Research Article

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Melanoma Patterns of Care in Ontario: a call for a strategic alignment of multidisciplinary care

Nicole J Look Hong 0000-0002-2106-341X 0000-0002-2106-341X MD MSc¹, Stephanie Y Cheng MSc², Nancy N Baxter MD PhD^{2,3}, Frances C Wright MD MEd¹

¹ Department of General Surgery, Sunnybrook Health Sciences Centre, Toronto, ON, CANADA

² Institute for Clinical Evaluative Sciences, Toronto, ON, CANADA

³ St. Michael's Hospital, Department of Surgery and Keenan Research Centre, Toronto, ON, CANADA

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Synopsis: This study provides the first comprehensive look at patterns of multidisciplinary melanoma care in Canada. Results indicate a close association between adequacy of care within the first year and consultation with appropriate specialists.

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Corresponding Author:

Nicole Look Hong MD MSc FRCSC

Division of Surgical Oncology, Sunnybrook Health Sciences Centre

T2-102, 2075 Bayview Avenue

Toronto, Ontario

M4N 3M5

416.480.4832 (p)

416.480.6002 (f)

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n.lookhong@utoronto.ca

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Abstract

Background and Objectives:

Variability in melanoma management has prompted concerns about equitable and timely treatment. We investigated patterns of melanoma diagnosis and treatment using population-level data.

Methods:

Patients with invasive cutaneous melanoma were identified retrospectively from the Ontario Cancer Registry (2003–2012) and deterministically linked with administrative databases to identify incidence, disease characteristics, geographic origin, and multimodal treatment within a year of diagnosis. Melanoma treatment was categorized as inadequate or adequate based on multidisciplinary clinical algorithms. Multivariable logistic regression was used to model factors associated with treatment adequacy.

Results:

From 2003-2012, 22,918 patients with invasive melanoma were identified with annual age/sex standardized incidence rates of 11.7–14.3/100,000 for females and 13.4-15.9/100,000 for males. Melanoma occurred at median age of 62 and primarily on extremities (43.9%). Within one year after diagnosis, 86.7% of patients received surgery as primary therapy. 2,312 (10.6%) patients received inadequate or no treatment after diagnosis. Receiving adequate treatment was associated with consultation with dermatology (OR 1.92, CI 1.71-2.14), plastic surgery (OR 4.80, CI 4.32-5.34), or general surgery (OR 2.15, CI 1.94-2.38).

Conclusions:

Significant variation exists in melanoma management and nearly one in 9 patients is inadequately treated. Referral to subspecialized providers is critical for ensuring appropriate care.

Key Words: surgery, variation, dermatology

INTRODUCTION

Melanoma is the 6th most commonly diagnosed malignancy across North America and its incidence is increasing [1-4]. In 2016, 6,800 Canadians were diagnosed with melanoma and 1200 people died of the disease [1]. In the same year in the United States, 76,380 Americans were diagnosed with melanoma and 10,130 people succumbed [2]. Melanoma causes over 80% of skin cancer deaths and forms a substantial burden of medical costs and years of life lost [3-5].

Wide variations in melanoma diagnosis and treatment have been identified in the United States, Australia, Germany, Italy, and France [6-14]. However, few studies assess population-based patterns of melanoma diagnosis and management in Canada. In Ontario, higher income and rural (versus urban) residence have been significantly associated with a higher prevalence of melanoma [15]. In addition, recent studies indicate that significant geographic disparities exist to accessing surgery for other common cancers, including rectal and breast cancer [16]. In New Brunswick, the majority of melanoma management is carried out by dermatologists and plastic surgeons [17]. However, access to dermatologists in Canada varies widely, as the majority practice in urban settings [18-19]. In order to inform a sustainable and equitable plan for the care of patients with melanoma, the goal of this study was to identify patterns of melanoma diagnosis and management. We hypothesize that patterns of treatment vary across the province and that patient and tumour factors are associated with the receipt of adequate initial melanoma care.

METHODS

Cohort creation

We conducted a retrospective cohort study identifying population-based patterns of care for patients >18 years old diagnosed with their first primary invasive cutaneous melanoma between January 1, 2003 and December 31, 2012. Patients with mucosal melanomas, invalid provincial health insurance number, or ineligibility for provincial health insurance, were excluded. Patients were followed forward for one year from diagnosis to capture all treatments received for the primary diagnosis.

Data sources

Ethical approval for this study was obtained from the Research Ethics Board of the Sunnybrook Health Sciences Centre and all datasets are housed at the Institute for Clinical Evaluative Sciences (ICES), Toronto, Ontario.

The Ontario Cancer Registry (OCR) identified melanoma cases using the International Classification of Diseases, Ninth Revision (ICD-9) codes for melanoma (172.0 – 172.9). We linked identified cases from the OCR, using unique encoded patient identifiers, to other administrative databases, to ascertain patient demographics and patterns of care: Registered Persons Database (RPDB) for demographic information, Ontario Health Insurance Plan Claims database (OHIP) for physician billing claims, Discharge Abstract Database (DAD) for inpatient hospital admissions, Same Day Surgery dataset (SDS) for ambulatory surgery, National Ambulatory Care Reporting System (NACRS) for ambulatory care claims including cancer clinic visits and radiation, Ontario Drug Benefit (ODB) claims database for prescription drugs received under the ODB program, Cancer Activity Level Reporting database (ALR) for chemotherapy visit information and standard drug costs, New Drug Funding Program (NDFP) for provincially-funded chemotherapeutics, and Office of the Registrar General – Deaths dataset (ORG-D) for death. All treatments, biopsies and consultations with specialists were identified through OHIP using physician billing codes (Appendix). All physicians registered in Ontario are eligible to claim the same codes for billing. Radiation treatments were identified through NACRS using Canadian Classification of Health Interventions (CCI) codes. Interferon and chemotherapy treatments were identified through ODB, ALR, NDFP and OHIP (Appendix).

Patient demographics

We identified demographic variables including sex, age, rurality, income quintile based on location of residence, anatomic location of melanoma, and geographic local health integration network (LHIN) of residence and treatment. Identification of at least one visit to a family/general practitioner (GP) or dermatologist was defined within one year prior to diagnosis. New consultation with a general or plastic surgeon, or a dermatologist, was defined within 3 months prior to and up to one year after diagnosis.

The burden of disease comorbidity was characterized using The Johns Hopkins Adjusted Clinical Groups (ACG) Case Mix System. This validated software uses diagnostic information for each patient in the two years prior to melanoma diagnosis (from administrative databases: DAD, SDS, NACRS, OHIP), to describe and predict health care resource utilization. This study used resource utilization bands (RUBs) to describe concurrent resource use: 0–No utilization or invalid diagnoses, 1–Healthy Users, 2–Low Users, 3–Moderate Users, 4–High Users, 5–Very High Users [20].

Definition of treatments

We assessed patients' treatment using a one-year time window after date of diagnosis of the incident melanoma. A 3-month look-back window was utilized when patients were categorized as having no treatment or inadequate treatment to ensure capture of all procedures.

Patient treatment was first defined as 1) **Adequate** surgical treatment of the primary melanoma, 2) **Inadequate** surgical treatment of the primary melanoma, or 3) **No treatment** beyond the initial biopsy of the primary melanoma.

Adequate treatment: Patients were subdivided into either curative or non-curative-intent treatment. Patients who were treated with curative intent had one of the following: curative surgery alone, surgery and interferon, surgery and radiation, or surgery, interferon and radiation. Curative surgical treatments were defined as: wide local excision, skin or musculocutaneous flap, full or split thickness skin graft, amputation, sentinel lymph node biopsy (SLNB) (October 2010 and beyond), lymphoscintigraphy (used as a proxy for SLNB prior to October 2010), and neck/axillary/groin dissection (See Appendix). Surgical procedures were correlated with both OHIP and SDS/DAD codes to ensure capture of maximal extent of surgery. As such, patients with curative surgical treatments identified by DAD/SDS or OHIP codes were ascribed as having adequate treatment. Patients treated adequately but with non-curative intent (e.g. distant metastases) had one of the following: chemotherapy alone, chemotherapy and radiation, chemotherapy and surgery, chemotherapy and surgery and radiation, radiation alone, interferon alone, or interferon and radiation. Patients with a surgically inadequately treated primary melanoma but with a concurrent non-curative intent treatment (i.e. patient presumed to have

distant metastases) were ascribed to the *adequate treatment* category. In this scenario, surgical treatment of the primary melanoma did not determine adequacy of treatment.

Inadequate Treatment: Patients who received inadequate surgical treatment were defined as receiving one of the following: minimal/simple excision, curettage, dessication, debridement, or cryotherapy only, WITHOUT concurrent receipt of a non-curative treatment within the year following diagnosis.

No Treatment: Patients had diagnostic biopsy alone.

Analysis

We described patient demographics and tumour characteristics using mean, median and interquartile ranges for continuous variables and proportions for categorical variables. Differences between groups were assessed using χ^2 tests (categorical) or two sampled pooled-variance *t*-tests (continuous). The incidence of melanoma was directly age-standardized using the 1991 Canadian census population and trended over 10 years. Average annual rates of change for incidence were determined for each age category and trended over time by testing for a non-zero slope for the incidence regressed over time.

A multivariable logistic regression model determined the relationship of the following factors to the receipt of adequate treatment (versus inadequate/no treatment): age (grouped by decade), sex, region (LHIN) of residence, rurality, income quintile based on residence, comorbidity (RUBs grouped as 0-3; 4; 5), anatomic site of melanoma (grouped as: head and neck, trunk, extremity, other), visit to family physician or dermatologist at least once in the year prior to diagnosis (Y/N), new consultation with dermatology, plastic surgery and/or general surgery in the year after diagnosis (Y/N for each specialist). We present crude and adjusted odds of receiving adequate treatment with 95% confidence intervals. Statistical tests were two-sided with a $p=0.05$ level of significance. Statistical analyses were performed using SAS Enterprise Guide version 6.1 (2013, SAS Institute Inc., Cary, NC).

RESULTS

Baseline characteristics

Between January 1, 2003 and December 31, 2012, 22,918 patients were diagnosed with primary cutaneous melanoma. 1,042 patients were excluded and the final study cohort comprised 21,876 patients (Figure 1). Baseline demographics and clinical characteristics are presented in Table 1.

Directly age-sex standardized rate of melanoma incidence was consistently greater among men compared to women throughout the ten-year period. An analysis of age- and sex-specific rates of melanoma (Figure 2) found substantially higher incidence rates and higher rates of increase in older patients. Male patients 80+ years old had an average 6.0% annual increase in melanoma incidence ($p=0.001$) and females over 80 had an average 3.1% increase ($p=0.03$).

Melanoma care pathways

In the study cohort, 19,564 (89.4%) of patients received adequate treatment. However, nearly 1 in 9 (2,312) patients received inadequate/no treatment within the three months prior to and up to one year following diagnosis. Of those with adequate therapy, surgery was the most common treatment. Of the 86.7% of patients who had a surgical procedure, 48.5.0% had a wide local excision, and 48.2% had a flap or skin graft procedure (OHIP codes for flap/graft include wide local excision). 30.4% of patients with surgical management had a SLNB. 5.8% of patients had interferon treatment and <3% had radiation therapy. Men were more likely than women to receive axillary or groin lymphadenectomy (10.6% vs. 8.0%, $p < 0.001$) and interferon (6.7% vs. 4.8%, $p < 0.001$).

Treatment adequacy

The distribution of melanoma care pathways is shown in Figure 1. Patients who received adequate treatment were significantly younger than those who received inadequate/no treatment (median age 62 vs. 67, $p < 0.001$) (Table 2). Melanoma of the extremities made up a larger proportion of adequately treated patients compared to those inadequately/not treated (44.8% vs. 36.2%). Patients with inadequate/no treatment had significantly higher comorbidities (25.0% of patients had very high resource utilization [RUB=5] compared to 19.2% that received adequate treatment).

In adjusted multivariable analysis, older patients were significantly less likely to receive adequate treatment (age 80-89, OR = 0.62 (95% CI 0.47-0.81), age 90+ OR = 0.28 (95% CI 0.20-0.40)). LHN of

patient residence significantly affected odds of receiving adequate treatment (Figure 3). Visit to a dermatologist before (OR = 1.39, 95% CI 1.25-1.54) or a consultation with a dermatologist after (OR = 1.92, 95% CI 1.71-2.14) diagnosis were associated with adequate treatment. Consultation with a general surgeon (OR = 2.15, 95% CI 1.94-2.38) or plastic surgeon (OR = 4.80, 95% CI 4.32-5.34) from 3 months before, to within one year after diagnosis were significantly associated with adequate treatment.

DISCUSSION

This is the first population-level study that comprehensively describes incidence and initial treatment patterns of care for patients with cutaneous melanoma in Canada. The overall incidence of melanoma is increasing in patients over the age of 60. In addition, an alarming 1 in 9 patients received inadequate or no subsequent treatment for their primary melanoma following diagnosis. Factors associated with lack of adequate treatment include age >80, LHIN of patient residence, and lack of consultation with dermatologists and/or surgeons.

Incidence trends reported in this study mirror previous Canadian and international reports [21-25]. In these studies, rates of increase were highest in men and women >60 years old and stable in patients <40 years old. These trends may reflect awareness among younger patients of sun protection as a result of increasingly aggressive public health campaigns. Interestingly, we did not see an association between incidence of melanoma and income quintile or rurality (data not shown), contrary to previous reports in the province of Ontario and in the United States [13,15,26]. In a cross-sectional study of 14,623 patients using administrative data in Ontario from 2000-2004, higher median income quintile based on residence was associated with a 225% increase in melanoma prevalence when compared to the lowest income quintile. Prevalence was also significantly associated with rural residence with a relative increase of 30% compared to urban areas [15]. Authors postulate that these results may be a reflection of variable lifestyle choice between high and lower income individuals, and may also reflect variable access to health services and/or promotion materials.

In our cohort, 10.6% of patients, nearly 1 in 9, received inadequate or no treatment for their melanoma. This result is startling, as primary surgical management with wide local excision is the cornerstone for

preventing melanoma recurrence and progression, and can frequently be performed in outpatient settings, under local anesthetic, with low procedural risk. Capture of these procedures was comprehensively correlated in this study through BOTH billing and hospital-based data. While age and/or severe co-morbidities may influence this rate, it is concerning that the median age of this cohort was 67, and close to 50% had minimal measured co-morbidities (RUB $\leq$ 3). However, this trend corresponds with Australian data demonstrating that guideline-concordant care for surgical margins in melanoma occurred in only 35% of patients [27]. However, in a US study using algorithm based identification of guideline-congruent care, 96% of patients received adequate care [28]. Mitigating factors for such discrepancies are postulated to include patient declining treatment, triaging of patient referrals by age, inadequate knowledge of referring physicians concerning indications for and perceived benefit of specialist referral, resistance of physicians to follow recommended guidelines, and inadequate geographic supply of specialists.

Variations in geographic location (LHIN of patient residence) were associated with care adequacy in this study, and have been cited in American, German, French and Italian reports on surgical melanoma treatment [11,12,29,30]. Geographic location of patient treatment, and distance to definitive care, have been associated specifically with the receipt of SLNB for melanomas > 1mm in depth [30,31], and also with the receipt of combined wide local excision and SLNB [33,34]. In addition, the size of treatment facility has been associated with performance and extent of surgical procedures [29,30]. Finally, receipt of adequate surgical care has been associated with treatment at a regional cancer centre, and at a site with a residency training program [35]. System-related regional factors appear to have an impact on melanoma care.

Consultations with a dermatologist and/or surgeon were strongly related to the receipt of adequate care. American and Canadian studies indicate that visiting a dermatologist and plastic surgeon up to 2 years prior to and following diagnosis are not only associated with discovery of melanoma, but also with treatment receipt and melanoma-associated mortality [36-38]. As such, linking at-risk patients with appropriate multidisciplinary clinicians is of paramount importance. Multidisciplinary melanoma clinics have been established to identify patients needing streamlined specialist management [38-40]. In a study from Ireland, creation of a rapid-access pigmented lesion clinic increased the incident proportion of early-stage melanomas (65% vs 57%) compared to the rest of the country [40]. In the setting of diagnosed high-risk melanomas, specialized surveillance in a high-risk clinic in Australia was shown in

modeled analysis to be cost-effective compared to standard surveillance [41]. It is clear that coordinated approaches to melanoma diagnosis and treatment are internationally recognized, although optimal organization depends on available resources [37]. In Canada, streamlined clinics for melanoma surveillance and treatment have not been described. Concerted effort is therefore needed to apprise front-line clinicians of referral networks for definitive multidisciplinary management, and the indications for specialist care. Coordination may be expedited by routine audio/videoconferenced multidisciplinary cancer conferences to discuss challenging cases and encourage referrals.

Our study has a number of strengths, including the contemporary population-based nature of the data, complete data acquired from a universally funded health system, and a comprehensive clinically-based categorization of care adequacy. Limitations include a lack of consistent data on staging and recurrence during the time period examined, lack of data for those treated outside of Ontario, and inadequate knowledge of treatment intent and clinical trial enrolment from administrative data. We recognize that new systemic therapies arose within the final years of the study period and this may change intent and intensity of specialist referrals. However, this is anticipated to affect a minority of patients, as surgical treatment is the cornerstone of most newly diagnosed melanomas. Additionally, it was assumed that physicians would bill the most extensive procedure performed, thereby permitting accurate identification from OHIP billings. All procedures were cross-referenced with SDS/DAD codes in order to ascertain the most extensive surgical procedure done, and thus best categorize patients into treatment categories.

CONCLUSION

Significant variations exist in melanoma incidence and management in Ontario, and concerningly, nearly 1 in 9 patients are inadequately treated, largely a reflection of inadequate surgical management. Definitive reasons for this treatment discrepancy are multifactorial and represent a complex interplay of factors. It is paramount to promote education initiatives to identify patients at risk for melanoma, and to create networks that permit appropriate access to multidisciplinary melanoma specialists, particularly surgeons. Finally, the association of care adequacy with survival outcomes and cost are the subject of ongoing research.

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Figure 1. Cohort creation and melanoma care pathway definitions

Δ = average annual change

p = p-value for trend

IFN = Interferon; RT = radiation therapy; Chemo = Non-Interferon chemotherapy

* Includes n = 198 patients who had completed treatment prior to melanoma diagnosis.

** Includes n = 210 patients who had completed treatment prior to melanoma diagnosis.

Adequate treatment = patients who received curative, non-curative or other treatment as outlined in the figure above.

Inadequate treatment = patients who received an inadequate resection or biopsy as their only source of melanoma treatment.

No treatment = patients not treated in the year following melanoma diagnosis.

Figure 2. Age-, sex-specific rates of melanoma for females (A) and males (B), 2003 – 2012

* Visit in the year prior to diagnosis

† Consultation within a year after diagnosis

§ Consultation from three months prior, to within a year after diagnosis

Figure 3. Adjusted predictors of receipt of adequate treatment for melanoma patients.

Table 1. Baseline demographics and clinical characteristics, by sex

Characteristic	Female N=10,106	Male N=11,770	Overall N=21,876	P-value
Age at diagnosis (years)				
Mean $\pm$ SD	58.77 $\pm$ 17.50	63.19 $\pm$ 15.42	61.15 $\pm$ 16.56	<.001
Median (IQR)	59 (46-73)	65 (53-75)	62 (50-74)	<.001
Age group, No. (%)				
< 18	11 (0.1%)	16 (0.1%)	27 (0.1%)	<.001
18 - 29	501 (5.0%)	273 (2.3%)	774 (3.5%)	
30 - 49	2,674 (26.5%)	1,964 (16.7%)	4,638 (21.2%)	
50 - 69	3,884 (38.4%)	5,038 (42.8%)	8,922 (40.8%)	
70 - 89	2,821 (27.9%)	4,297 (36.5%)	7,118 (32.5%)	
90+	215 (2.1%)	182 (1.5%)	397 (1.8%)	
Anatomic site, No. (%)				
Head and neck	1,389 (13.7%)	2,619 (22.3%)	4,008 (18.3%)	<.001
Trunk	2,156 (21.3%)	4,588 (39.0%)	6,744 (30.8%)	
Extremities	5,978 (59.2%)	3,624 (30.8%)	9,602 (43.9%)	
Other ^a	583 (5.8%)	939 (8.0%)	1,522 (7.0%)	
Follow up (years)				
Mean $\pm$ SD	5.86 $\pm$ 3.07	5.26 $\pm$ 3.15	5.53 $\pm$ 3.13	<.001
Median (IQR)	6 (3-8)	5 (3-8)	5 (3-8)	<.001
Death (prior to Dec 31, 2014), No. (%)				
N	8,176 (80.9%)	8,135 (69.1%)	16,311 (74.6%)	<.001

Y	1,930 (19.1%)	3,635 (30.9%)	5,565 (25.4%)	
ACG Resource Utilization Band (RUB), No. (%)				
0 – No or only invalid diagnoses	16 (0.2%)	31 (0.3%)	47 (0.2%)	<.001
1 – Healthy Users	50 (0.5%)	66 (0.6%)	116 (0.5%)	
2 – Low Users	368 (3.6%)	463 (3.9%)	831 (3.8%)	
3 – Moderate Users	5,075 (50.2%)	5,351 (45.5%)	10,426 (47.7%)	
4 – High Users	2,916 (28.9%)	3,197 (27.2%)	6,113 (27.9%)	
5 – Very High	1,681 (16.6%)	2,662 (22.6%)	4,343 (19.9%)	
Seen by family or general physician at least one in year prior to diagnosis, No. (%)				
N	578 (5.7%)	940 (8.0%)	1,518 (6.9%)	<.001
Y	9,528 (94.3%)	10,830 (92.0%)	20,358 (93.1%)	
Seen by dermatologist at least once in year prior to diagnosis, No. (%)				
N	5,923 (58.6%)	6,756 (57.4%)	12,679 (58.0%)	0.07
Y	4,183 (41.4%)	5,014 (42.6%)	9,197 (42.0%)	

^a Melanoma not elsewhere classified, melanoma not otherwise specified

Table 2. Baseline demographics and clinical characteristics, by treatment group

Characteristic	Adequate treatment	Inadequate or no treatment	Overall	P-value
	N=19,564	N=2,312	N=21,876	
Sex, No. (%)				
Female	9,050 (46.3%)	1,056 (45.7%)	10,106 (46.2%)	0.59
Male	10,514 (53.7%)	1,256 (54.3%)	11,770 (53.8%)	
Age at diagnosis (years)				
Mean ± SD	60.70 ± 16.39	64.96 ± 17.52	61.15 ± 16.56	<.001
Median (IQR)	62 (49-74)	67 (52-79)	62 (50-74)	<.001
Age group, No. (%)				
< 30	724 (3.7%)	77 (3.3%)	801 (3.7%)	<.001
30 - 49	4,257 (21.8%)	381 (16.5%)	4,638 (21.2%)	
50 - 69	8,086 (41.3%)	836 (36.2%)	8,922 (40.8%)	
70 - 89	6,221 (31.8%)	897 (38.8%)	7,118 (32.5%)	
90+	276 (1.4%)	121 (5.2%)	397 (1.8%)	
Anatomic site, No. (%)				
Head and neck	3,512 (18.0%)	496 (21.5%)	4,008 (18.3%)	<.001
Trunk	6,154 (31.5%)	590 (25.5%)	6,744 (30.8%)	
Extremities	8,766 (44.8%)	836 (36.2%)	9,602 (43.9%)	
Other*	1,132 (5.8%)	390 (16.9%)	1,522 (7.0%)	
Follow up (years)				
Mean ± SD	5.56 ± 3.05	5.31 ± 3.69	5.53 ± 3.13	<.001
Median (IQR)	5 (3-8)	5 (2-8)	5 (3-8)	<.001
Region of residence, No. (%)				
Missing	11 (0.1%)	4 (0.2%)	15 (0.1%)	<.001
Erie St. Clair	1,017 (5.2%)	149 (6.4%)	1,166 (5.3%)	

South West	1,980 (10.1%)	268 (11.6%)	2,248 (10.3%)	
Waterloo Wellington	1,302 (6.7%)	140 (6.1%)	1,442 (6.6%)	
Hamilton Niagara Haldimand				
Brant	2,646 (13.5%)	263 (11.4%)	2,909 (13.3%)	
Central West	673 (3.4%)	56 (2.4%)	729 (3.3%)	
Mississauga Halton	1,445 (7.4%)	108 (4.7%)	1,553 (7.1%)	
Toronto Central	1,519 (7.8%)	184 (8.0%)	1,703 (7.8%)	
Central	1,769 (9.0%)	215 (9.3%)	1,984 (9.1%)	
Central East	2,364 (12.1%)	222 (9.6%)	2,586 (11.8%)	
South East	1,028 (5.3%)	182 (7.9%)	1,210 (5.5%)	
Champlain	1,591 (8.1%)	206 (8.9%)	1,797 (8.2%)	
North Simcoe Muskoka	1,008 (5.2%)	123 (5.3%)	1,131 (5.2%)	
North East	954 (4.9%)	109 (4.7%)	1,063 (4.9%)	
North West	257 (1.3%)	83 (3.6%)	340 (1.6%)	
Rurality, No. (%)				
Missing	12 (0.1%)	4 (0.2%)	16 (0.1%)	0.13
Urban	16,375 (83.7%)	1,918 (83.0%)	18,293 (83.6%)	
Rural	3,177 (16.2%)	390 (16.9%)	3,567 (16.3%)	
Income quintile, No. (%)				
Missing	56 (0.3%)	11 (0.5%)	67 (0.3%)	0.04
1 (lowest)	2,726 (13.9%)	342 (14.8%)	3,068 (14.0%)	
2	3,418 (17.5%)	414 (17.9%)	3,832 (17.5%)	
3	3,691 (18.9%)	427 (18.5%)	4,118 (18.8%)	
4	4,333 (22.1%)	548 (23.7%)	4,881 (22.3%)	
5	5,340 (27.3%)	570 (24.7%)	5,910 (27.0%)	
ACG Resource Utilization Band (RUB), No. (%)				
0 – No or only invalid diagnoses	33 (0.2%)	14 (0.6%)	47 (0.2%)	<.001
1 – Healthy Users	104 (0.5%)	12 (0.5%)	116 (0.5%)	
2 – Low Users	726 (3.7%)	105 (4.5%)	831 (3.8%)	
3 – Moderate Users	9,422 (48.2%)	1,004 (43.4%)	10,426 (47.7%)	
4 – High Users	5,513 (28.2%)	600 (26.0%)	6,113 (27.9%)	
5 – Very High	3,766 (19.2%)	577 (25.0%)	4,343 (19.9%)	
Consultation (from 3 months pre to within 1 year post diagnosis): general surgery				
	7,999 (40.9%)	746 (32.3%)	8,745 (40.0%)	<.001
Consultation (from 3 months pre to within 1 year post diagnosis): plastic surgery				
	11,321 (57.9%)	574 (24.8%)	11,895 (54.4%)	<.001
Consultation (within 1 year post diagnosis): dermatology				
	7,223 (36.9%)	487 (21.1%)	7,710 (35.2%)	<.001

Figure 1

Figure 2

Figure 3

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Author/s:

Hong, NJL;Cheng, SY;Baxter, NN;Wright, FC

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