



# Population-based utilization of radiation therapy by a Canadian breast cancer cohort

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## ABSTRACT

We examined trends in radiation therapy (RT) utilization by a population-based breast cancer cohort in Ontario. The provincial cancer registry provided a breast cancer cohort based on diagnosis dates from April 1, 2005, to March 31, 2010. Staging information was also available. The cohort was then linked, by encrypted health card number, to linkable administrative datasets, including RT utilization.

The average age in the identified female breast cancer cohort ( $n = 39,656$ ) was  $61.6 \pm 14.0$  years. Almost two thirds of the patients ( $n = 25,225$ ) received RT, and staging information was available for 22,988 patients (9541 stage I, 8516 stage II, 4050 stage III, and 881 stage IV). The average number of RT courses received by the patients was  $1.4 \pm 0.7$  for stage I,  $1.8 \pm 1.1$  for stage II,  $2.5 \pm 1.3$  for stage III, and  $2.8 \pm 2.4$  for stage IV. The ratio of conventional RT to intensity-modulated RT was 70.9%:16.6% for stage I, 71.6%:11.3% for stage II, 74.6%:4.6% for stage III, and 89.6%:2.2% for stage IV.

From 2005 to 2010, almost two thirds of a Canadian female breast cancer cohort received RT, and the average number of courses increased with disease severity. A similar trend was observed with the type of RT (use of conventional RT increased with disease severity). The next step is to apply unit costs to the number of fractions and to obtain RT planning and radiation therapist times.

## KEY WORDS

Radiation, breast cancer, utilization

## 1. INTRODUCTION

Breast cancer is the leading cause of morbidity and mortality in Canadian women<sup>1</sup>. In Ontario, based on 10-year prevalence, an estimated 59,236 women are living with breast cancer<sup>2</sup>. Radiation therapy (RT) is an important part of the management of breast

cancer. The publicly funded Ontario health care system pays for approved radiation treatments for all permanent residents<sup>3</sup>. The conventional form of RT involves delivery of tangential radiation, which can damage surrounding tissues. Intensity-modulated RT (IMRT) delivers radiation with varying intensity across a field, which has the benefit of avoiding proximal organs<sup>4</sup>. Population-level RT utilization has not been investigated. Our goal was to examine trends in RT utilization and to determine the proportions of conventional RT and IMRT utilization in a population-based breast cancer cohort in Ontario.

## 2. METHODS

Incident cases of female invasive breast cancer (ICD-9 174.x) diagnosed from April 1, 2005, to March 31, 2010, were extracted from the provincial cancer registry. Disease stage (I–IV) of this breast cancer cohort at diagnosis was obtained from Cancer Care Ontario<sup>5</sup>. At the Institute for Clinical Evaluative Sciences, the cohort was then linked by encrypted health card number to the activity-level reporting dataset for RT utilization. Radiation therapy visits consisted of both planning and treatment visits. The types and use of RT were then stratified by disease stage for the first 2 years after diagnosis. Descriptive statistics were used to characterize the dataset, and in particular, the ratio of conventional RT to IMRT was calculated for each stage of the disease at diagnosis.

## 3. RESULTS

The average age in the overall cohort of 39,656 breast cancer patients was  $61.6 \pm 14.0$  years. Most members of this group resided in an urban setting. Almost two thirds of the patients ( $n = 25,225$ ) had at least 1 RT visit. Disease stage and radiation course information were available for 22,988 patients (Table 1). Most individuals in the RT cohort were categorized as stage I (37.8%) or II (33.8%) at time of

TABLE 1 Radiation therapy by disease stage

Disease stage	Patients receiving radiation therapy [n (%)]	Average courses per patient (n)
Overall	25,225	1.8±1.2
I	9541 (37.8)	1.4±0.7
II	8516 (33.8)	1.8±1.1
III	4050 (16.1)	2.5±1.3
IV	881 (3.5)	2.8±2.4
Not staged	2237 (8.9)	NA

NA = not available.

diagnosis. The proportion of patients who received RT declined with stage, and the average number of courses per patient increased with stage. The ratio of conventional RT to IMRT was calculated for each stage at diagnosis (Figure 1). Conventional RT utilization increased with increase in stage; use of IMRT declined with increase in stage. The proportion of patients who received both types of RT increased with increase in stage, but peaked at stage III (19.9%) before dropping to 6.6% at stage IV.

#### 4. DISCUSSION AND CONCLUSIONS

Our analysis of female breast cancer patients diagnosed over a 5-year period found that almost two thirds received RT. Radiation therapy is therefore an important medical resource to analyze and report. The number of patients receiving RT increased with disease severity, as did the number of RT courses. A similar trend was observed for RT type: conventional RT increased and IMRT decreased with disease severity, likely because of use of palliative RT.

Our next step is to determine the average number of fractions per course and per disease stage, to determine unit costs for the fractions, and to analyze RT planning and radiation therapist times.

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#### 6. CONFLICT OF INTEREST DISCLOSURES

The authors have no financial conflicts of interest to declare.

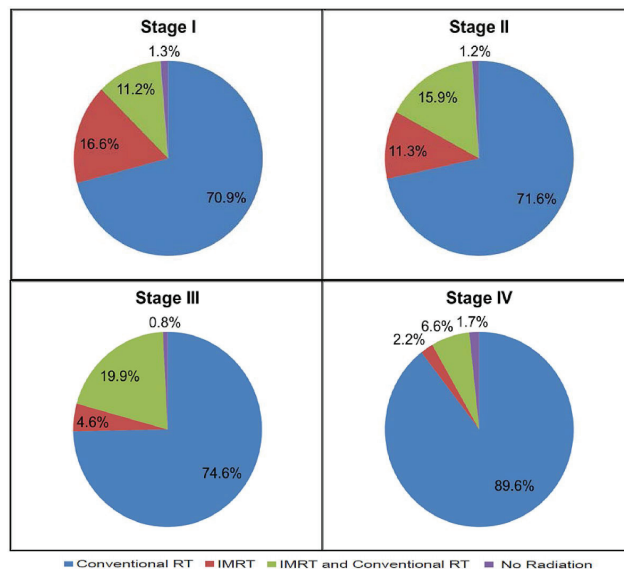


FIGURE 1 Type of radiation received, by breast cancer stage.

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