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Editorial

Implementation of Intensity-modulated Radiotherapy: Lessons Learned and Implications for the Future

T. Cooper *, M.V. Williams †

* National Cancer Action Team, London, UK
† Oncology Centre, Addenbrooke's Hospital, Cambridge University Hospital NHS Trust, Cambridge, UK

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Introduction

Intensity-modulated radiotherapy (IMRT) was implemented in much of Europe and North America on the basis of improved dose distributions to tumour and organs at risk. Evidence of clinical benefit was slow to emerge [1,2] and in the interim IMRT was developed as a research technique in the UK. This facilitated clinical trials in the radiotherapy of prostate, breast and head and neck cancer that now underpin current practice [3–5]. IMRT was highlighted in the National Radiotherapy Advisory Group (NRAG) report as an essential step towards the 10 year aim of developing four-dimensional adaptive radiotherapy [6]. Here we describe the programme and policy steps undertaken to ensure that a comprehensive IMRT service would be provided by radiotherapy centres across England.

Background

The Royal College of Radiologists established the Radiotherapy Development Board in 2007 to review the evidence in support of IMRT and to document current practice. In the UK, only 18 centres were able to treat with IMRT in 2008 [7], with only 2% of patients receiving inverse planned IMRT, mainly for prostate and head and neck cancer. This was a marginal improvement on an earlier survey in 2007 [8]. It was estimated that around 32,500 patients who might have benefited from IMRT who were not able to access this treatment despite the fact that 97% of all linacs were IMRT capable.

The National Radiotherapy Implementation Group (NRIG) has an oversight role and is charged with developing a modern and timely radiotherapy service for England. Its annual conference in November 2008 focused on the implementation of IMRT and was attended by 226 delegates from all the professions involved in radiotherapy delivery and commissioning. It became clear that there were a number of obstacles to the clinical implementation of IMRT. Clinical teams expressed apprehension at starting an IMRT programme, mainly centred on time pressures and lack of experience. Additionally, perceived blocks in the contractual commissioning of IMRT led to reluctance by provider organisations to initiate a service before commissioners had agreed contracts to pay for the service.

National Radiotherapy Implementation Group Technology Subgroup

In response to the outputs from the NRAG 08 event, the NRIG technology subgroup agreed to develop and publish a 'Guide to Commissioners' [9] to address the perceived lack of commissioner understanding of the role of IMRT. This document reviewed the role of IMRT, the data to support its implementation and included an overview of the clinical evidence base for each cancer site. It was estimated that 24% of all fractions should be delivered using inverse planned IMRT and that 9% of all fractions should be delivered using forward planned IMRT [10]. Table 1 sets out these estimates.

Recognising that agreement for delivery of IMRT would ultimately need to be sanctioned by the host provider organisation's board, the NRIG technology subgroup produced a template IMRT business case [9]. This was developed with significant support from The Christie NHS Foundation Trust and assisted other organisations to

Author for correspondence: T. Cooper, National Cancer Action Team, 18th Floor, Portland House, Bressenden Place, Victoria, London SW1E 5RS, UK.
E-mail address: timcooper@nhs.net (T. Cooper).

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Table 1
Estimate of the percentage of radically treated patients who would probably benefit from intensity-modulated radiotherapy (IMRT) and the consequent proportion of all fractions as IMRT

Tumour site	Percentage of all radiotherapy fractions	Percentage of patients who benefit	Percentage of all fractions as IMRT	
			Forward planned	Inverse planned
Breast	30	30	9	–
Prostate	16	80		13
Gynaecological	5	20		1
Head and neck	8	80		6
Central nervous system	3	60		2
Other sites	10	20		2
Total			9	24
Grand total			33	

provide a nationally consistent and comprehensive argument for IMRT provision to their patients.

The Intensity-modulated Radiotherapy Training Plan

The intelligence received from the NRAG 08 conference suggested that clinicians, physicists and radiographers had already undertaken theoretical IMRT training courses, and that the real obstacle was practical support for implementation. NRIG therefore designed a training programme to support the practical application of IMRT with each service's own equipment in their own department.

The NRIG technology group used a training concept previously used by the National Cancer Action Team and others. Key components were:

- Provide support to all three clinical disciplines as a team-based approach.
- Support the creation of protocols (generic for local adaptation).
- Provide peer quality assurance of outlined target volumes and organs at risk.
- Training to allow the principles and practice to be applied to other body/tumour sites not specifically included in the programme.
- Provide on-site support for the inverse planned IMRT solution for the first cohort patients (three to five patients) from voluming through to the first fraction of radiotherapy delivery and all steps in between.
- Provide remote support for the next cohort of patients.
- Provide off-site remote telephone and e-mail support for a period of not more than 3 months.

This methodology allows a service to feel increasing confidence in their application of the technology as successive cohorts of patients are treated and outside support is gradually withdrawn.

The tender was set out during December 2009 [9] and six responses were received proposing various approaches to achieve the same final output. The responses were scored against strict pre-agreed criteria (see below). A panel of 12 experts were used to assess each of the six responses. From this evaluation, a training contract was initially awarded to three organisations; a Christie/Clatterbridge Hospitals partnership proposal, Ipswich Hospitals and University Hospitals North Staffordshire (Figure 1).

External quality assurance of the programme was provided via the Radiotherapy Trials Quality Assurance team. Training partners were allocated to centres on the basis of matched planning systems between trainer and trainee centres: matching was undertaken using the National Radiotherapy Equipment Survey 2008 [11]. This decision was based on the expectation that the detailed practical use of planning systems would be the major focus of this practical training programme.

Previous data from IMRT survey work had identified those providers not yet delivering IMRT and there was no shortage of volunteers to undertake the IMRT training programme, once it was announced. As this was intended to be practical application training leading to the commencement of IMRT within the trainee organisation, trusts wishing to undertake the programme were required to meet key criteria:

- Key staff had already undertaken a theoretical training course on IMRT delivery.
- Linear accelerators were confirmed as IMRT enabled.
- Treatment planning systems had been commissioned for IMRT planning.
- Oncology management and record and verify systems should be such that integrated data transfer was achievable; an end to end test of the system should have been carried out.
- Agreement from the trust management to begin an IMRT programme. Local agreement with commissioners is a matter between the trust and its commissioners.
- Any other foreseeable issues that will prevent IMRT being delivered will have been resolved prior to training being provided.

In the first allocation; eight National Health Service trusts received training. Two further training providers