

Scientific Article

A Comparison Between the Rates of Radiation Oncologist and Urologist Consultations in Men Diagnosed With Prostate Cancer in Northern Ontario, Canada



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Abstract

Purpose: Recommendations from Cancer Care Ontario stress the importance of multidisciplinary care from radiologists and urologists for prostate cancer treatment. The present study sought to examine what percentage of patients had a consultation with a radiation oncologist before undergoing a radical prostatectomy in Ontario, Canada, between 2010 and 2019.

Methods and Materials: Administrative health care databases were used to analyze the number of consultations billed to the Ontario Health Insurance Plan from radiologists and urologists who treated men with a first prostate cancer diagnosis (n = 22,169).

Results: In Ontario, 94.70% of Ontario Health Insurance Plan billings for patients with prostate cancer who had a prostatectomy within 1 year of a prostate cancer diagnosis were from urology, and 37.66% and 1.77% of billings were received from radiation oncology and medical oncology specialties, respectively. When sociodemographic variables were examined, having a lower neighborhood income (adjusted odds ratio [aOR], 0.69; confidence interval [CI], 0.62-0.76) and a rural residence (aOR, 0.72; CI, 0.65-0.79) were associated with lower odds of receiving a consultation from a radiation oncologist. When billings for consultations were

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Data sharing statement: The dataset from this study is held securely in coded form at ICES. While legal data sharing agreements between ICES and data providers (eg, health care organizations and government) prohibit ICES from making the dataset publicly available, access may be granted to those who meet pre-specified criteria for confidential access, available at www.ices.on.ca/DAS (e-mail: das@ices.on.ca). The full dataset creation plan and underlying analytic code are available from the authors upon request, with the understanding that computer programs may rely on coding templates or macros that are unique to ICES and therefore are either inaccessible or may require modification.

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examined geographically by region, Northeast Ontario (Local Health Integrated Network 13) had the lowest odds of receiving a radiation consultation compared with the rest of Ontario (aOR, 0.50; CI, 0.42-0.59).

Conclusions: The results of this study show that differences in equitable access to multidisciplinary health care exist for men with a first prostate cancer diagnosis who reside in more northern and rural regions within Ontario, relative to the rest of the province. The reasons for these findings are likely multifactorial and may include factors such as patient treatment preference and distance/travel to receive treatment. However, as diagnosis year increased, so did the chances of receiving a radiation oncologist consultation, and this upward trend may reflect the implementation of Cancer Care Ontario guidelines.

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Introduction

Prostate cancer is one of the most commonly diagnosed cancers in men, and is characterized by high mortality rates worldwide.^{1,2} Prostate cancer care and management are guided by formal consensus and guidelines that emphasize the importance of multidisciplinary care through referrals to both urology and radiation oncology.³ In Ontario, Canada, these guidelines and treatment strategies for prostate cancer have been developed by Cancer Care Ontario (CCO).⁴ In the most recent CCO treatment pathway, a referral to both a urologist and radiation oncologist should be made before embarking on curative treatment and before surgery is indicated³⁻⁵ by evaluating factors such as comorbidities, life expectancy, and patient treatment preference.⁶ For patients who are candidates for a prostatectomy, guidelines from the American Urological Association/American Society for Radiation Oncology also recommend a discussion about radiation.⁷⁻⁹ Patients should be presented with all possible treatment options if found to be a suitable candidate for curative treatment of prostate cancer.

However, having equitable access to health care may influence whether patients with prostate cancer receive the full spectrum of multidisciplinary care during the course of their illness. Discrepancies can exist in the delivery of health care services due to geography, specifically to patients who reside in rural areas.¹⁰ Recent findings demonstrated that rurality was one of the variables associated with lower oncology consultations in a decedent cancer cohort.¹¹ Furthermore, a rural geographic location was also associated with reduced access to palliative care services.¹² Of note, these studies both examined access to these health care services in Northeastern Ontario, Canada, a geographic area classified, in general, as more rural. Health care regions in Ontario are categorized into 14 Local Health Integrated Networks (LHINs), and the North East LHIN (region 13) has a land mass that covers approximately 400,000 square kilometers, providing health care to approximately 565,000 residents (2017 estimate), with 30.2% of the population residing in rural regions.^{11,13,14} When taken together the population of northern Ontario (both northeast and northwest combined) comprises approximately 6% of the total population in Ontario¹¹⁻¹³ and is characterized by less proximity

to necessary health care resources, with patients usually incurring greater travel times and undertaking greater personal expenses to receive these services.^{10,13}

Using administrative health services databases, the purpose of the present retrospective population-based study was to analyze the number of referrals billed from urology, radiation, and medical oncology specialties for patients with prostate cancer in Northern Ontario and Ontario as a whole for whom surgery or radiation therapy are indicated for treatment.

Methods and Materials

Study population

The study population (n = 22,169) included men with a first prostate cancer diagnosis in Ontario between 2010 and 2019 who had a prostatectomy within 1 year of diagnosis and no other additional cancer diagnoses between the time of their initial prostate cancer diagnosis and the date of prostatectomy. Patients were included in the study cohort if they were male, age >18 years, Ontario residents, and eligible to receive coverage under the Ontario Health Insurance Plan (OHIP; publicly funded health care program available to all residents of Ontario). The exclusion criteria included patients with prostate cancer who had an additional cancer diagnosis other than prostate cancer between the time of the initial prostate cancer diagnosis and prostatectomy (n = 124).

A subsection of the cohort residing in LHIN region 13-Northeast (Northeastern Ontario) was selected for further analyses (n = 548). This selected study population met the same selection criteria as those for the Ontario analysis; however, the time frame analyzed for this selected population was 2015 to 2019. ICES is a prescribed entity under Ontario's Personal Health Information Protection Act (PHIPA). Section 45 of PHIPA authorizes ICES to collect personal health information, without consent, for the purpose of analysis or compiling statistical information with respect to the management of, evaluation or monitoring of, the allocation of resources to or planning for all or part of the health system. Projects that use data collected by ICES under section 45 of PHIPA, and use no other data, are exempt from Research Ethics Board review. The

use of the data in this project is authorized under section 45 and approved by ICES' Privacy and Legal Office.

Data sources and outcome measures

This study leveraged administrative databases available through ICES, an independent, nonprofit research institute whose legal status under Ontario's health information privacy law allows for the collection and analysis of health care and demographic data without consent for the purpose of health system evaluation and improvement. These data sets were linked using unique encoded identifiers and analyzed at ICES. Using encrypted provincial health number data, men with a first prostate cancer diagnosis identified by International Classification of Diseases, 10th edition, code C61 in the Ontario Cancer Registry between 2010 and 2019 comprised the initial study cohort. These data were linked with the Registered Persons Database to obtain the demographic variables examined in the study, including patient age, region of Ontario residence (by LHIN classification), urban or rural residence (as defined by Statistics Canada⁸), and neighborhood income quintile.

The study population was further linked with the OHIP physicians claims database to identify patients who underwent a prostatectomy within 1 year of prostate cancer diagnosis, and obtain the billing data for consultations and services rendered by Ontario physicians for the subspecialties of urology, radiation oncology, and medical oncology between the diagnosis date and date of prostatectomy. For each patient with prostate cancer (as defined by the aforementioned criteria), the main outcome variable was receipt of a consultation defined by OHIP billing codes billed by the appropriate specialists.

Statistical analysis

Descriptive statistics and frequencies were used to characterize the demographic variables (age, diagnosis year, neighborhood income quintile, rurality, geographic residence categorized by LHIN region), as well as the rates of consultations and services billed by physicians for the study cohort. Logistic regression analyses, with and without multivariate adjustment, were used to calculate the crude and adjusted odd ratios (aORs) and confidence intervals (CIs) for patient variables associated with receiving a consultation. All statistical analyses were performed using SAS (SAS Institute, Cary, NC).

Results

There were 22,169 men in Ontario diagnosed with a first prostate cancer diagnosis who underwent a prostatectomy within 1 year of their diagnosis between 2010 and

Table 1 Ontario Health Insurance Plan physician billings between diagnosis and prostatectomy surgery for men in Ontario with a first prostate cancer diagnosis who underwent a prostatectomy within 1 year of diagnosis between 2010 and 2019 (n = 22,169)

Ontario Health Insurance Plan billings: Ontario		
	Yes, n (%)	No, n (%)
Specialization(s)		
Any billing		
Urology	20,993 (94.70)	1176 (5.30)
Radiation oncology	8348 (37.66)	13,821 (62.34)
Medical oncology	393 (1.77)	21,776 (98.23)
Consultation billing (patients who had a billing for a consultation)		
Urology	4037 (18.21)	18,132 (81.79)
Radiation oncology	8224 (37.10)	13,945 (62.90)
Medical oncology	212 (0.96)	21,957 (99.04)
Any nonconsultation billing (patients who had a billing for something other than consultation)		
Urology	19,817 (89.39)	2352 (10.61)
Radiation oncology	248 (1.12)	21,921 (98.88)
Medical oncology	217 (0.98)	21,952 (99.02)
Consultation billing only (patients who only had a consultation billing)		
Urology	1176 (5.30)	20,993 (94.70)
Radiation oncology	8100 (36.54)	14,069 (63.46)
Medical oncology	176 (0.79)	21,993 (99.21)
Nonconsultation billing only (patients who only had a non-consultation billing)		
Urology	16,956 (76.49)	5213 (23.51)
Radiation oncology	124 (0.56)	22,045 (99.44)
Medical oncology	181 (0.82)	21,988 (99.18)

2019. Patients (n = 124) who had an additional cancer diagnosis other than prostate cancer between the time of diagnosis and prostatectomy were excluded from the analysis. When OHIP billings from urology, radiation oncology, and medical oncology in Ontario were examined, 94.70% of patients (n = 20,993) had billings by urology, indicating that 94.70% of patients in Ontario with prostate cancer in our study population had a point-of-care contact with a urologist (Table 1). Conversely, 37.66% (n = 8348) and 1.77% (n = 393) of patients had billings from radiation oncology and medical oncology specialties, respectively (Table 1). When billings were analyzed for patients who only received a consultation, 36.54% (n = 8100) and 0.79% (n = 176) of patients with prostate cancer had a consultation with radiation oncology or medical oncology specialties, respectively (Table 1).

Table 2 Logistic regression analyses of patient characteristics associated with receiving a radiation oncologist consultation in Ontario in men diagnosed with a first prostate cancer who underwent a prostatectomy within 1 year of diagnosis between 2010 and 2019

Variable	No radiation oncologist consultation (n = 13,945)	Radiation oncologist consultation (n = 8224)	Odds ratio (95% confidence interval)	Adjusted odds ratio (95% confidence interval)
Age (y), median (range)				
	63 (58-68)	63 (58-67)	0.99 (0.99-0.99)	0.99 (0.99-0.99)
Diagnosis year				
2010	2153 (15.44)	732 (8.90)	0.54 (0.48-0.61)	0.51 (0.45-0.58)
2011	2106 (15.10)	788 (9.58)	0.59 (0.53-0.67)	0.56 (0.50-0.64)
2012	1674 (12.00)	675 (8.21)	0.64 (0.56-0.72)	0.61 (0.54-0.70)
2013	1332 (9.55)	828 (10.07)	0.98 (0.87-1.11)	0.97 (0.85-1.10)
2014	1257 (9.01)	794 (9.66)	Reference	Reference
2015	1204 (8.63)	901 (10.96)	1.19 (1.05-1.34)	1.20 (1.06-1.36)
2016	1254 (8.99)	946 (11.50)	1.19 (1.06-1.35)	1.23 (1.08-1.39)
2017	1224 (8.78)	971 (11.81)	1.26 (1.11-1.42)	1.30 (1.15-1.48)
2018	1149 (8.24)	1061 (12.90)	1.46 (1.29-1.65)	1.47 (1.30-1.67)
2019	592 (4.25)	528 (6.42)	1.41 (1.22-1.64)	1.43 (1.23-1.66)
Neighborhood income quintile				
1 (low)	2092 (15.00)	961 (11.69)	0.67 (0.61-0.74)	0.69 (0.62-0.76)
2	2591 (18.58)	1430 (17.39)	0.81 (0.74-0.88)	0.83 (0.76-0.90)
3	2850 (20.44)	1582 (19.24)	0.81 (0.75-0.88)	0.82 (0.75-0.89)
4	3024 (21.69)	1932 (23.49)	0.93 (0.86-1.01)	0.91 (0.84-0.99)
5 (high)	3388 (24.30)	2319 (28.20)	Reference	Reference
Rural residence				
No	11,856 (85.02)	7294 (88.69)	Reference	Reference
Yes	2089 (14.98)	930 (11.31)	0.72 (0.67-0.79)	0.72 (0.65-0.79)
Local health integrated network				
1-Erie St. Clair	690 (4.95)	497 (6.04)	1.40 (1.22-1.60)	1.37 (1.19-1.57)
2-South West	1318 (9.45)	775 (9.42)	1.14 (1.01-1.28)	1.18 (1.05-1.34)
3-Waterloo-Wellington	739 (5.30)	311 (3.78)	0.82 (0.70-0.95)	0.76 (0.65-0.88)
4-Hamilton Niagara Haldimand Brant	1581 (11.34)	711 (8.65)	0.87 (0.78-0.98)	0.81 (0.72-0.91)
5-Central West	855 (6.13)	418 (5.08)	0.95 (0.82-1.09)	0.89 (0.77-1.03)
6-Mississauga Halton	967 (6.93)	658 (8.00)	1.32 (1.17-1.50)	1.15 (1.01-1.31)
7-Toronto Central	1065 (7.64)	554 (6.74)	1.01 (0.89-1.15)	0.93 (0.82-1.06)
8-Central	1650 (11.83)	1012 (12.31)	1.19 (1.06-1.33)	1.09 (0.98-1.22)
9-Central East	1928 (13.83)	994 (12.09)	Reference	Reference
10-South East	527 (3.78)	301 (3.66)	1.11 (0.94-1.30)	1.25 (1.06-1.48)
11-Champlain	894 (6.41)	1289 (15.67)	2.80 (2.50-3.14)	2.72 (2.42-3.06)

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Table 2 (Continued)

Variable	No radiation oncologist consultation (n = 13,945)	Radiation oncologist consultation (n = 8224)	Odds ratio (95% confidence interval)	Adjusted odds ratio (95% confidence interval)
12-North Simcoe Muskoka	720 (5.16)	292 (3.55)	0.79 (0.67-0.92)	0.81 (0.69-0.95)
13-North East	931 (6.68)	233 (2.83)	0.49 (0.41-0.57)	0.50 (0.42-0.59)
14-North West	80 (0.57)	179 (2.18)	4.34 (3.30-5.71)	5.33 (4.03-7.06)

Data are presented as n (%) unless otherwise indicated.

Logistic regression analyses were performed on the Ontario cohort to examine which variables were associated with receiving a consultation from a radiation oncologist before undergoing a radical prostatectomy. Both a lower neighborhood income (aOR, 0.69; CI, 0.62-0.76) and having a rural residence (aOR, 0.72; CI, 0.65-0.79) were associated with lower odds of receiving a radiation oncologist consultation (Table 2). When geographic location was analyzed by Ontario LHIN region, residing in LHIN region 13-North East was associated with lower odds of receiving a consultation from a radiation oncologist. Furthermore, the North East had the lowest rate in the entire province compared with other LHINs (aOR, 0.50; CI, 0.42-0.59). LHIN regions associated with the highest odds of receiving a radiation oncologist referral included region 11-Champlain, region 1-Erie St. Clair, region 10-Southeast, and region 14-North West (Table 2). As diagnosis year increased, so did the odds of receiving a referral for a radiation oncologist consultation (for year 2010: aOR, 0.51; CI, 0.45-0.58 vs year 2018: aOR, 1.47; CI, 1.30-1.67).

When OHIP billings between 2015 and 2019 were examined for LHIN region 13-North East (Northeastern Ontario), billings from radiation oncology were lower than those for all of Ontario (n = 135 [24.64%]; Table 3 vs. Ontario total: n = 8348 [37.66%]; Table 1). Similar trends were observed for consultation billing (n = 131 [23.91%] for Northern Ontario; Table 3 vs n = 8224 [37.10%] for all of Ontario; Table 1), as well as nonconsultation billings (Table 3).

Discussion

The results of the present study found that, in men with a first prostate cancer diagnosis and who had a prostatectomy within the first year after diagnosis, only 37.66% overall received a consultation with a radiation oncologist in Ontario between 2010 and 2019. Recommendations published by Cancer Care Ontario recommend that patients with prostate cancer receive consultations from both radiation oncologists and urologists for their prostate cancer before embarking on

curative intent treatment.⁴ Generally, patients with primary/local recurrence, secondary recurrence (both hormone naïve and castrate resistant), and metastatic disease would be the exception to this, because more advanced disease undergoes a different treatment trajectory.⁴ However, the results from the logistic regression analysis showed that, as time progressed from 2010 to 2018 (and most notably from 2015 onward), the odds of receiving a consultation from a radiation oncologist in Ontario increased over time, a result consistent with findings between 2007 and 2017 published by Corkum et al.¹⁵ This trend may be a direct result of the implemented recommendations from Cancer Care Ontario to provide these treatment options to patients, and as time progresses, the gap observed between the two care modalities for patients undergoing prostate cancer treatment in Ontario begins to lessen.

Our results show that patients living in a rural residence and residing in a neighborhood with a lower income quintile were factors associated with the type of referrals received for prostate cancer treatment in Ontario. Patients who lived in a rural residence or resided in a neighborhood with a lower income were less likely to receive a consultation from a radiation oncologist before treatment. With respect to rurality, a study conducted by Chan et al¹⁰ found that patients who lived in northern Canada had reduced access to radiation treatment, primarily because most treatment centers were located in southern Canada (generally considered more urban and more densely populated areas). Having a rural residence was also associated with a lower chance of receiving definitive treatment (radical prostatectomy, external beam radiation therapy daily for 5-8 weeks, brachytherapy, or combination of external beam radiation therapy and brachytherapy) for patients with early prostate cancer compared with urban residents in the United States.¹⁶

Residing within the North East LHIN (Northeastern Ontario), one of the 2 most northern LHIN regions in Ontario was associated with lower odds of receiving a consultation from a radiation oncologist relative to the rest of Ontario, which is in agreement with the findings by Corkum et al.¹⁵ Furthermore, the chance of receiving multidisciplinary care for prostate cancer was lower when

Table 3 Ontario Health Insurance Plan physician billings between diagnosis and prostatectomy surgery for men in Northeastern Ontario (local health integrated network region 13) with a first prostate cancer diagnosis who underwent a prostatectomy within 1 year of diagnosis between 2015 and 2019 (n = 548)

Ontario Health Insurance Plan billings in Northeastern Ontario (2015-2019)		
	Yes, n (%)	No, n (%)
Specialization(s)		
Any billing		
Urology	498 (90.88)	50 (9.12)
Radiation oncology	135 (24.64)	413 (75.36)
Medical oncology	30 (5.47)	518 (94.53)
Consultation billing (patients who had a billing for a consultation)		
Urology	94 (17.15)	454 (82.25)
Radiation oncology	131 (23.91)	417 (76.09)
Medical oncology	27 (4.93)	521 (95.07)
Any nonconsultation billing (patients who had a billing for something other than consultation)		
Urology	484 (88.32)	64 (11.68)
Radiation oncology	1-5	540-545
Medical oncology	6 (1.09)	542 (98.91)
Consultation billing only (patients who only had a consultation billing)		
Urology	14 (2.55)	534 (97.45)
Radiation oncology	130 (23.72)	418 (76.28)
Medical oncology	24 (4.38)	524 (95.62)
Nonconsultation billing only (patients who only had a non-consultation billing)		
Urology	404 (73.72)	144 (26.28)
Radiation oncology	1-5	540-545
Medical oncology	1-5	540-545

the distance to travel to the nearest cancer center increased in Ontario.¹⁵ Similarly, patients with prostate cancer chose radiation treatment less than a surgical option if they lived a greater distance from the treatment center, regardless of whether their primary residence was urban or rural.¹⁷ This may be representative of what the patient population in the North East LHIN (LHIN-13) experiences. Patients in this region receive radiation treatments at a centralized cancer center located in a more urban center of Northeastern Ontario (LHIN-13). Given that approximately 30.2% of this population resides in a rural area,¹³ many patients may have to travel as much as ≥ 100 km to receive treatment for their prostate cancer. In northern Canada, patients may experience long travel times, harsh traveling conditions in a Canadian winter,

missed employment, and incur greater expenses associated with medical treatment than patients with prostate cancer who reside in more urban communities.¹³ Taken together, this provides further evidence for the differences others have observed in accessing equitable health care services in northern and more rural regions.^{11,12,18}

In addition to living in a rural locale, the results of this study also found that residing in neighborhoods with a lower income quintile were associated with lower odds of receiving a radiation oncology consultation in Ontario. In a study that assessed the financial impact of out-of-pocket expenses in patients with prostate cancer from a remote region in Quebec, 22.3% reported that the financial impact was 'moderate, considerable, or unsustainable', and 83% reported incurring out-of-pocket expenses for their cancer treatment. In addition, 50% of patients said they had incurred treatment-related absences from work.¹⁹ In a similar study conducted in Ontario, 35.6% of patients reported that others within their support network were required to take time off from their employment to provide them with assistance, and 20% also reported that their expenses were 'significant and unmanageable'.²⁰ All these factors would undoubtedly result in greater financial hardship in individuals who are in the lower income quintile in this study. Ultimately, being presented with different treatment options and similar treatment outcomes may influence a patient to choose a surgical treatment route over radiation treatment, which may require a greater investment in time and personal resources to attend multiple medical appointments and treatment sessions (assuming the diagnostic treatment plan is not a singular event).

Although the guidelines from Cancer Care Ontario recommend that patients with prostate cancer receive multidisciplinary care from both urologists and radiation oncologists,^{3,4} the number of consultations received from radiation oncology in the present study is far lower than that recommended by Cancer Care Ontario, and this may be a direct reflection of patient treatment preference.⁵ A study by Jang et al²¹ found that the type of prostate cancer treatment received was associated with the type of specialist a patient consulted. Another study reported that the location where a patient received a diagnosis could influence whether or not they sought a consultation from a radiation oncologist. When patients received a diagnosis from a urologist in an office setting (compared with an institutional setting), there were greater odds of seeking a referral from a radiation oncologist.²² Furthermore, men who saw both a urologist or primary care physician and a radiation oncologist chose radiation treatment over surgery.²³

However, most interesting is the fact the North West LHIN (also a northern region) had higher rates of radiation oncologist consultations, suggesting that the observed gap between the LHINs is not entirely attributable to geographic location. Of note, there may be additional clinical factors outside of the scope of what was measured in this study that may explain these observed differences in the

North West LHIN. For instance, there may be a stronger emphasis on a more cooperative and coordinated multidisciplinary model of care that is practiced within their regional health care centers that would result in the higher consultation rates observed for this LHIN.

There are advantages to the present study. Using large administrative databases provided larger sample sizes that ensured greater validity in the observed data trends. Also, all medical doctors in Ontario billed OHIP for services provided for patient care, ensuring that the number of consultations billed was the type of care patients received, which adds another layer of validity to the analysis. However, there are some disadvantages to the present study. First, there are limitations of using administrative health databases. By accessing administrative health service databases, we have no knowledge of the stage and grade or the severity of the prostate cancer in our population, and that is directly reflected in the type of prostate cancer care received.¹¹ OHIP medical billings are being used as surrogates for consultations, but we cannot elaborate further on the type of care that patients in this population received, only that a consultation was billed for them.¹¹ There may also be a small percentage of patients in Ontario who may not have had billings submitted to the provincial health insurance system (OHIP), making their interactions undetectable to our study methodology. Furthermore, there may be errors in data entry or missing data, which are limitations inherent to using administrative health databases.

Conclusions

The results of our study demonstrate that the reasons for lower radiation oncology consultations are likely multifactorial and can potentially be attributed in part to rurality and socioeconomic status, but may also be partly attributed to the type of specialist the patient consulted for their prostate cancer treatment, the patient's treatment preference, as well as other factors not easily quantified using administrative health databases. The fact that the logistic regression analysis showed that the odds of receiving a radiation oncologist consult in Ontario was trending upwards over time, may be a direct reflection of the guidelines implemented from Cancer Care Ontario. Despite this, the findings of the present study have shown that there are differences in the type of care received by patients in northern Ontario for their prostate cancer, relative to that received by patients in other regions of Ontario inferred by consultation billings to the OHIP plan. Further, these results add veracity to the published literature that more northern and rural regions experience gaps and inequities in their access to health care services compared with more urban communities in Ontario. While the study results concluded that there was improvement over time in the

volume of consultations to radiation oncologists, there remains a difference in the degree of multidisciplinary care received for patients with prostate cancer.

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