

# Use of low-value radiotherapy practices in Canada: an analysis of provincial cancer registry data

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## ABSTRACT

**Background** As part of Choosing Wisely Canada (a national campaign to encourage patient–provider conversations about unnecessary medical tests, treatments, and procedures), a list of ten oncology practices that could be low-value in some instances was developed. Of those practices, two were specific to radiation therapy (RT): conventional fractionation as part of breast-conserving therapy (BCT) for women with early-stage breast cancer, and multifraction radiation for palliation of uncomplicated painful bone metastases. Here, we report baseline findings for the current utilization rates of those two RT practices in Canada.

**Results** The use of conventional fractionation as part of BCT varied substantially from province to province. Of women 50 years of age and older, between 8.8% (Alberta) and 36.5% (Saskatchewan) received radiation in 25 fractions (excluding boost irradiation) as part of BCT. The use of hypofractionated RT (that is, 16 fractions excluding boost irradiation)—a preferred approach for many patients—was more common in all 6 reporting provinces, ranging from 43.2% in Saskatchewan to 94.7% in Prince Edward Island.

The use of multifraction RT for palliation of bone metastases also varied from province to province, ranging from 40.3% in British Columbia to 69.0% in Saskatchewan. The most common number of fractions delivered to bone metastases was 1, at 50.2%; the second most common numbers were 2–5 fractions, at 41.7%.

**Conclusions** Understanding variation in the use of potentially low-value RT practices can help to inform future strategies to promote higher-value care, which balances high-quality care with the efficient use of limited system resources. Further work is needed to understand the factors contributing to the interprovincial variation observed and to develop benchmarks for the appropriate rate of use of these RT practices.

**Key Words** Breast cancer, bone metastasis, radiation, appropriateness, patterns of care

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## INTRODUCTION

In 2012, the ABIM Foundation in the United States launched the Choosing Wisely campaign to encourage patient–provider conversations about unnecessary medical tests, treatments, and procedures. To date, similar campaigns have been developed in more than 15 countries, including Canada<sup>1</sup>, with speciality society partners developing recommendations of “Things Providers and Patients Should Question”<sup>2</sup>.

In Canada, a Tri-Society Task Force consisting of representatives from the Canadian Association of Radiation

Oncology, the Canadian Association of Medical Oncologists, and the Canadian Society of Surgical Oncology was convened by the Canadian Partnership Against Cancer to develop recommendations for oncology practices that should be questioned because they are low-value in some instances and are frequently used in Canada<sup>3</sup>. A final list of ten cancer care practices that should be questioned was developed.

Of the final recommendations, two are specific to radiation therapy (RT).

The first of those recommendations suggests that whole-breast RT in 25 fractions (that is, conventional

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fractionation) as part of breast-conserving therapy (BCT) in women 50 years of age and older with early-stage invasive breast cancer should not be initiated without considering shorter treatment schedules<sup>3</sup>. In North America, conventional fractionation has been the standard for whole-breast RT after breast-conserving surgery, likely because multiple randomized controlled trials have demonstrated the efficacy and safety of BCT using that fractionation scheme<sup>4</sup>. However, several randomized controlled trials have now demonstrated that hypofractionated RT provides equivalent tumour control, cosmetic outcomes, and survival, while optimizing patient convenience<sup>5–8</sup>. As a result, published guidelines have endorsed hypofractionated whole-breast RT as the preferred approach<sup>9,10</sup>.

The second recommendation suggests that more than a single fraction of palliative radiation should not be recommended for an uncomplicated painful bone metastasis<sup>3</sup>. Bone metastases are a common cause of cancer-related pain. Characteristics of uncomplicated bone metastases include the “presence of painful bone metastases unassociated with impending or existing pathological fracture or existing spinal cord or cauda equina compression”<sup>11</sup>. Numerous randomized controlled trials have consistently demonstrated equivalent pain relief and morbidity for uncomplicated bone metastases with single- and multiple-fraction regimens, but a slightly higher rate of retreatment with single-fraction regimens<sup>12–14</sup>. Given that single-fraction regimens provide equivalent early outcomes and greater patient convenience, several practice guidelines have endorsed their use<sup>15–17</sup>.

It is important to note that considerable evidence shows the efficacy and safety of conventional fractionation as part of BCT and of multifraction radiation for the palliation of bone metastases<sup>12,14,18</sup>. Those practices are therefore appropriate and beneficial for some cancer patients and would, in some cases, be preferred over the hypofractionated approaches. But here, we present baseline measures of the current utilization rates of the two foregoing RT practices in Canada. Understanding variation in the use of potentially low-value RT practices can help to inform future strategies to promote higher-value care, which balances high-quality care with the efficient use of limited system resources.

## METHODS

To examine the use of hypofractionated and conventionally fractionated RT for breast cancer, women 50 years of age and older diagnosed with stage I or II breast cancer in 2013 were identified using data from 6 provincial cancer registries (specifically, Alberta, Saskatchewan, Manitoba, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador; the remaining provinces were unable to participate because of data limitations). Receipt of breast-conserving surgery within 1 year of diagnosis was identified by surgical procedure codes in the provincial cancer registries or by linking registry data with cancer centre or hospital data. Receipt of RT within 270 days of breast-conserving surgery was identified by linking registry data to cancer centre or hospital data. The RT data excluded boost irradiation and nodal irradiation.

To examine the fractionation of palliative RT for bone metastases, cancer patients 18 years of age and older who were treated with external-beam RT to bone in 2013 were identified using data from 5 provincial cancer registries (specifically, British Columbia, Saskatchewan, Manitoba, Nova Scotia, and Prince Edward Island; the remaining provinces were unable to participate because of data limitations). Reporting provinces were able to consistently identify only the site of RT (that is, bone). Provinces were not able to determine if RT was for a bone metastasis. Patients with primary malignancies of the bone were therefore excluded from the analysis, because RT to the skeletal site could represent treatment of the primary site rather than of a metastasis. With that exclusion, RT to bone was accepted as a proxy for RT for bone metastasis.

Participating provinces were provided with a standardized data entry template. The template was populated with provincial results and provided to the authors of the present work. Descriptive statistics were generated. Results are reported by province.

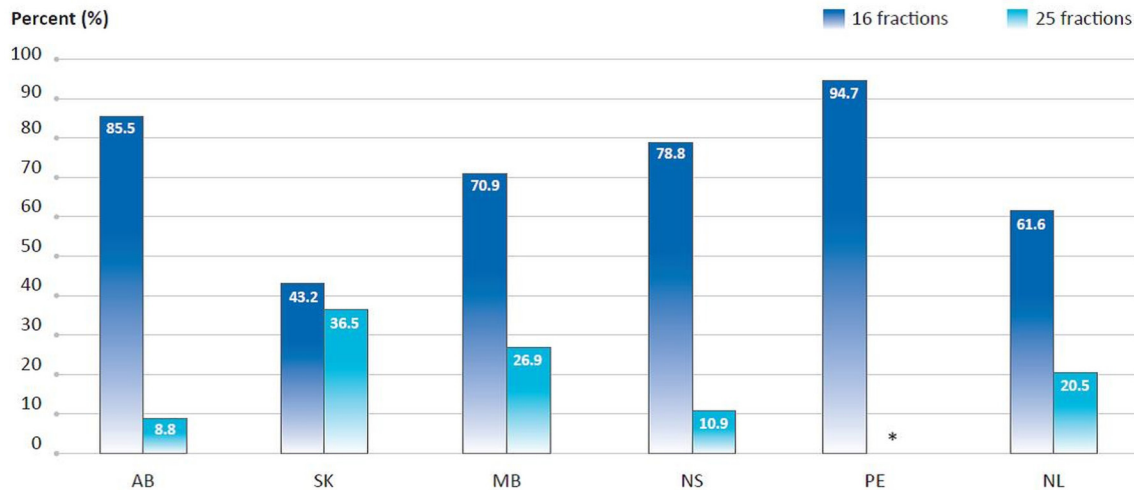
## RESULTS

Of women diagnosed with stage I or II breast cancer in 2013, 1471 in 6 provinces received RT after breast-conserving surgery. Of those 1471 women, 16.5% ( $n = 242$ ) received conventionally fractionated RT (that is, 25 fractions, excluding boost irradiation), 75.5% ( $n = 1110$ ) received hypofractionated RT (that is, 16 fractions, excluding boost irradiation), and 8.0% ( $n = 119$ ) received a different fractionation regimen. Compared with hypofractionated RT, conventional fractionation as part of BCT was less commonly used in all reporting provinces, but use varied substantially from province to province (Figure 1). Of women 50 years of age or older, between 8.8% (Alberta) and 36.5% (Saskatchewan) received radiation in 25 fractions as part of BCT. In the same population, the use of hypofractionated RT ranged from 43.2% in Saskatchewan to 94.7% in Prince Edward Island.

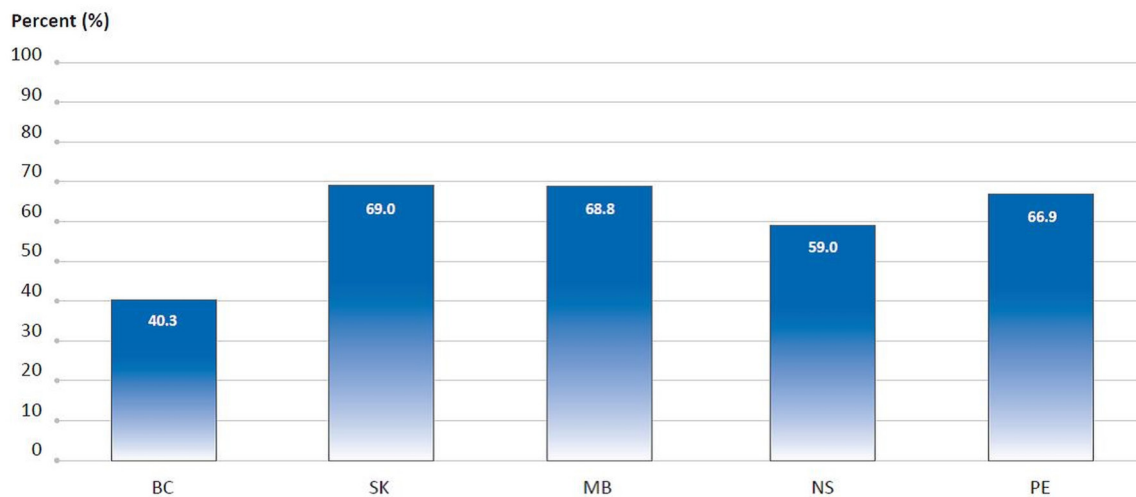
In 2013, 5115 cancer patients received palliative RT for bone metastases in 5 provinces (Figure 2). Of those 5115 patients, 49.8% ( $n = 2549$ ) received multiple fractions of palliative RT. The number of fractions most commonly delivered to a bone metastasis was 1, at 50.2%; the second most common numbers were 2–5 fractions, at 41.7% (Figure 3). The use of multifraction palliative RT varied from province to province, ranging from 40.3% in British Columbia to 69.0% in Saskatchewan.

## DISCUSSION

Here, we present baseline findings for the use of two radiotherapy practices that might be low-value in some instances, highlighting current variations in care across Canada. The findings suggest that practice patterns vary considerably from province to province. That variation could be a result of differences in culture and clinical practice between cancer centres<sup>19,20</sup>. Factors influencing practice patterns include physician education, attitudes, and preferences; patient choice or preference; tumour and institutional factors; local treatment capacity; and distance from the radiation treatment centre<sup>15,21,22</sup>.



**FIGURE 1** Percentage of female patients 50 years of age or older with stage I or II breast cancer receiving 16 or 25 fractions of radiation therapy after breast-conserving surgery, by province, 2013 diagnosis year (excludes boosts). \*Suppressed because of small numbers. Data for MB reflect planned fractions rather than number of fractions actually delivered. Data source: Provincial cancer agencies and programs.



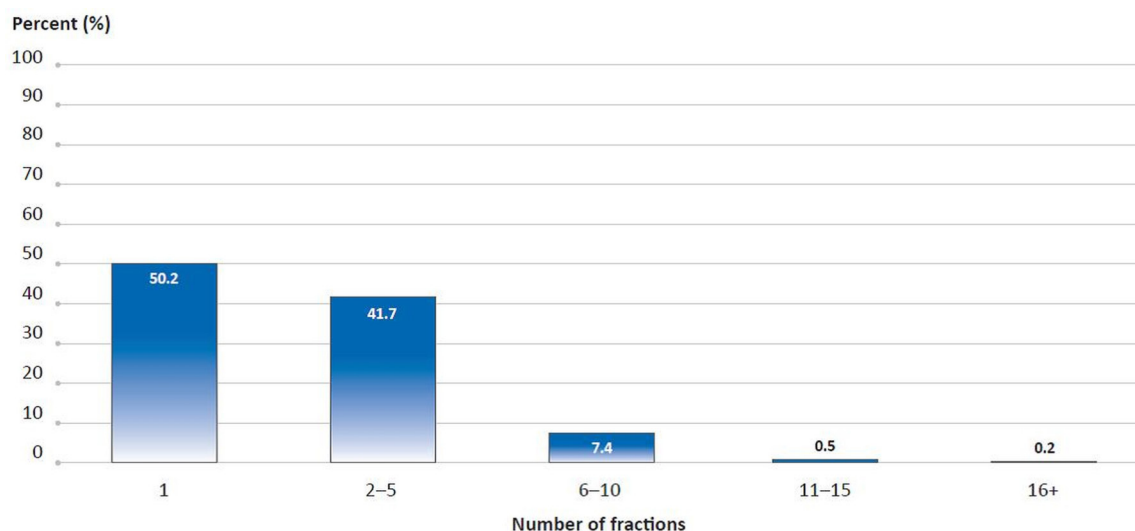
**FIGURE 2** Percentage of cancer patients receiving more than 1 fraction of palliative radiation therapy to bone, by province, 2013 treatment year. Data for MB reflect number of planned fractions rather than number of fractions actually delivered. Data source: Provincial cancer agencies and programs.

Our findings suggest that, in 5 of 6 provinces, most women with early-stage breast cancer received hypofractionated whole-breast RT, suggesting alignment with guidelines. Use ranged from 43% to 95%, depending on the province. Those rates are higher than rates reported in the United States; a retrospective cohort study that included 7% of adult American women found that 35% of women aged 50 and older with early-stage breast cancer received hypofractionated whole-breast RT<sup>23</sup>.

With respect to fractionation of palliative RT for a bone metastasis, our findings suggest that, depending on the province, 31%–60% of patients receive single-fraction RT. That observation accords with results of other Canadian and European studies, but shows rates substantially higher than rates in the United States<sup>20</sup>. Studies conducted in the

United States suggest that the use of single-fraction radiotherapy ranges from 3% to 14%<sup>24</sup>. Despite the evidence for single-fraction radiation for palliation of uncomplicated bone metastases, several survey-based studies suggest that single-fraction regimens are underused internationally<sup>21,25–28</sup>. A 2009 practice patterns survey found that 20 Gy delivered in 5 fractions was the schedule most commonly prescribed by Canadian radiation oncologists<sup>21</sup>. Our findings suggest that the use of single-fraction regimens might therefore have increased in Canada, given that 1 fraction of palliative RT was found to be the most common regimen.

It is important to note that conventional fractionation as part of BCT is appropriate for some women. For example, women with a large breast size or women who have had breast reconstruction or augmentation might have better



**FIGURE 3** Percentage of cancer patients receiving palliative radiation therapy to bone, by number of fractions, all reporting provinces (BC, SK, MB, NS, and PE) combined, 2013 treatment year. Data for MB reflect number of planned fractions rather than number of fractions actually delivered. Data source: Provincial cancer agencies and programs.

cosmetic outcomes with conventional fractionation<sup>29</sup>. Among cancer patients receiving RT for pain arising from bone metastases, multiple fractions of palliative RT might be appropriate for those with complications such as spinal cord compression, cauda equina compression, or pathologic fracture, or for those who prefer to have a lower risk of re-treatment<sup>15,30</sup>. However, a relatively even distribution of the foregoing clinical scenarios would be expected across the country; such cases would not be expected to account for the interprovincial variation observed here. Further work is needed to develop benchmarks and to understand appropriate rates of use.

### Limitations

The present analysis has several limitations. The data do not include measures of patient or provider preference, which are important considerations when assessing the appropriateness of care. Data limitations also prevented the identification of RT delivered with palliative intent and the ability to distinguish between complicated and uncomplicated bone metastases. Lastly, the two provinces with the greatest volume of new cancer cases—Ontario and Quebec—were unable to provide data for the study indicators. The findings might therefore not be generalizable to those provinces or to other provinces not represented here.

### CONCLUSIONS

Although the optimal rates of use of hypofractionated whole-breast RT for early-stage breast cancer and of single-fraction RT for palliation of bone metastases are not known, our findings suggest that both practices might be underused in some provinces. Increasing the use of these hypofractionated radiotherapy practices, where appropriate, can have positive implications for quality of life and resource availability. Further work is needed to understand the factors contributing to the interprovincial variation

observed and to develop benchmarks for the appropriate rate of use of these RT practices.

More information about the Canadian Partnership Against Cancer's System Performance Initiative and its reports and indicators can be found at <http://www.systemperformance.ca/>.

### CONFLICT OF INTEREST DISCLOSURES

We have read and understood *Current Oncology's* policy on disclosing conflicts of interest, and we declare that we have none.

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