Estimating shortfalls in radiotherapy capacity across Canada

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Target journal: Red or Green journal

* Red: article limits – summary (≤75 words), abstract (≤300 words), manuscript (≤3500 words; word count includes abstract, text, and figure captions); references (≤50 references preferred); tables and figures (≤6 total).
* Green: *Full length original papers (max. 3000 words)* Describe original scientific work in the field of radiation oncology or related areas. The content of the paper should be sufficient to reach valid conclusions. Full papers should include a structured abstract and be divided into sections (Introduction; Materials and Methods; Results; Discussion; References; Tables; Figures) and should not normally exceed 6 printed pages, including references and a maximum of 6 tables/figures. Additional material can be submitted as supplementary files.

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***Abstract*** *(structured (purpose, methods, results, conclusions);  /300 words)*

**Purpose**:

**Methods:**

**Results:**

**Conclusions**:

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/ 3500 words

/ 50 references

/ 6 tables and figures

**INTRODUCTION**

**METHODS AND MATERIALS**

*Cancer incidence*

Canada is divided into ten provinces and three territories, which can be further subdivided into health regions. These are administrative areas defined by provincial ministries of health (XX), and Statistics Canada collects and publishes cancer data by health region, in three-year aggregates. For our study, the estimated number of new cases of all cancers were extracted per health region in Canada from Statistics Canada (XX) for the 2010-2012 period, with the exception of Quebec for which the most recently available incidence data is from 2008-2010. For the province of Ontario, which can be divided into either public health units or local health integration networks, we chose to use public health units due to the higher number of subdivisions.

*Radiotherapy centres and catchment areas*

A list of radiotherapy centres in Canada was obtained from The Directory of Radiotherapy Centres (DIRAC), an online international registry of radiotherapy centres maintained by the International Atomic Energy Agency (IAEA). It includes approximately 90% of existing radiotherapy facilities worldwide, and is updated daily with information provided to the IAEA by radiotherapy centres or national organisations. Equipment and centres that are no longer operational are recorded as non-operational, rather than being deleted from the database. For this study, we filtered the database to include only radiotherapy centres and equipment that were operational in 2012.

Since each radiotherapy centre may treat patients from more than one health region, we created radiotherapy catchment areas based on nearest distance from each health region. All health regions were mapped using GIS software (QGIS v. XX), using 2015 boundary files from Statistics Canada (XX). The centroid of each health region polygon was then auto-calculated, and the Euclidean (straight line) distance, in kilometres, from each health region centroid to the nearest radiotherapy centre was measured. Health regions were classified as part of the catchment area of the radiotherapy centre to which they were closest, based on this method, irrespective of provincial boundaries. We included the entire territory of Nunavut into the Ottawa catchment area, given that Ottawa is the referral centre for the most populated region of Nunavut (XX).

*Radiotherapy demand*

The number of expected radiotherapy cases over a 3-year period was calculated per health region by multiplying the number of expected cases, with the Ontario bench-marking radiation utilization rate of 0.415 (XX). Explain this figure (Yap paper, MacKillop). Combined to have per catchment area, number of cases that would require radiotherapy sometime during cancer treatment.

*Radiotherapy capacity*

Yap paper

**RESULTS**

**DISCUSSION**

**CONCLUSIONS**