# Patient costs associated with external beam radiotherapy treatment for localized prostate cancer: the benefits of hypofractionated over conventionally fractionated radiotherapy

Perakaa Sethukavalan, BSc(C),<sup>1</sup> Patrick Cheung, MD,<sup>1,2</sup> Colin. I. Tang, MBBS,<sup>3,4</sup> Harvey Quon, MD,<sup>1,2</sup> Gerard Morton, MBBCh,<sup>1,2</sup> Robert Nam, MD,<sup>1,2</sup>

D. Andrew Loblaw, MD<sup>1,2</sup>

<sup>1</sup>Odette Cancer Centre, Sunnybrook Health Sciences Centre, Toronto, Ontario, Canada <sup>2</sup>University of Toronto, Toronto, Ontario, Canada <sup>3</sup>Department of Radiation Oncology, Calvary Mater Newcastle, Newcastle, Australia <sup>4</sup>University of Newcastle, Newcastle, Australia

SETHUKAVALAN P, CHEUNG P, TANG CI, QUON H, MORTON G, NAM R, LOBLAW DA. Patient costs associated with external beam radiotherapy treatment for localized prostate cancer: the benefits of hypofractionated over conventionally fractionated radiotherapy. The Canadian Journal of Urology. 2012;19(2):6165-6169.

**Introduction:** To estimate the out-of-pocket costs for patients undergoing external beam radiotherapy (EBRT) for prostate cancer and calculate the patient-related savings of being treated with a 5-fraction versus a standard 39-fraction approach.

*Materials and methods:* Seventy patients accrued to the pHART3 (n = 84) study were analyzed for out-of-pocket patient costs as a result of undergoing treatment. All costs are in Canadian dollars. Using the postal code of the patient's residence, the distance between the hospital and patient home was found using Google Maps. The Canada Revenue Agency automobile allowance rate was then applied to determine the cost per kilometer driven. **Results:** The average cost of travel from the hospital and

Accepted for publication January 2012

Acknowledgement

The authors would like to acknowledge partial funding for this study from the CARO – Abbott Urologic Research Award (CARO-ACURA).

Address correspondence to Dr. D. Andrew Loblaw, Odette Cancer Centre, 2075 Bayview Avenue, Toronto, ON M4N 3M5 Canada pHART3 patient's residence was \$246 per person after five trips. In a standard fractionation regimen, pHART3 patients would have incurred an average cost of \$1921 after 39 visits. The patients receiving hypofractionated radiotherapy would have paid an average of \$38 in parking while those receiving conventional treatment would have paid \$293. The difference in out-of-pocket costs for the patients receiving a standard versus hypofractionated treatment was \$1930.

**Conclusions:** Medium term prospective data shows that hypofractionated radiotherapy is an effective treatment method for localized prostate cancer. Compared to standard EBRT, hypofractionated radiotherapy requires significantly fewer visits. Due to the long distance patients may have to travel to the cancer center and the expense of parking, the short course treatment saves each patient an average of \$1900. A randomized study of standard versus hypofractionated accelerated radiotherapy should be conducted to confirm a favorable efficacy and tolerability profile of the shorter fractionation scheme.

**Key Words:** hypofractionation, patient costs, prostate cancer, radiotherapy

## Introduction

Prostate cancer is the most common cancer among Canadian men. It is estimated that in the year 2010, 25,500 men were diagnosed with prostate cancer and another 4,100 died from the disease.<sup>1</sup> Over the past few decades, there has been an increase in the incidence rate of prostate cancer, which is likely due to increased screening, possible changes in risk factors, and lower

thresholds for prostate biopsy. However, despite the increase in incidence, mortality rates rose much more slowly during the same time period and even started to decline in the mid 1990s due to early detection and better treatment. By 2021, the Canadian incidence is estimated to be 76,379.<sup>2</sup>

Treatment options vary depending on the stage and grade. For low risk prostate cancer patients, there are an array of treatment options, which include watchful waiting, active surveillance, radical prostatectomy, and radical radiotherapy. The prognosis for these patients is very favorable, with long term biochemical control rates greater than 80% with either surgery or radiotherapy.

Radiotherapy can be delivered using either low dose rate brachytherapy or an external beam approach. The current standard of care for low risk prostate cancer patients for external beam radiotherapy at the Odette Cancer Centre (OCC), Sunnybrook Health Sciences Centre, involves delivering 78 Gy in conventional 2 Gy fractions, 5 days a week, over 8 weeks using imageguided intensity modulated radiotherapy (IGRT). These numerous visits are burdensome, particularly for patients who work and/or need to travel long distances to the cancer center for treatment.

In 2006, at the OCC, a phase I/II study of 84 low risk prostate cancer patients were treated with 35 Gy in 5 fractions over 29 days (one 7 Gy fraction per week) using image-guided intensity modulated radiotherapy (IGRT) with a standard linear accelerator (the pHART3 study).<sup>3</sup> The patients were enrolled between October 2006 and February 2008. The results are encouraging, after a median follow up of 36 months, no grade 3+ acute GI toxicities were seen and only one patient with acute grade 3 GU toxicity was noted. One patient each experienced late grade 3+ GI and GU toxicity. Eight percent reached the Phoenix biochemical failure definition (though 6 were due to benign bounce and the other patient has a history of chronic non-bacterial prostatitis and his prostate biopsy was negative). Of 35 patients who have had a biopsy to date, 2 (6%) were positive but both are under biochemical control.<sup>4</sup>

There is no doubt that the diagnosis, treatment and follow up of these patients places a burden on our healthcare system and there is very limited data available on the effect these treatment options have on patients financially and socially. However, we believe that accelerated hypofractionated radiotherapy is not only cost effective for the hospital, but most of all cost effective and convenient for the patient. The conventional radiotherapy treatment for low risk candidates requires the patient to make 39 trips, over 8 consecutive weeks, to the OCC. For the accelerated radiotherapy treatment, patients made five trips, once a week for 5 consecutive weeks. The goal of this study was to estimate the out-of-pocket expenses for patients undergoing external beam radiotherapy for prostate cancer and calculate the patient-related savings of being treated with a 5-fraction approach versus a standard 39-fraction approach.

#### Materials and methods

This study was a retrospective chart review. Only patients accrued to the pHART3 (n = 84) study were analyzed for associated patient costs as a result of undergoing treatment.

In this study patient-related treatment costs were defined as parking expenses, travel costs, and loss of income during the treatment period. Costs related to follow up and those costs borne by others (e.g. volunteer drivers) were not included.

Using the postal code of the patient's residence, the shortest distance between the hospital and patient home was found using Google Maps. The Canada Revenue Agency automobile allowance rate was then applied to determine the cost per kilometer driven. This accounts for the costs of operating an average vehicle (including insurance, gas and maintenance). The automobile allowance rate for the years 2006-2007 was 50¢ per kilometer and for the year 2008 was 52¢ per kilometer for the first 5000 kilometers driven.<sup>7</sup>

To determine patient's employment status at the time of treatment each patient was called. Of the 84 patients enrolled in the hypofractionated radiotherapy trial, 70 patients were used to analyze costs; 14 patients were unable to be contacted, including 2 deceased patients. If the patient was employed at the time of treatment, he was questioned regarding: full-time or part-time work, the approximate amount of time lost per treatment, if missed work had an effect on income and if so, how much, method of transportation to the hospital, and any other additional costs he incurred as a result of undergoing treatment. If the patient was retired at the time of treatment, he was only asked about method of transportation to the hospital and any other additional costs he incurred as a result of undergoing treatment.

We assumed that patients undergoing the standard fractionation treatment would live approximately the same distance from the OCC, choose to travel approximately the same way (ie., self-drive versus go with volunteer drivers) and commute from their house to treatment (versus staying with friends or at a hotel / lodge for part or all of the treatment).

Research Ethics Board approval and informed consent was obtained for this study.

Patient costs associated with external beam radiotherapy treatment for localized prostate cancer: the benefits of hypofractionated over conventionally fractionated radiotherapy

#### Results

The pHART3 study was carried out from October 2006 to February 2008. A total of 84 patients were accrued. Patient characteristics are seen in Table 1. Patients at the Odette Cancer Centre travel from all around the province of Ontario. During the pHART3 study the average distance between the Odette Cancer Centre and patient's place of residence was 48.7 km (range 1 km-395 km). Approximately 44% (37 patients) of the patients accrued to the pHART3 study lived less than 25 km away from the Odette Cancer Centre and approximately 15% (13 patients) of the patients lived 100 km away or further. All surveyed patients stated that the five treatments would be preferable to the 39 treatments (tumor control and toxicity being equal).

The average distance travelled by pHART3 patients to and from the hospital was approximately 487 km after five treatments (range 10 km-3950 km); this would have resulted in an average cost of \$246 per person after five trips (range \$5-\$1995). If these patients would have received standard fractionation (39 treatments), each patient would have travelled an average of 3799 km (range 78 km-30810 km) for a cost of \$1918 (\$40-\$15564). The difference in travel cost between the two treatment regimens was calculated to be \$1672 (range \$35-\$13569).

Of the 70 patients able to be reached by phone, 47% (33 patients) acknowledged paying parking costs. Patients reported spending anywhere between 1-3 hours waiting and receiving radiotherapy treatment. The parking charge is \$4.00 per half hour at Sunnybrook (maximum daily rate is \$23.00). The average parking cost per treatment was approximately \$16.00 per treatment visit for those who parked (range \$8-\$23). For those receiving hypofractionated RT and paying for parking the cost was on average \$80 (range \$24-\$115). For those receiving conventional treatment and paying for parking the average cost was calculated to

#### TABLE 1. Patient characteristics

Parameter	Value	
Median age (range)	67 years	(48-82)
Age (%)		
40-49 years	1	1%
50-59 years	14	17%
60-69 years	38	45%
70-79 years	30	36%
80+ years	1	1%
Mean distance (range)	37.5	(1-395)
Distance from hospital		
< 25.0 km	37	44%
25.0-49.9 km	20	24%
50.0-99.9 km	14	17%
100 > km	13	15%
Patients retired at time of RT (%)	43	51%
Patients working at time of RT (%)	27	32%
Unknown working status (%)	14	17%
RT = radiotherapy		

be \$624 (\$312-\$897). The difference in parking costs was calculated to be \$544 (range \$288-\$782).

In addition, two patients each reported spending one night in a hotel (the respective patients lived 118 km and 198 km from the hospital). The cost of accommodations was not factored in to the average out-of-pocket patient costs.

The median age range for patients accrued to the pHART3 study was approximately 67 years of age, with the youngest patient aged 48 and the oldest aged 82. Of the patients who were enrolled in the pHART3 study, 43 patients (51%) were retired at the time of radiotherapy treatment and approximately 27 patients (32%) were employed full-time. The employment status for 14 patients (17%) at the time of radiotherapy treatment is unknown. Of the 27 patients who were

#### TABLE 2. Treatment related patient costs by patient group

Travel Parking Travel + parking Average patient (47% paid for parking) **39 Treatment group** \$1,918 (\$40-\$15,564) \$624 (\$312-\$897) Patient costs (range) 5 Treatment group \$246 (\$5-\$1,995) \$80 (\$24-\$115)

#### Difference

\$1,672 (\$35-\$13,569) \$544 (\$288-\$782) \$2,216 (\$323-\$14,351) \$1,928 (\$170-\$13,937) working at the time of radiation treatment, 89% (24) of patients said that the radiation treatment did not affect their income. We could not estimate the lost income in the 11% of patients whose income was affected.

The difference in patient-related treatment costs between the two treatment regimens (excluding lost wages and boarding costs) was calculated to be \$2216 (range \$323-\$14351) for those who paid for parking and \$1928 (range \$170-\$13937) for the average patient. Table 2 summarizes the costs.

### Discussion

In Ontario alone, approximately 10,000 males are diagnosed each year with prostate cancer;1 by 2021, this could increase to 30,500.2 Most men with localized prostate cancer prefer treatments with high control rates and minimal disruption to their lives. As more and more patients are diagnosed with localized prostate cancer, the demand will be for a treatment regimen that has better prostate cancer control, fewer side effects, more patient convenience and is cost and resource efficient. The medium term data has shown that for low risk patients, accelerated hypofractionated radiotherapy can maintain high bioequivalent tumor doses, decrease treatment visits, decrease acute and late toxicities, and allow patients to maintain somewhat regular lives. Other hypofractionated regimens are being investigated for intermediate and high risk patients.4-6

Normally the cost of a treatment is calculated from the departmental or hospital perspective. Given the financial challenges today's and tomorrow's healthcare system, this is critical. Our group is currently costing out brachytherapy, standard external beam radiotherapy (EBRT), radical prostatectomy, hypofractionated RT and active surveillance. Hypofractionated RT increases the system treatment capacity – 8 times the number of patients to be treated in the same time frame compared to standard EBRT. Normally a technology that increases throughput is more expensive, however, our initial calculations indicate that hypofractionated RT is approximately \$4000 cheaper.

Also important but infrequently documented are the costs borne by the patient to go through treatment and follow up. Currently we are conducting a study comparing side effects and biochemical control of patients undergoing hypofractionated versus conventional RT and will redo these analyses looking at the costs of long term follow up (including management of side effects).

However, our experience is that treatment-related costs have a bearing on which method of treatment a

patient chooses (especially when all other aspects of tumor control and side effects remain the same). A patient takes into consideration the number of times he has to come in to the hospital, how long the treatment will take, and whether the treatment method is feasible for his lifestyle. Based upon our analyses, accelerated hypofractionated radiotherapy is approximately \$1900 cheaper and more convenient to the patient compared to the standard hypofractionated regimen. The hypofractionated radiotherapy treatment only requires five visits to the radiotherapy treatment requires a minimum of 35 visits to the radiotherapy center (39 visits at OCC).

Treatment-related patient costs that were not included or could not be estimated in this study include lost wages, drug costs, boarding costs and rebates through tax deductions for medical travel. For those patients receiving standard fractionation who are required to have treatment 5 days per week (rather than the once per week for the hypofractionated regimen), the income impact may have been greater.

Approximately 5%-10% of patients would have been prescribed a medication to address a short or long term problem post-treatment. Our experience is that the majority of patients had private or governmental drug coverage (residents of Ontario over the age of 65 are members of the Ontario Drug Benefit Plan). While our group is currently abstracting data on the use of medication in patients undergoing standard RT, our clinical experience is that the patients treated with hypofractionated RT had a lower incidence of medication use. However, formal prospective data collection would be needed to accurately calculate out-of-pocket costs for medication use.

A small percentage of the patients that were enrolled in the hypofractionation study stayed at a lodge or hotel during their treatment. In our experience, a greater but still small proportion of patients undergoing 7-8 weeks of radiotherapy choose to stay with friends, family or at a lodge or hotel. Those that do most often stay Monday-Thursday nights. Usually patients who live farther away and who are retired choose this option. Staying closer to the cancer center does have the benefit of reducing vehicle-related costs and well as the "burden" of driving, but it often adds extra costs not borne by those who live at home: parking costs for their car (if they drove) during their time in Toronto, transportation from temporary place of residence to cancer center, food and hoteling costs.

The Canada Revenue Agency allows deduction of medically necessary travel more than 40 km. The amount that could be recovered would depend on Patient costs associated with external beam radiotherapy treatment for localized prostate cancer: the benefits of hypofractionated over conventionally fractionated radiotherapy

the patient's income and source of income as well as total medical expenses. While this would reduce the magnitude of the net cost savings reported in this study, we didn't undertake a detailed accounting exercise to estimate the magnitude of these deductions.

Another limitation of this study is its modest sample size and the assumptions that patients in each group would choose travel methods with identical costs. Only a properly powered and conducted phase III randomized controlled trial with economic outcomes would be able to determine the real cost differences between these two approaches. As there is an impetus to do such a trial to articulate potential differences in biochemical, toxicity and quality of life outcomes, we strongly urge that economic outcomes are included in such a study.

In addition, for patients who are eligible for brachytherapy, brachytherapy may be an even more cost-effective alternative for the patient because it only requires one planning and one treatment visit.

#### Conclusion

Medium term prospective data shows that hypofractionated accelerated radiotherapy is an effective and well-tolerated treatment method for localized prostate cancer. Compared to standard external beam radiotherapy, hypofractionated accelerated radiotherapy requires significantly fewer visits to the radiotherapy center. Due to the long distance many patients have to travel to the cancer center and the expense of parking, the short course treatment saves each patient an average of \$1900. A randomized study of standard versus hypofractionated accelerated radiotherapy should be conducted to confirm a favorable efficacy and tolerability profile of the shorter fractionation scheme.

References

- 1. Canadian Cancer Society's Steering Committee on Cancer Statistics. Canadian cancer statistics 2011. Toronto, ON: Canadian Cancer Society; 2011.
- 2. Quon H, Loblaw DA, Nam R. Dramatic increase in prostate cancer cases by 2021. *BJU Int* 2011;108(11):1734-1738.
- 3. Tang CI, Loblaw DA, Cheung P et al. Phase I/II study of a fivefraction hypofractionated accelerated radiotherapy treatment for low-risk localised prostate cancer: early results of pHART3. *Clin Oncol* (R Coll Radiol) 2008;20(10):729-737.
- 4. Quon H, Loblaw DA, Cheung P, et al. Prospective study of extreme hypofractionated radiotherapy (35 Gy in five fractions) for localized low-risk prostate cancer: toxicity results. *Radioth & Oncol* 2010;96:S46.

- 5. Quon H, Cheung PC, Loblaw DA, et al. Hypofractionated concomitant intensity-modulated radiotherapy boost for high-risk prostate cancer: late toxicity. *Int J Radiat Oncol Biol Phys* 2012; 82(2):898-905.
- 6. Morton GC, Loblaw DA, Sankreacha R et al. Single-fraction high-dose-rate brachytherapy and hypofractionated external beam radiotherapy for men with intermediate-risk prostate cancer: analysis of short- and medium-term toxicity and quality of life. *Int J Radiat Oncol Biol Phys* 2010;77(3):811-817.
- Canada Revenue Agency. Automobile Allowance Rates. Available from URL: http://www.cra-arc.gc.ca/tx/bsnss/tpcs/ pyrll/bnfts/tmbl/llwnc/rts-eng.html. Accessed December 22<sup>nd</sup>, 2011.