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## Original research article

# Decentralisation of radiation therapy. Is it possible and beneficial to patients? Experience of the first 5 years of a satellite radiotherapy unit in the province of Tarragona, Spain



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## ABSTRACT

**Background:** The concept of satellite radiotherapy originates in countries whose populations are largely dispersed in order to treat homogeneously the population by a unique fixed team. **Aim:** This report describes the creation and management of a satellite radiotherapy unit in Spain (RUTE-Radiotherapy Unit, Terres de l'Ebre). It is managed by the Radiation Oncology Department at Hospital Universitari Sant Joan de Reus. We report the benefit gained in the comfort of patients and the economic benefit gained by reducing the expense of transport for the health care system.

**Materials and methods:** RUTE is equipped with a linear accelerator. A team of 10 physicians, specialised in different oncology pathologies, travel to RUTE on a rotational basis from the main Radiation Oncology Department. Simulation and planning of treatment is managed at the Radiation Oncology Department in Reus. Patients from RUTE only have to visit the centre in Reus once throughout the treatment process.

**Results:** Since August 2008, 1500 patients have completed treatment in the satellite unit. The implementation of RUTE has greatly improved the comfort of patients and along with that, there have been important savings in transport costs to the regional health care system.

**Conclusions:** Despite the high technological requirements of our speciality, decentralising radiotherapy is feasible. We can guarantee the highest standards of treatment with no

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differences from attending the main centre. It implies a clear benefit for the comfort of the patients and an economic benefit by decreasing transport costs.

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## 1. Background

The incidence of cancer is increasing. Every year, 36,000 new cancer cases are diagnosed in Catalonia (Spain). It is estimated that in 2010, 4036 (11%) of those were in province of Tarragona, southern Catalonia.<sup>1</sup> It is currently estimated that over 60% of cancer patients (between 45% and 70%, depending on the series) need radiotherapy in the course of their illness, whether for radical or curative intent, preoperative, postoperative (adjuvant or complementary), or for prophylactic and palliative intent.

The province of Tarragona has a total area of 6303 km<sup>2</sup> and a total population of over 810,000.<sup>2</sup> The province is divided into two health care regions and one of them is the health care region of Terres de l'Ebre, which services 25% of the population, all within about 100 km of Reus. However, the Radiotherapy Department of *Hospital Universitari Sant Joan de Reus* is located in the heart of the city of Reus and covers the needs of the entire province of Tarragona. In order to guarantee the best quality of care to such a large number of patients, some of whom may come from distant villages to our centre, the Unit needed to make it easier for patients to access treatment units, and it was decided to decentralise treatments by way of a satellite unit (RUTE – Radiotherapy Unit of the Terres de l'Ebre), located in the city of Tortosa in the south of the province, which would cover the radiotherapy needs of the Terres de l'Ebre health region (Fig. 1). The unit is equipped with a linear accelerator and an ortovoltage unit. Until the creation and starting of the satellite radiotherapy centre in August 2008, the patients travelled during all treatment to the main department located in Reus.

The concept of satellite radiotherapy originates in countries whose populations are largely dispersed (Norway, Australia, USA, Canada)<sup>3–6</sup> with a single processing unit

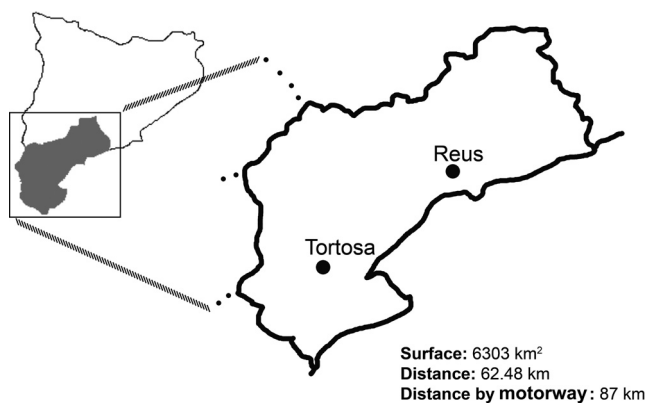


Fig. 1 – A map showing the distance between Reus and Tortosa.

staffed by a fixed team of consultants taken from relevant reference centres.

## 2. Aim

This report describes the creation and management of the satellite radiotherapy, RUTE, and the consequential benefits enjoyed.

## 3. Materials and methods

The headquarters of the Radiotherapy Department of *Hospital Sant Joan de Reus* is in the city of Reus. It is equipped with 3 linear accelerators, a CT-simulator and high-dose rate brachytherapy (Fig. 2). The RUTE satellite unit is equipped with a linear accelerator (Varian Clinac 2100C) and an ortovoltage 90–350 kV, which runs daily from 7.30 a.m. to 3 p.m. It is twinned with three other linear accelerators located in the main Radiotherapy Department in Reus. When a machine is out-of-order or under maintenance, patients can be treated directly through the other machines without any changes to their treatment.

A team of 10 physicians, specialised in different oncology pathologies, travel to RUTE on a rotational basis from the main Radiation Oncology Department, ensuring that there is at least one physician in attendance every day for patient care and in order to guarantee the quality of service. In our centre, there are two clinicians always available, one who specialises in breast cancer and the other in prostate cancer. In addition, there are two technicians responsible for treatment and nursing care, who are a permanent staff. Clinical protocols are shared with those of the main radiotherapy department in Reus, as well as all clinical history files, so that patients' information can be accessed from any location.

Patients are referred from hospitals in the RUTE catchment area, the majority of them from multidisciplinary committees

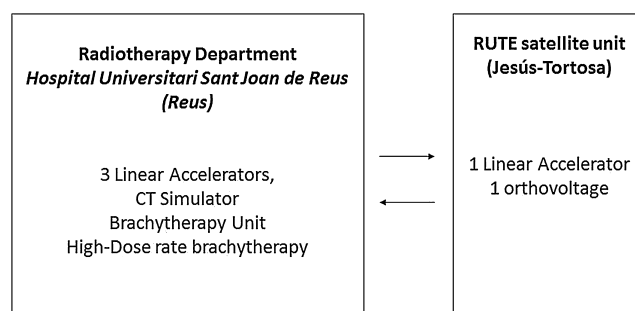


Fig. 2 – The equipment located in the Radiotherapy Department (at the main centre in Reus and in Tortosa). RUTE – Radiotherapy Unit of the Terres de l'Ebre.

of Tumours. New patients are admitted directly into the RUTE system, with the exception of palliative care patients or those admitted into a ward. Because of the lack of a CT-simulator in RUTE, admissions are done at the main radiotherapy unit in Reus so that the initial patient consultation can be made where the CT simulator is located. The simulation and treatment planning process is carried out in the main Radiation Oncology Department. The Internet bandwidth available in the region limits the synchronisation between the servers in the main centre and the satellite unit, therefore when treatment has been planned and verified, they are exported via the RUTE local server and then recovered through a remote desktop controller or by the same satellite centre. Alternatively, treatments can be sent via removable devices (CD, USB storage...) and then loaded to the RUTE server. During treatment, checks are carried out by the on-call clinician and a nurse.

The cost of transport was evaluated. The benefits to patients' comfort took into account the time saved in not having to go to the radiotherapy unit and the clinical benefit in preventing fatigue, including savings in medical visits related to treatment.

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#### 4. Results

In the two health regions involved, population density varies. In *Camp de Tarragona*, density is 192 inhabitants per km<sup>2</sup> while in *Terres de l'Ebre* the density is a quarter of that (57.1).<sup>2</sup> Overall, the Radiotherapy Department treated 1800 patients last year (2013), 400 of them were treated in RUTE. Since starting RUTE in August 2008, 1500 patients have completed RT in the satellite unit, which implies 37,500 treatment sessions. The most frequently treated pathologies were: breast 29%, prostate 19%, palliative 11.5%, rectum 10% and head and neck 10%.

During the treatment regimen, patients being treated at the satellite unit only have to travel to the main unit once. This has improved the quality of patients' life, avoiding 37,500 trips to the main unit, representing an estimated saving of around 75,000 h. Before RUTE, patients had to travel every day, some more than 200 km, taking up more than two hours on every treatment day. In the 5 years to date, the saving has been estimated at some €2 million. It is very important to note that we can guarantee patients the best treatment choice, with the clinical-technical excellence that is available at the main centre.

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#### 5. Discussion

The characteristics of an ideal health care system have been identified as efficiency, quality and access.<sup>7,8</sup> Radiotherapy requires a uniform and efficient planning, verification, monitoring, quality control and constant improvement of all aspects of service delivery, referring both to patients and organisational, technical and physics matters.<sup>9</sup> The satellite radiotherapy units can accomplish these requirements.

In the treatment of cancer, outreach and community programmes for the administering systemic therapy are well established. In contrast, the alternative non-surgical therapeutic strategy for this disease, radiotherapy, has been

mainly available in large facilities in major metropolitan areas, housing many treatment units. Radiotherapy services have traditionally been offered in large, centralised multi-megavoltage unit treatment centres. The reason for this has been to ensure the maintenance of high standards and continuity of care.<sup>10-13</sup> It is important to identify patient's requirements and to evaluate the level of patient's satisfaction. Based on this evaluation, we can provide some solutions in order to improve the quality management system in health care institutions.<sup>18,19</sup> One study suggests that centralised radiotherapy imposes the greatest financial burden on the patient population in both the urban and rural scenarios.<sup>11</sup> Technology now exists that can also ensure quality technical radiotherapy at remote locations.<sup>11,14</sup> Mackillop et al. concluded that Ontario's centralised radiotherapy system does not, at present, provide adequate or equitable access to care. In that province, which is largely rural, the rates of radiotherapy use are much lower than the accepted national and international targets, the proportion of incident cases treated with radiotherapy was 28.2% at 5 years and 29.1% at 8 years.<sup>8,15</sup> Denham et al. drew a similar conclusion in the Australia context, indicating that difficulties of access contribute to low use of radiotherapy treatment rates and suggesting that access would be improved by providing further small treatment centres in moderately large rural or semi-rural population centres.<sup>8,16,17</sup>

Terres de l'Ebre is a Health Region with more than 190,000 inhabitants. The international recommendation is one machine per 160,000 inhabitants that can provide treatment for 400 patients annually. Radiation therapy is usually administered in a large number of fractions (between 25 and 38) depending on the location of the target volume and treatment with concomitant chemotherapy toxicity can lead to severe damage to the patient. Until the creation of RUTE, patients from this health region had to travel every day to receive RT treatment, some as far as 200 km. A patient with tumour of the larynx, for example, receiving 35 sessions of RT (maybe concomitant chemotherapy) would travel 7000 km in physical and psychological conditions badly affected by the disease and the therapy. This fact precludes or hinders some patients from multi-modality treatment schemes.

Rather than measuring distances, we measured time, and defined different isochrones in the populations of the area and the location of Radiotherapy facilities need to satisfy strict. Therefore, the lower population density in the Terres de l'Ebre, health region, along with the long travelling times to the processing units in Reus, justifies the creation and maintenance of RUTE. Additionally, the reduction in transport times implies a reduction in CO<sub>2</sub> emissions, having a positive impact on the health of the population.<sup>20</sup>

RUTE has brought with it a priceless improvement in the quality of life for patients living in the health region of Terres de l'Ebre who need radiation treatment. It has ensured they can receive the best technical, specialised treatment just as they would in the main centre. Dunscombe et al. published a very interesting economic study about radiotherapy service delivery models for a dispersed population. They demonstrated that centralised models for radiotherapy are still the most expensive from a society perspective. The outreach service delivery model (central comprehensive facility

and satellite) is the cheapest one. The study concluded that beyond 170 km, a fully decentralised service would be warranted even if the only consideration was economic.<sup>8</sup> On the other hand, decentralisation can come with a risk of duplication in resource investment and the risk of low activity when maintaining small centres with limited technology and a proliferation of personnel costs. In some cases, decentralisation may not be cost-effective from an operational point of view due to the population distribution. Regional deployment must mean improved accessibility provided that it maintains quality of care. Consolidating the services offered in radiotherapy reference centres and evaluating the need for service facilities located in other hospitals are an important consideration when designing satellite units. Incorporating new technologies for high complexity treatments must be done in highly specialised centres following planning criteria that take into account estimated annual treatment volumes, professional training requirements, access to the technology and the evaluation of results. The model of a major “hub” site and one or more satellite units that work with the same protocols and the same clinicians is probably the best one as our speciality is highly complex and needs continuity.

## 6. Conclusions

In spite of the highly technological requirements of radiotherapy, decentralisation is feasible, and has a clear benefit for the comfort of patients and economic benefit by reducing patient costs.

## Conflict of interest

None declared.

## Financial disclosure

None declared.

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