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Original Article

Variations in Radiotherapy Delivery in England — Evidence from the National Radiotherapy Dataset

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Abstract

Aims, Materials and method: Data in the national radiotherapy dataset for England for 2009–2011 is based upon downloads of activity from every linear accelerator in the country through its oncology management system linked to the local patient administration system to give a full overview of each patient episode.

Results: An analysis of this dataset shows that there is still a considerable variation in radiotherapy activity across the country, with a two-fold variation between the most and least active networks. Lower activity is seen in London and the southeast compared with the rest of the country, but when the data are split between the north and south of the country, no such variation is seen. Activity is higher in smaller centres and non-teaching centres. About half of all treatment is palliative and this proportion does not vary with geography, although there is considerable variation between individual centres in the proportion of radical radiotherapy given. There is a trend towards less use of radiotherapy, both radical and palliative, in the more deprived population groups, although no change in the relative use of palliative and radical treatment.

Conclusion: It is important to emphasise that these data currently reflect activity patterns only and do not reflect quality of care or treatment outcomes, which will be achieved by linkage with cancer registry data in the future.

Key words: Deprivation; England; linear accelerator; population; radiotherapy; regions

Introduction

Radiotherapy is the most effective non-surgical modality in cancer treatment and contributes to cure in over 40% of cancer patients [1]. However, the use of radiotherapy in England has historically been limited by access to and availability of modern radiotherapy equipment. This was highlighted in a report from the National Radiotherapy Advisory Group (NRAG) published in 2007 [2], which found that the number of linear accelerators in England was 4.6 per million compared with a predicted requirement based on equivalent European countries of 5.5–6 per million. Furthermore, although data from Europe and Australasia predicted that 52% of cancer patients should receive radiotherapy, in England use of radiotherapy was about half that predicted from published literature [2]. In addition, long waiting lists and limited use of advanced technology was evident in many services. As a result of this, significant investment was seen in new linear accelerators and standards for radiotherapy delivery of at least 40 000 fractions per million population by 2010 rising to around 54 000 per million by 2016 were set out.

Integral to these recommendations from the NRAG was the establishment of a national radiotherapy dataset (RTDS) to provide an accurate picture of radiotherapy activity as

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new equipment was commissioned and practices changed in the light of these standards.

It is clear that radiotherapy activity is not uniform across the country and initial activity analyses have been included in the first annual report from the RTDS (http://ncat.nhs.uk/news/rtds-annual-report-2009-2010). This paper seeks to explore these differences further in relation to the provision of radiotherapy resources in England.

Materials and Methods

Modern linear accelerators are networked within a department and their activity recorded on an oncology management system. Each department can therefore produce a database within which the activity of each linear accelerator is recorded in detail. These data are the mainstay of the English national RTDS linked to patient demographic and tumour details acquired from the patient administration system to give a full overview of each patient episode.

The data returns from each radiotherapy centre are collated in a central data warehouse at the National Cancer Services Analysis Team (NatCanSAT). Quality assurance of the data is maintained using customised software through which data returns are run to ensure internal consistency and to identify missing data. Datasets failing to meet the quality assurance requirements are returned to the submitting centre for correction before incorporation into the RTDS.

The currency used in this paper is that of radiotherapy attendances and episodes rather than fractions. This is seen as a more accurate measure of activity, avoiding the issues of double counting fractions where different phases of treatment are delivered or more than one site is treated. A radiotherapy episode is defined by the entire duration of radiotherapy procedures from planning to delivery and completion of treatment to a defined site. A radiotherapy attendance is defined by each treatment delivery, which may consist of radiation exposure to one or multiple sites during that event.

The full dataset can be found at the NatCanSAT website (http://www.canceruk.net/rtservices/rtds/home.htm).
Ethical approval for the dataset was obtained from the Patient Information Advisory Group at the Department of Health and submitted to the Information Standards Board. The dataset was approved and designated a mandatory data return for all National Health Service Trusts from April 2009.

Data are presented graphically with each centre named as defined in the RTDS; a comparison between datasets was carried out using a paired *t*-test.

Activity in relation to geographical disposition was analysed comparing first centres around London with the rest of the country and, second, north and south of the country with the divide between north and south defined by considering all centres south of Birmingham as 'south' and all the remainder, including Birmingham, as 'north'. In the analysis of attendances by size of radiotherapy facility; large was designated as six or more linear accelerators and small as fewer than six linear accelerators.

Results

Two years of mature data returns were available for analysis in the RTDS covering the period April 2009 to March 2011. Figure 1 shows a broad overview of activity in terms of episodes per million population and per thousand incident cancer cases across networks in England, demonstrating that the crude figures show a considerable variation in activity from just over 3000 episodes per million population to just over 6000 episodes per million, but when corrected for cancer incidence this was substantially reduced, with most centres achieving 40–50 episodes per thousand incident cases. Although episodes are an important parameter of overall radiotherapy activity and patient access, resource utilisation is also critically influenced by patterns of fractionation. In the RTDS this is reflected in the number of attendances. The number of attendances will depend upon the mix of palliative and radical treatment delivered. The RTDS does not currently include a collected data item for palliative or radical. Therefore, in this analysis this was derived using an arbitrary divide between patients receiving 14 or fewer fractions (defined as palliative) or 15 or more fractions (defined as radical). It is recognised that a relatively small proportion of patients will be misclassified. For example, patients receiving five fraction preoperative rectal treatment will be counted as palliative. Figure 1b shows the proportion of radical episodes and attendances for each radiotherapy centre in the country. Although there was variation across the country, in most centres radical work accounted for around 50–60% of episodes.

In order to evaluate whether there are reasons for a systematic variation in the provision of radiotherapy resources to account for these patterns, further analyses were undertaken to explore the effect of geographical distribution within the country, the size of the centre and whether it is a teaching hospital-based department or not. Activity in relation to geographical disposition is shown in Figure 2a, b comparing London with the rest of the country and north versus south. There was no significant difference between the number of attendances per calculated catchment population between the north and the south ($P = 0.8$; 95% confidence interval south to north −2154 to 2823).

The average number of attendances per episode across England was 14.1; in the south it was 14.0 and in the north 14.3, whereas in London and the southeast it was 14.2. Similarly, no difference in the number of episodes was seen between large and small centres (14.0 and 14.2) or teaching and non-teaching centres (14.1 and 14.2).

The analysis of attendances was also repeated, looking at the size of radiotherapy facility, as defined above (Figure 3a). Large centres treated significantly fewer attendances for their calculated catchment population ($P < 0.0011$; 95% confidence interval large − small −7487 to −1923). The overall average linear accelerator activity was 6503 fractions annually, with only a small difference between large centres, which achieved an average of 6312 fractions compared with small centres, which delivered 6609 fractions annually. Figure 3b has divided centres by whether they were based in a teaching