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Volume of practice in HN cancer

Population-based assessment of relationship between volume of practice and outcomes in head and neck cancer patients treated in a provincially coordinated radiotherapy program

Mary McLay [a], Adrienne Stedford [a], Emily Yurkowski [b], Scott Matlock [a], Winson Cheung [a,c], Eric Tran [a,c], Eric Berthelet [a,c], Jonn Wu [a,c], Robert Olson [a,b,c,d,*]

[a] University of British Columbia, Vancouver; [b] University of Northern British Columbia, Prince George; [c] BC Cancer Agency: Vancouver Centre; and [d] BC Cancer Agency: Centre for the North, Prince George, Canada

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ABSTRACT

Background and purpose: Literature suggests that higher volumes of practice are associated with better survival outcomes for head and neck cancer (HNC) patients. The objective of this study was to evaluate the effect of treatment center on the overall survival (OS) and cancer-specific survival (CSS) in a provincially coordinated program.

Materials and methods: A population-based provincial database was used to identify all patients in BC diagnosed for the first time with a primary non-thyroid HNC and treated with radiotherapy between 2006 and 2011.

Results: 2330 HNC patients were included. On multivariable analysis, after controlling for age, gender, cancer stage, anatomical site, treatment and physician case frequency, OS (HR range = 0.91–1.05; $p = 0.60$–0.88) did not significantly differ by center. OS was also not significantly different for patients treated by physicians with low case frequency (HR = 0.96; 0.81–1.13; $p = 0.60$) and medium case frequency (HR = 1.12; 0.84–1.49; $p = 0.43$) in reference to high case frequency. There was no effect on OS or head and neck CSS when physician case frequency was treated as a continuous variable.

Conclusions: In our provincially coordinated radiotherapy program, there was no significant difference in survival between cancer centers after controlling for differences in rurality, physician case volume and other potential confounding variables.

Recent literature has suggested that higher volumes of practice are associated with better survival outcomes for head and neck cancer (HNC) patients [1–4]. Some limitations in these studies, however, include looking at the volume of practice on a cancer center level (i.e. not a provider level) and not controlling for rurality of patient residence. Other studies have demonstrated worse outcomes for cancer patients residing in rural areas compared to urban areas [5–9]. It is therefore possible that differences found by volume of practice could alternately be associated with the rurality of patients, as large centers with large volumes predominantly see urban patients. Multiple previous studies have demonstrated that patients living in rural areas have lower socioeconomic status, higher rates of smoking status, and decreased access to health care, all of which could explain worse outcomes for these patients, rather than attributing it to the center they received their radiotherapy.

A recent US study demonstrated that among patients treated with intensity modulated radiotherapy (IMRT), those treated by radiation oncologists with a higher practice volume had superior survival over those treated by radiation oncologists with a lower practice volume [10]. However, in the US as compared to Canada, it is more common for community radiation oncologists to practice as generalist radiation oncologists treating many, and in some cases all tumor sites without an affiliation with an academic center [11,12]. In other jurisdictions, such as British Columbia (BC), Canada, most radiation oncologists specialize in 1–3 tumors sites and have a strong relationship with academic centers within their province. We were therefore interested in assessing whether the association found between practice volume and outcomes in the US was transferrable to a Canadian population where radiation

* Corresponding author at: University of British Columbia Radiation Oncologist, BC Cancer Agency: Centre for the North, 1215 Lethbridge Street, Prince George, BC V2M7E9, Canada.

E-mail addresses: mary.mclay@bccancer.bc.ca (M. McLay), a.stedford@alumni.ubc.ca (A. Stedford), emily.yurkowski@gmail.com (E. Yurkowski), scott.a.matlock@gmail.com (S. Matlock), winson.cheung@ucalgary.ca (W. Cheung), etran2@bccancer.bc.ca (E. Tran), eberthelet@bccancer.bc.ca (E. Berthelet), jonnwu@bccancer.bc.ca (J. Wu), rolson2@bccancer.bc.ca (R. Olson).

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oncologists specialize more frequently and potentially have a larger support network.

The primary objective of this study was to evaluate the effect of treatment center on the overall survival (OS) and cancer-specific survival (CSS) of HNC patients in BC between 2006 and 2011, while controlling for physician case volume and rurality. We hypothesized that rurality and physician case volume would be associated with survival outcomes in BC, but after controlling for these and other potential confounding variables, we hypothesized there would be no significant difference in survival among cancer centers.

Material and methods

Study population

We conducted a retrospective cohort study using the BC Cancer Registry (BCCR), a population-based provincial database. All patients in BC newly diagnosed with a primary non-thyroid HNC and treated with radical radiotherapy between 2006 and 2011 were included. The BCCR automated dataset was supplemented with information from cancer center patient charts using the BC Cancer Agency Information System (CAIS). A full chart review was not possible, as some patients were not referred to the BC Cancer Agency (BCCA). Patients with a prior history of HNC, a thyroid cancer, or those who only received palliative radiotherapy were excluded from the study.

The BCCA operated five regional cancer centers during the study period and provided all radiotherapy (RT) services. The province of BC, with an estimated population of 4.4 million [13], was divided into 90 administrative local health areas (LHAs) using BC Stats and BC Ministry of Health information. Patients were categorized as residing in rural, small and large LHAs using this information and Canadian census data based on patients' postal code, and outlined elsewhere [8]. An LHA was defined as rural if greater than 50% of its residents lived in a community of fewer than 10,000. A small LHA was defined by less than 50% of its population residing in communities of fewer than 10,000 and a large LHA if at least 95% of its population resided in communities over 100,000. Physician case frequency was defined as low (0–14 cases per year), medium (15–29 cases per year) and high (>30 cases per year), using similar divisions to the recent US study where the number of HNC patients treated per year (15 more and fewer) were compared to baseline [10].

Table 1
Patient, tumor and treatment characteristics by cancer center.

Characteristic		Cancer Center					Total	*P*-value
		Vancouver (*N* = 884)	Abbotsford (*N* = 87)	Southern Interior (*N* = 398)	Fraser Valley (*N* = 464)	Vancouver Island (*N* = 497)	*N* = 2330	
Median age at diagnosis in years (range)		66 (23–100)	68 (37–92)	69 (37–101)	67 (24–99)	69 (29–101)	68 (23–101)	<0.001
Proportion male		639 (72%)	60 (69%)	317 (80%)	350 (75%)	376 (76%)	1742 (75%)	0.04
AJCC Staging 6th & 7th ed.	I	145 (16%)	8 (9%)	73 (18%)	74 (16%)	61 (12%)	361 (16%)	0.04
	II	166 (19%)	13 (15%)	61 (15%)	83 (18%)	85 (17%)	408 (18%)	
	III	155 (18%)	18 (21%)	65 (16%)	85 (18%)	86 (17%)	409 (18%)	
	IVA	356 (40%)	35 (40%)	169 (43%)	184 (40%)	236 (48%)	980 (42%)	
	IVB	38 (4%)	8 (9%)	22 (6%)	26 (6%)	24 (5%)	118 (5%)	
	IVC	8 (1%)	1 (1%)	3 (1%)	3 (1%)	2 (<1%)	17 (1%)	
Index HNC anatomical site	Nasal cavity and sinuses	33 (4%)	2 (2%)	12 (3%)	10 (2%)	11 (2%)	68 (3%)	<0.001
	Oral cavity	210 (24%)	27 (31%)	91 (23%)	90 (19%)	118 (24%)	536 (23%)	
	Lip	4 (1%)	0	1 (<1%)	4 (1%)	10 (2%)	19 (1%)	
	Nasopharynx	146 (17%)	0	8 (2%)	27 (6%)	12 (2%)	193 (8%)	
	Oropharynx	214 (24%)	28 (32%)	108 (27%)	162 (35%)	203 (41%)	715 (31%)	
	Hypopharynx	35 (4%)	3 (3%)	25 (6%)	23 (5%)	27 (5%)	113 (5%)	
	Supraglottis	52 (6%)	11 (13%)	33 8%)	43 (9%)	38 (8%)	177 (8%)	
	Glottis	118 (13%)	8 (9%)	98 (25%)	77 (17%)	60 (12%)	361 (16%)	
	Subglottis	4 (1%)	0	1 (<1%)	2 (<1%)	2 (<1%)	9 (<1%)	
	Major salivary gland	67 (8%)	8 (9%)	20 (5%)	26 (6%)	16 (3%)	137 (6%)	
Treatment	Radiotherapy alone	307 (35%)	30 (35%)	149 (37%)	196 (42%)	279 (56%)	961 (41%)	<0.001
	Chemoradiotherapy	377 (43%)	35 (40%)	171 (43%)	160 (35%)	136 (27%)	879 (38%)	
	Surgery + adjuvant radiotherapy ± chemotherapy	179 (20%)	22 (25%)	69 (17%)	101 (22%)	75 (15%)	446 (19%)	
	Radiotherapy + salvage surgery ± chemotherapy	21 (2%)	0	9 (2%)	7 (2%)	7 (1%)	44 (2%)	
Population size of LHA	Large	689 (78%)	53 (61%)	114 (29%)	418 (90%)	228 (46%)	1502 (65%)	<0.001
	Small	95 (11%)	26 (30%)	137 (34%)	29 (6%)	235 (47%)	522 (22%)	
	Rural	100 (11%)	8 (9%)	147 (37%)	17 (4%)	34 (7%)	306 (13%)	