



Original Article

Examining Determinants of Radiotherapy Access: Do Cost and Radiotherapy Inconvenience Affect Uptake of Breast-conserving Treatment for Early Breast Cancer?



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Abstract

Aims: Radiotherapy utilisation is likely affected by multiple factors pertaining to radiotherapy access. Radiotherapy is an integral component of breast-conserving treatment (BCT) for early breast cancer. We aimed to determine if stepwise improvements in radiotherapy access in regional Australia affected the uptake of BCT and thus radiotherapy.

Materials and methods: Breast cancer operations in the Central Coast of New South Wales between January 2010 and March 2014 for T1-2N0-1M0 invasive or *in situ* (≤ 5 cm) disease in female patients eligible for BCT were examined. BCT uptake was calculated for three 1 year periods: period 1 (local radiotherapy available at cost to user or out of area radiotherapy with travel cost and inconvenience); period 2 (as per period 1 + publicly funded transport and radiotherapy at out of area facilities at no cost to user); period 3 (as per period 1 + publicly funded local radiotherapy at no cost to user).

Results: In total, 574 cases met eligibility criteria. BCT declined with increasing distance to publicly funded radiotherapy ($P = 0.035$). BCT rates for periods 1, 2 and 3 were 63% (113/180), 61% (105/173) and 71% (156/221). There were no statistically significant differences in BCT between periods 1 and 2 in the whole cohort or within age, histology or tumour size subgroups. Overall, there was a 9% increase in BCT in the whole cohort in period 3 compared with periods 1 and 2 ($P = 0.031$). This increase was statistically significant for women over 70 years (19% increase, $P = 0.034$), for women with ductal carcinoma *in situ* (25% increase, $P = 0.013$) and for women with primary tumours that were ≤ 10 mm (21% increase, $P = 0.016$).

Conclusions: Improving the affordability of radiotherapy through publicly funded transport and radiotherapy at out of area facilities did not improve BCT uptake in a region where radiotherapy was locally available, albeit at cost to the user. Improving both affordability and convenience through the provision of local publicly funded radiotherapy increased BCT uptake. Service availability and affordability have long been recognised as important determinants of radiotherapy access. Our findings suggest that inconvenience may also influence radiotherapy utilisation.

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Key words: Access; availability; cost; inconvenience; radiotherapy; utilisation

Introduction

Radiotherapy remains an underutilised cancer treatment, despite its recognised roles in various curative and palliative settings, and its cost-effectiveness [1,2]. There may be several contributing factors. First, there may be barriers affecting consumers' (patients and carers) and

referring doctors' opportunities for radiotherapy. These include service availability, affordability, acceptability and adequacy. Further factors at the consumer, referring doctor and radiotherapy service provider levels may influence the translation of the opportunity for radiotherapy to actual radiotherapy utilisation. Radiotherapy-related inconvenience may be one of these factors. Inconvenience related to using a service refers to the time and effort consumers expend on service acquisition and utilisation [3]. Perceived inconvenience relating to radiotherapy may affect treatment decisions made by consumers and their doctors, and thereby affect radiotherapy utilisation.

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Early breast cancer can be treated with either breast-conserving treatment (BCT) or mastectomy with equivalent disease control outcomes [4–7]. The former approach involves wide local excision of the primary tumour followed by adjuvant radiotherapy to the whole breast. This typically involves daily fractions of radiotherapy for a minimum period of 4 weeks. In this clinical scenario, women who undergo mastectomy for early breast cancer are not receiving inappropriate care. They are simply exercising their choice to not have BCT, which involves adjuvant radiotherapy. Their treatment decision may be influenced by actual or perceived difficulties with access to radiotherapy. An examination of factors influencing BCT utilisation provides the opportunity to examine factors influencing radiotherapy utilisation.

The Central Coast of New South Wales (NSW) has had local access to radiotherapy since 1995 through a private sector radiotherapy service provider located at Gosford, NSW. Although local radiotherapy services have been available since this time, the opportunity for radiotherapy may have been suboptimal due to direct costs incurred by the user. Until January 2011, the alternative option for patients wanting radiotherapy was to temporarily relocate or commute daily at their own cost and inconvenience to publicly funded radiotherapy facilities outside of the Central Coast. In January 2011, a publicly funded transport service was established to transport patients from the Central Coast to either Royal North Shore Hospital in Sydney (68 km from Gosford) or Calvary Mater Newcastle Hospital in Newcastle, NSW (86 km from Gosford) at no cost to the patient. This initiative improved the affordability of radiotherapy but the inconvenience remained. In March 2013, publicly funded radiotherapy services were offered locally at Gosford Hospital. This resulted in local availability of affordable radiotherapy, which could be utilised with less inconvenience. Given the sequential, stepwise changes in radiotherapy access, this geographical location offered an ideal setting to examine two of the factors potentially affecting radiotherapy access and utilisation, namely cost and inconvenience.

This study aimed to determine if stepwise interventions to improve the affordability of radiotherapy and reduce radiotherapy inconvenience in the Central Coast of NSW, Australia, affected the uptake of BCT for early breast cancer in this region. Secondary aims were to determine if there was a relationship between the distance to radiotherapy and the uptake of BCT and if there were differences in the uptake of BCT by age, histology (invasive breast cancer versus ductal carcinoma *in situ*) and tumour size.

Materials and Methods

After approval by the Hunter New England Human Research Ethics Committee and the Central Coast Local Health District Research Governance Office, records of female patients who underwent surgery in the Central Coast Local Health District of NSW for early breast cancer

during three 1 year time periods between January 2010 and March 2014 were retrospectively identified from records maintained by breast care nurses, Breast Screen NSW (Central Coast), multidisciplinary team (MDT) records and hospital databases. All patients (whether operated on in the private or public sector) had been discussed in a breast MDT and had been recorded in the MDT database. Demographic information, tumour characteristics and treatment details were collated from the above records. Early breast cancer was defined as T1–2 (5 cm or less without direct extension to chest wall and/or the skin), N0–1 (movable ipsilateral axilla lymph nodes without cutaneous involvement or fixity to underlying tissue), M0 (no distant disease). Given that the study focus was on the initial management decision, cases of mastectomy for inadequately cleared margins from previous BCT were included in the BCT group (as per their initial surgery date) as long as all other criteria were met. For patients who had bilateral breast cancers (synchronous or metachronous), each cancer was considered separately. Patients with documented inflammatory breast cancer, multicentric disease (two or more primaries in separate quadrants of the breast) and those who had received neoadjuvant chemotherapy were excluded. Patients who had documented conditions precluding adjuvant radiotherapy (pregnancy, scleroderma/CREST syndrome, previous local radiotherapy) and those with a familial cancer history of BRCA1 or -2 were also excluded.

The proportion of BCT cases was calculated for each of the 1 year time periods (Figure 1). In period 1 (1 January 2010 to 31 December 2010) patients incurred direct costs and inconvenience accessing radiotherapy. During period 2 (1 January 2011 to 31 December 2011) the direct cost of radiotherapy to the user was minimised but the inconvenience remained. In period 3 (1 April 2013 to 31 March 2014) patients could access radiotherapy at no direct cost and inconvenience was minimised. To our knowledge, there was no change in the level of access to radiotherapy in the Central Coast region in the time gap between periods 2 and 3. We deliberately chose to avoid the time period leading up to the opening of the public radiotherapy service (the start of period 3) in order to avoid any confounding effects from anticipation regarding the impending start of the publicly funded free service. Given the breast cancer clinical scenario being studied, patients and referrers may have chosen BCT with plans to safely defer adjuvant radiotherapy by some months until the publicly funded local service was operational. This was an additional reason for avoiding this time period.

The distance to radiotherapy (from suburb of residence by road) was determined using Google Maps [8]. The ‘nearest radiotherapy’ was defined as the closest radiotherapy facility regardless of the direct cost of radiotherapy. The ‘nearest no cost radiotherapy’ was defined as the closest publicly funded radiotherapy facility offering radiotherapy at no direct cost to the consumer.

Descriptive statistical analyses were carried out and the proportion of women undergoing BCT during each of the time periods was determined and compared. The chi-

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