Several of these have provided proof of principle of the value of technical innovation. These trials include the value of conformal therapy to reduce toxicity [9], dose escalation for prostate cancer [10] and proof of reduced salivary gland toxicity

Table 1. Summary of pre-meeting strengths, weaknesses, opportunities and threats (SWOT) analyses from 23 radiotherapy physics departments

Strengths	Opportunities
Infrastructure Modern equipment Cancer Research UK cancer centre status Staff Motivated and highly skilled staff Funding Good grant funding track record Industrial links Culture Track record in research Track record in translational research Trial involvement Links Academic links Links to academic oncologists	Infrastructure New technology opportunities Links Academic links Increased links with manufacturers Increased number of academic oncologists
Weaknesses	Threats
Infrastructure Therapy equipment access and laboratory space Staff Lack of protected time physics for research Lack of critical mass Staffing establishment less than IPEM standards Funding Lack of grant income or core funding Clinical academics Limited number of research-active clinicians or no academic lead Culture Large clinical service hampering research Progress in advanced radiotherapy Academic links No academic links	Funding NHS funding cuts and cost improvement programmes Current economic climate Lack of (national) funding streams for radiotherapy-related research Clinical radiotherapy service NHS service pressure

IPEM, Institute of Physics and Engineering in Medicine; NHS, UK National Health Service.

Key factors (nominated by more than five centres) in bold; common factors (nominated by more than two centres) in plain text.

from IMRT in head and neck cancer [13]. These trials have also uncovered unexpected findings, such as increased levels of tiredness in the IMRT arm of PARSPORT (parotid sparing radiotherapy trial) thought to be due to increased brain/brainstem irradiation [13], illustrating the benefit of formal evaluation within a randomised trial setting. Tremendous progress has been made in dose and fractionation, well illustrated by clinical trials of hypofractionated breast treatments [14]. Many of these are seminal trials, which have been performed in a multicentre setting supported by strong physics QA with dedicated research time allocated.

This trials activity is being further strengthened by the activities of the NCRI CTRad workstreams. It has been recognised that radiotherapy clinical trials can play a key role in the routine uptake of new radiotherapy technologies, for instance conformal therapy [9, 10] and IMRT [13, 15]. It is also now understood that high-quality radiotherapy QA is required for successful outcome [16].

There are a number of areas of potential common interest between clinicians and radiotherapy physics-related research which fit within a medium-term time frame. These include:

1. The incorporation of functional imaging into target volume delineation and radiotherapy planning.

2. Better, faster and more accurate radiotherapy treatment planning, especially by the incorporation of Monte Carlo simulation.
3. Newer ways of delivering (conventional) X-rays, *e.g.* SABR and IGRT.
4. Improved delivery of charged particle radiotherapy, both protons and other light ions.
5. Modelling and better understanding of normal tissue response. (This work is often done by radiotherapy physicists in the UK, partly because radiation biology is no longer a large discipline, and partly because of the obvious link with radiotherapy dose distributions. In addition, radiotherapy physicists have the skills to undertake the necessary complex mathematical modelling.)
6. Further development of radiotherapy delivery techniques in order to test the value of "ideal" dose distributions in clinical trials.

Developments in these areas will lead to more sophisticated target volume delineation, dose painting and treatment adaptation, allowing increased tumour control and/or reduced toxicity. The management of patients with oligometastases is an important area for development and represents a new indication for highly focal radiotherapy, conceivably shifting the boundary

Table 2. Priority research topics from the pre-meeting evaluation, compiled from returns from 23 centres

Priority	Number of nominations
Image guidance planning (including functional imaging, target volume delineation and auto segmentation)	9
Delivery and verification of complex treatments (IMRT, VMAT, stereotactic)	7
Radiobiological modelling of the effects of advanced radiotherapy	5
Radiobiological modelling for treatment planning	4
Adaptive radiotherapy using physical or biological imaging and deformation modelling	4
Proton therapy	3
Hypofractionated radiotherapy techniques, e.g. SABR for lung, prostate, liver	2
Brachytherapy	2
Response assessments of advanced radiotherapy (tumour control, late effects, second malignancies and relation to treatment technique)	2
Individualised radiotherapy (radiotherapy informatics)	2
Workflow in radiotherapy	2
Imaging and dose delivery methods in radionuclide radiotherapy	1
Intra-operative radiotherapy	1

IMRT, intensity-modulated radiotherapy; SABR, stereotactic ablative body radiotherapy; VMAT, volumetric modulated arc therapy.

between palliation and cure. Finally, further attention is required for the combination of drugs with radiotherapy. In this context, the most modern and sophisticated radiotherapy techniques, especially image-guided IMRT, are required in order to optimise outcomes.

These types of innovation in radiotherapy will require a synergy or “symbiosis” between clinicians and physicists, each of whom must have sufficient time to devote to development. Symbiosis is used in this context as it embodies the idea of close and often long-term interaction between different “species”, a key notion for effective multidisciplinary working.

Barriers to research

At the meeting, participants were asked to rank 15 barriers to research in order of importance (Figure 2). In common with the SWOT analyses, the lack of protected time for research was identified as the biggest barrier, closely followed by the availability of external funding

and staffing issues. A key achievement of the CTRad group has been to obtain centralised funding for the NCRI Radiotherapy Clinical Trials Quality Assurance group, providing a very high level of QA in the preparation and delivery of clinical trials—promisingly, support for trial QA in centres was now *not* ranked as a major issue.

During the day’s discussion, further barriers emerged and are summarised in Table 3. Four of the major topics are explored in more detail below.

Research time and staffing models

Research requires time and dedication and cannot be expected to be conducted by physicists with a demanding clinical workload without sufficient protected time. This was the topic of the most robust discussion of the day, which centred around the most appropriate staffing model for radiotherapy research.

One model is that research is conducted by academic physicists situated within an academic programme. The

Figure 1. The arrow of radiotherapy physics research (courtesy of John Fenwick, Clatterbridge Centre for Oncology, 2011).

Figure 2. Barriers to research as prioritised by participants during the physics think tank meeting in July 2011. Participants were asked to rank the topics from 1 (most important barrier) to 15 (least important barrier). The range of rankings (minimum to maximum) is shown by the bar, and the median response for each statement by the square (compiled from 40 evaluable responses). QA, quality assurance.

contrasting view was that effective radiotherapy research requires physicists embedded in the clinic, that the radiotherapy physics profession has the skills and training to be conducting and leading research and that it should be possible to balance a research and clinical role. The answer is probably that both models can be effective. As proposed by Bortfeld and Jeraj [5], typically there will be a small number of posts at the *ab initio* end of radiotherapy research where research is best conducted by dedicated research staff in an academic programme, but there are several aspects of transitional research best conducted by physicists with clinical and research skills. The final step of rolling out a well-developed technique into all centres across the UK still requires local R&D skills and a national infrastructure in which the larger technique-developing centres support the smaller centres, which may have fewer staff. Both models need to flourish if the UK is to contribute across the entire research spectrum. The fundamental need is for physicists with research skills and sufficient protected time for R&D, including effective translation into the clinic.

One mechanism for liberating time for radiotherapy physicists is to ensure that departments are fully staffed with clinical technologists. In many departments this will

mean recruiting additional technologists without sacrificing scientists' posts, an extremely difficult business-case proposition in the modern NHS. Reinforcement of the guidance from professional bodies such as the Institute of Physics and Engineering in Medicine (IPEM) on scientist and technologist staffing levels [17] is required.

Academic career structure

The lack of career structure for academic physicists remains an important issue. In comparison with clinical physics posts, academic posts have lack of tenure, lower pay and less possibility for career advancement than equivalent NHS posts. This is in contrast to the increasingly structured and professional *clinical* role for radiotherapy physicists that has developed through the Ionising Radiation (Medical Exposure) Regulation, Agenda for Change and most recently Modernising Scientific Careers (MSC). There is considerable lack of clarity for the more academic career path in MSC.

There is a need to identify a stable career structure for post-doctoral-level clinical scientists. Only 2 of the 23 departments had >5 posts dedicated to radiotherapy research, with many posts being time limited with

Table 3. Key challenges in radiotherapy physics research

- Dedicated research time for physicists
- Lack of time at senior level to conduct research or train junior physicists, owing to managerial or service delivery commitments
- A shortfall in the type and quantity of dosimetrist/technologist support available, meaning junior physicists are overburdened
- Vacancy slippages and difficulty filling posts impacting on workload
- The model of scheduling of research time for NHS physicists (with mixed views on whether full- or part-time models would work better)
- Concerns about loss of research-active physicists to NHS service delivery (owing to higher salaries and high vacancy rate) and frequent turnover of research staff; the politics of poaching from a finite pool
- Concerns about the impact of Modernising Scientific Careers on preventing cross-recruitment of researchers from other branches of physics
- Changes in eligibility and terms and conditions of grants resulting in physics research falling through the gaps between funding streams
- Complexity of intellectual property negotiations making research initiation lengthy
- Higher education institute restrictions on journal choices (arbitrary impact factor thresholds may be mandated, which prevent publication of research in the appropriate medical physics titles)
- The lack of awareness among other local groups of departments' work and role, leading to missed opportunities for collaboration

NHS, UK National Health Service.

insecure funding. Currently, a common career pathway following completion of a PhD is to work for the NHS in a non-research role. The presence of junior and senior staff with PhDs facilitates knowledge transfer into the NHS, especially in an era of rapid implementation of novel technology, but the research community is therefore losing the majority of its trainees and the NHS is often failing to exploit excellent research training.

Concerns were raised throughout the meeting, and in the pre-meeting SWOT analyses, over the role of MSC and the considerable uncertainty in research training. With such uncertainties it is essential that alternative routes into the radiotherapy physics profession for research-trained scientists from other backgrounds remain viable.

Funding dilemmas

Of the departments surveyed for the workshop, 12 centres have some form of external funding, from either research councils or industry. This can be seen as a testament to the strength of R&D in radiotherapy in the UK. However, the SWOT analyses suggested that funding to support research in radiotherapy is becoming scarcer, and NHS departments in particular are struggling to find relevant and eligible funding streams.

A number of organisations in the UK fund medical physics research as part of their portfolio, including the Engineering and Physical Sciences Research Council (EPSRC), the National Institute for Health Research (NIHR), the Medical Research Council and the Science and Technology Facilities Council (STFC). However, the dynamic between funding streams has changed in the last decade, in a way that inadvertently separates basic and applied research. The 2006 "Best Research for Best Health" paper promised an era of NHS-led and embedded research, based on competitively secured funding [18]. Working with others was attractive to NHS physics researchers, who already collaborated with clinical colleagues and universities (HEIs) at home and abroad. The promise of long-term strategic support for R&D was equally promising. It was assumed that NHS-employed physics researchers would thereafter secure research funding through NIHR funding streams, and that medical physicists working in an HEI would apply for funding to the EPSRC and other research councils as usual. Those with joint NHS/academic

appointments could apply through either mechanism, although such individuals are uncommon.

While this seemed fine in principle, experience in recent years has revealed some problems. The NIHR supports "evaluation and confirmatory research" but not what is loosely termed as "basic research", and NHS-employed physicists are not eligible to apply for response-mode basic funding from the EPSRC. Relevant, "managed" (targeted) mode calls from the EPSRC, still open to NHS medical physics leadership, have dwindled. In practice, this has effectively excluded NHS medical physicists from undertaking basic research except in a supportive role to those holding HEI grants; this reduces their visibility as researchers and makes it harder to demonstrate a track record for future applications. Translational research is also at risk from the divisions between basic science and clinical application, as it requires these extremes to be brought together in a cycle of continuous improvement of knowledge and technical capability.

In order that physics researchers get the best advice, early contact with the appropriate funder to discuss the most suitable funding streams, and eligibility, is recommended. The funding organisation will then have sufficient time to consider the proposition and cross-refer to other funders as required. This will also demand greater communication between funding bodies, which could help to alleviate the challenges faced—constructive dialogue (e.g. consultation between radiotherapy physics and funders on the future of radiotherapy and greater representation on review panels) is needed to ensure that the UK does not miss the opportunity to lead in many of the highly technical developments in modern healthcare.

The impact of expansion of radiotherapy services

Over the last decade, UK radiotherapy treatment capacity has increased substantially. This has been achieved through extension of the clinical working day and an increase in accelerator provision. There has been a 14% increase in linac provision in England, from the 215 in 2007 to 246 in 49 centres recorded in 2010/11 [19, 20], although this is still below the 5 linacs per million population target [19]. The National Radiotherapy Advisory Group, and subsequently the National

Radiotherapy Implementation Group (NRIG), together with the Radiotherapy Development Board, led a concerted effort to introduce “advanced” radiotherapy into the UK. Much has been achieved, although more work is required to increase access to IMRT, SABR and IGRT [21].

This expansion of clinical services has stretched physics services:

- The expansion in staffing has lagged behind the expansion in activity.
- There is often a failure to recruit physics staff early enough in a project to ensure that they are in post and adequately trained for the commissioning of new services.
- It is often difficult to recruit staff at the desired grade, with the correct skills and training. Staff recruitment is often from lower banded staff members within a department.
- There is pressure to improve the efficiency of services, with ongoing cost improvement programmes in many trusts, and there is a tendency to see posts created by an expansion as an easy target for cuts.
- Examples have been reported of deliberate administrative delay in the creation of new posts or replacement of posts that become vacant, to save money.

Nationally, it is apparent that the expansion in radiotherapy services has stretched departments around the country, with the National Cancer Services Analysis Team census recording an average vacancy rate of 5% [22]. In general, staffing levels have not been matching activity levels, and, on average, departments have 70% of the staffing recommended by IPeM in 2008 [23]. In the face of such a shortfall, the priority for most departments will be to support the immediate needs of the clinic to the detriment of R&D, unless research time is very well protected and identified as a priority at a senior level.

Recommendations for developing radiotherapy physics research

The NCRI CTRad initiative provides a time-limited forum for taking on some of these central issues in radiotherapy research in order to help the community build a lasting legacy that will support clinical oncologists, radiographers and physicists. To develop radiotherapy research requires action in the following areas:

- **Funding opportunities:** CR-UK launched a call in late 2010 for *programme* grants including radiotherapy. Of eight outline applications invited to go forward to full applications, two were radiotherapy-related proposals—both have been funded. This process highlighted the need for *project* grant funding to be available for smaller scale work in radiotherapy. There is a need for the radiotherapy physics community to engage with representatives from the EPSRC, the STFC and CR-UK, and increased representation of radiotherapy physicists on the key research funding bodies is needed.
- **Collaboration:** Few individual departments have been successful in obtaining secure programmatic funding for research. One solution might be to increase the

level of collaboration between departments and with HEIs, addressing key research areas (Table 2) in a collaborative bid. This would also facilitate access to senior research leaders, when some departments lack this. CTRad Workstream 4 will work to identify additional key areas and specific issues within key areas, and to support potential collaborations.

- **Careers:** Many departments indicated that they had honorary links with an HEI, but relatively few had substantive posts at a senior level in radiotherapy research. Effective research programmes require academic infrastructure and mentoring for research staff. The radiotherapy physics community needs to increase substantive links to HEIs. There is also a clear need to examine the career path for academic radiotherapy physics researchers and to clarify the academic training route identified within MSC.
- **Workforce:** The possible role of job plans for physics clinical scientists should be explored, in partnership with IPeM and the NRIG. The requirement for greater protection of research time lends itself to a clearer identification using a job plan, as introduced for NHS and academic clinicians, rather than the current, looser job description used by physicists. This should be examined in partnership with IPeM and the NRIG. The NRIG and CTRad should share a common agenda of expanding the dosimetrist workforce to reduce the amount of routine work performed by highly skilled and research capable physics staff. In order to facilitate this, the NRIG and IPeM should closely monitor the evolving changes to training for clinical technologists in the NHS.
- **Facilities:** Research programmes would benefit from the availability of separate physical resources, to avoid conflict with the provision of clinical treatments.
- **Local initiatives:** Departments that have a clear local research strategy integrated within the trust and local HEI are clearly at an advantage in developing research, and carrying developments into clinical care. Individual trusts need to consider whether they wish to undertake radiotherapy research, with its attendant added value for the patient, and, if so, to ensure that they develop a strategy group for radiotherapy-related research that includes key NHS and HEI decision-makers and academic clinical oncologists. This is especially important for CR-UK centres. Departments should promote the work they do locally and develop local collaborations.
- **International comparison:** If we seek to compete internationally in radiotherapy research, we need to ensure that the radiotherapy physics infrastructure allows successful competition on the international stage. Infrastructure could be benchmarked against other successful centres, and should be included in the Department of Health International Cancer Benchmarking Exercise.

Conclusion

Radiotherapy as a leading cancer treatment has undergone enormous and rapid technological advances in the past decade and this will continue. To realise the

full potential of radiotherapy in improving outcomes for patients in the UK, the NHS, HEIs and funders need to provide a more secure physics R&D environment in the UK.

The development of academic programmes will happen through competition, provided there is sufficient funding to support both projects and programmes of research, in more than one institution. NHS departments should develop a clear multidisciplinary research strategy integrated with an HEI. Such academic programmes will require funding at a level upon which real infrastructure, in terms of staff and equipment, can be sustained. It is apparent that this is lacking in radiotherapy research, and it is a challenge to radiotherapy professionals to encourage the opening of funding streams. CTRad will aim to identify appropriate explicit funding streams, although it is clear that greater engagement and representation is needed on the major funding bodies.

The role of physicists in the development of modern medicine is well documented, but it is perhaps in the fields of imaging and radiation therapy where the link between the physicists and major progress in medicine is most apparent. R&D is essential to ensure that scientific advances lead to equitable access to radiotherapy and direct and immediate benefit to patients, and deserves to be supported in parallel to the recent expansion of radiotherapy service provision in the UK.

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