CMAJ OPEN

Research

Identification of the physician workforce providing palliative care in Ontario using administrative claims data

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Abstract

Background: Little is known about the physician workforce providing palliative care in Canada, and in Ontario specifically. We developed an algorithm to identify palliative care physicians using administrative claims data and validated it against a reference sample. We then applied the algorithm to all general practitioners/family physicians (GP/FPs) in the province of Ontario to describe and quantify those identified by the algorithm.

Methods: We reviewed Ontario Health Insurance Plan claims from Jan. 1, 2008, to Dec. 31, 2011, to determine each physician's proportion of claims that were for palliative care. We empirically selected a data-driven cut-off, whereby physicians whose proportion of palliative care claims was above the threshold were defined as palliative care physicians. We validated the cut-off against a reference sample of physicians who self-identified as providing mostly palliative care in a study-specific survey. We then applied this algorithm to all GP/FPs in the province.

Results: We empirically selected 10% as the cut-off for the proportion of palliative care claims. This threshold had exceptional specificity and positive predictive value (97.8% and 90.5%, respectively) and adequate sensitivity (76.0%) when compared with the reference sample (n = 118). When applied to all GP/FPs in the province, the algorithm identified 276 practising mostly palliative care. Of these, 135 (48.9%) were women, 265 (96.0%) practised in urban locations, and 145 (52.5%) worked part time.

Interpretation: Our algorithm readily identified and quantified the workforce of palliative care physicians in Ontario. Such a tool has numerous applications for both health service planners and researchers.

There is increasing recognition of the need to improve access to palliative care for patients with progressive life-limiting illnesses. Practice-based models and research data support the need for early palliative care involvement.[1,2] Increasing cancer incidence, a growing older population and increasing recognition for palliative care in non-cancer diagnoses are all drivers of the need for palliative care.

Physicians, as part of interprofessional teams, play a crucial role in the provision of palliative care. An adequate workforce of palliative care physicians with the necessary training and skill to manage complex cases and lead education, research, quality improvement and health services management is required.[3,4] However, other physicians, including general practitioners/family physicians (GP/FPs), also have an important role to play, particularly by providing generalist-level palliative care. This generalist approach is increasingly referred to as the "palliative care approach."[5]

Little is known about the physician workforce providing palliative care in Canada, and in Ontario specifically. A report from the Canadian Partnership Against Cancer on the cancer control workforce[6] describes a gap in human resources research and a need to understand better the current and future supply of physicians to provide cancer care, including palliative care. The Canadian data that are currently available are collected through surveys or interviews, which are time-consuming and subject to errors or bias.[7–9] A study in the United States also had difficulties identifying palliative care physicians to estimate the workforce.[10] Estimates from England vary considerably depending on the source.[11]

The absence, until recently, of formal recognition of palliative care as a specialty or subspecialty in Canada[12] has complicated the identification of physicians with advanced training and expertise in palliative care. Moreover, a lack of formal designation by the health ministries or regulatory bodies amplifies

Competing interests: José Pereira was the Provincial Lead for Palliative Care at Cancer Care Ontario when the analysis was being completed.

This article has been peer reviewed.

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***CMAJ Open* 2015. DOI:10.9778/cmajo.20150005**

the challenge. Being able to identify palliative care physicians using administrative data would provide a rapid means of quantifying the workforce of palliative care physicians for policy purposes and would provide a tool for other research studies.

We developed an algorithm to identify physicians who provide palliative care from administrative claims data and validated it against a reference sample of physicians. We then applied this algorithm to all GP/FPs in the province of Ontario to describe and quantify the physician workforce providing palliative care.

Methods

Study design and setting

We used administrative health care data to create an empirically based algorithm to identify physicians providing palliative care in Ontario. After we validated the algorithm in a reference sample of self-identified palliative care physicians, we applied it to all GP/FPs in the province. The study design was approved by the Research Ethics Board of Sunnybrook Health Sciences Centre. Standard protocols were followed to preserve physician privacy and confidentiality. All databases used for the study are housed at the Institute for Clinical Evaluative Sciences.

Ontario's population exceeds 13 million. All physician care in the province is provided by a government-funded single-payer health plan. Any patient who is felt to have need can receive palliative care regardless of whether they are still receiving life-prolonging therapy. Palliative care is typically provided by GP/FPs who have developed palliative care within the scope of their practice to greater or lesser degrees. For some, palliative care constitutes all or a major part of their practice. An unknown number have completed advanced training in palliative care, including an additional year of training in an accredited program.

Data sources and definitions

The Ontario Health Insurance Plan (OHIP) claims include the date and type of service and a unique provider number. Virtually all health services and physician visits are captured in this data. The OHIP Corporate Provider Database and the Ontario Physician Human Resources Data Centre database capture physician demographic and practice-related characteristics. We linked these administrative databases through each physician's unique provider number. We calculated each physician's full-time equivalent status by using total physician payments from all sources. We assigned a full-time equivalent value of 1.0 to physicians who fell between the 40th and 60th percentiles of their specialty.[13,14]

We reviewed physician OHIP claims from Jan. 1, 2008, to Dec. 31, 2011. To identify palliative care physicians, we used a collection of specific fee codes for palliative care. These fee codes were identified by consulting the Ontario Ministry of Health and Long-Term Care's OHIP Schedule of Benefits and Fees. This list of codes was vetted by one of us (J.P.), a practising palliative care physician, to ensure its completeness; codes that had few to no claims were excluded (Appendix 1, available at www.cmajopen.ca/content/3/3/E292/suppl/DC1).

Algorithm development and validation

To develop the algorithm for identifying palliative care physicians based on administrative data, we determined each physician's proportion of claims that were for palliative care.

Table 1: Characteristics of physicians in the validation sample* and all practising GP/FPs in Ontario

Characteristic	No. (%) of physicians†	
	Validation sample *n* = 118	Ontario GP/FPs *n* = 12 327
Age,‡ yr, mean ± SD	47.7 ± 10.2	50.7 ± 12.4
Sex		
Female	65 (55.1)	5 027 (40.8)
Male	52 (44.1)	7 300 (59.2)
Missing data	≤ 5	0 (0.0)
Practice location‡		
Rural	18 (15.3)	10 943 (88.8)
Urban	88 (74.6)	1 214 (9.8)
Missing data	12 (10.2)	170 (1.4)
Practice location by health region‡		
Erie St. Clair	≤ 5	468 (3.8)
South West	8 (6.8)	862 (7.0)
Waterloo Wellington	≤ 5	636 (5.2)
Hamilton Niagara Haldimand Brant	16 (13.6)	1 147 (9.3)
Central West	≤ 5	559 (4.5)
Mississauga Halton	≤ 5	935 (7.6)
Toronto Central	9 (7.6)	1 623 (13.2)
Central	≤ 5	1 493 (12.1)
Central East	12 (10.2)	1 161 (9.4)
South East	6 (5.1)	538 (4.4)
Champlain	25 (21.2)	1 463 (11.9)
North Simcoe Muskoka	≤ 5	418 (3.4)
North East	6 (5.1)	551 (4.5)
North West	≤ 5	303 (2.5)
Missing data	12 (10.2)	170 (1.4)
Full-time equivalent§		
≥ 1.0	95 (80.5)	7 540 (61.2)
< 1.0	19 (16.1)	4 775 (38.7)
Missing data	≤ 5	12 (0.1)
% of claims that were for palliative care¶	12.5	1.3

Note: GP/FP = general practitioner/family physician, SD = standard deviation.
*Validation sample = physicians who participated in survey and self-identified as practising mostly palliative care.
†Unless stated otherwise.
‡Age and practice location as of Mar. 31, 2011.
§Full-time equivalent status is based on self-reports; all other variables are based on administrative data.
¶During calendar years 2008–2011.

Table 2: Distribution of specific fee codes by physician specialty

Fee code (description)	GP/FP			Medical oncology			All other specialties			Total	
	No. of claims	Column %*	Row %*	No. of claims	Column %*	Row %*	No. of claims	Column %*	Row %*	No. of claims	Column %*
A901 (GP/FP house call)	16 197	1	97	2	0	0	429	0	3	16 628	0
A902 (pronouncement of death in home)	4 758	0	95	2	0	0	241	0	5	5 001	0
A945 (GP/FP special palliative care consultation)	47 298	2	91	523	0	1	3 958	1	8	51 779	2
B966 (travel premium, palliative care home visit)	53 467	2	94	6	0	0	3 504	1	6	56 977	2
B990 (special visit to patient's home, weekday/daytime)	298 642	11	94	71	0	0	18 072	5	6	316 785	9
B992 (special visit to patient's home, weekday/daytime, with sacrifice to office hours)	23 527	1	98	2	0	0	453	0	2	23 982	1
B994 (special visit to patient's home, nonelective, evenings)	181 541	7	97	57	0	0	6 463	2	3	188 061	6
B996 (special visit to patient's home, night time, first patient of the night)	8 226	0	91	7	0	0	769	0	9	9 002	0
B997 (special visit to patient's home, palliative care, days or evenings [from 2009])	461	0	94	4	0	1	27	0	5	492	0
B998 (special visit to patient's home, palliative care, days or evenings [from 2005])	146 806	5	95	31	0	0	7 342	2	5	154 179	5
C882 (GP/FP terminal care in hospital)	436 998	16	96	330	0	0	19 573	5	4	456 901	14
C945 (special palliative care consultation, hospital in-patient)	41 208	1	90	148	0	0	4 570	1	10	45 926	1
C982 (palliative care, hospital in-patient)	4	0	0	4 013	2	12	29 688	8	88	33 705	1
E083 (subsequent visit as most responsible physician)	68 524	2	89	255	0	0	7 918	2	10	76 697	2
K015 (counselling a relative on behalf of a patient)	73 267	3	33	23 632	11	11	124 872	32	56	221 771	7
K023 (palliative care support to individual, 30 minutes)	777 085	28	87	29 465	14	3	82 098	21	9	888 648	26
K700 (palliative care outpatient case conference)	1 204	0	93	85	0	7	12	0	1	1 301	0
W872 (terminal care in nursing home, GP/FP)	6 487	0	99	0	0	0	94	0	1	6 581	0
W882 (terminal care in chronic care hospital, GP/FP)	69 694	2	92	2	0	0	6 292	2	8	75 988	2
G511 (telephone management of palliative care at home)	15 849	1	92	331	0	2	1 112	0	6	17 292	1
G512 (weekly palliative care case management)	519 220	19	71	147 755	71	20	68 889	18	9	735 864	2
Total	2 790 463		82	206 721			386 376		11	3 383 560	

Note: GP/FP = general practitioner/family physician. Physicians in the GP/FP column were used to create the algorithm. Medical oncologists and other specialists are shown for comparison in this table but were not included in the algorithm.
*Column % allows within-group comparison. Row % allows between-group comparison.

We chose to use a proportion because it better characterizes practice patterns of palliative care physicians. Using absolute counts of claims for palliative care would have underestimated the number of palliative care physicians, because some physicians are busier than others. Because the fee paid for any of the individual claims was within a narrow range, we did not use the proportion of billings from palliative care codes (by contrast, a surgeon would have procedure claims that are worth much more than a clinic visit). We evaluated the distribution of the data and empirically identified a cut-off, whereby physicians whose proportion of palliative care claims was above the threshold were defined as palliative care physicians.

To validate the algorithm, we first identified a sample of physicians using a short survey we created that asked respondents to self-identify as physicians who practise mostly palliative care (v. occasionally or rarely) and their full-time equivalent status. The Ontario Medical Association[15] was consulted to identify and contact all GP/FPs and all physicians with a special interest in palliative care in the province. These physicians were surveyed from March to November 2013. After the initial contact, the physicians were given 8 weeks to respond. Those who responded to the survey were used as the validation sample.

We extracted all claims data for physicians in the validation sample. We compared the proportion of palliative care claims billed by each physician with the amount of palliative care he or she reported in the survey to determine the performance of the algorithm. Physicians who self-identified as practising mostly palliative care were considered palliative care physicians; those who indicated that they occasionally or rarely practised palliative care were considered non–palliative care physicians. For the algorithm to work perfectly, every physician whose proportion of palliative care claims was above the cut-off would also have self-identified as practising mostly palliative care, and every physician below the cut-off would have self-identified as practising palliative care only occasionally or rarely. We tested different thresholds to maximize the sensitivity, specificity and positive predictive value of the algorithm. We used a binomial distribution to calculate 95% confidence intervals.[16]

Identification of the palliative care workforce

Once the cut-off was validated, we applied the algorithm to claims from all GP/FPs in the province. Although we recognize that some specialists provide palliative care, we restricted our analysis to GP/FPs because they accounted for most of the palliative care claims in the validation sample. We then used the administrative data to quantify and describe those identified by the algorithm.

Results

A total of 125 physicians responded to the survey. We excluded 7 because they could not be linked to the databases or had no recorded billings within the study period. A final cohort of 118 physicians was included in the validation sample (Table 1). All specialties (n = 44) were evaluated for fee codes specific to palliative care. Most (82.5%) of the palliative care claims were billed by GP/FPs, including those also practising in emergency departments (Table 2). Medical oncologists billed the next largest proportion (6.1%), most commonly using a weekly case-management code. The other specialties billed palliative care codes infrequently. Fee codes for counselling were used most commonly by the GP/FPs.

We examined the distribution of the proportion of claims that were palliative care claims and empirically selected 10% as the cut-off (data not shown). Performance of this value and 3 additional thresholds in the validation sample are presented in Table 3. The 10% cut-off was shown to have optimal performance, with exceptional specificity and positive predictive value (97.8% and 90.5%, respectively) and adequate sensitivity (76.0%). Use of a lower threshold of 5% or 3% sacrificed specificity and positive predictive value without improving sensitivity. A higher threshold of 50% greatly reduced sensitivity (24.0%) with marginal increases in specificity and positive predictive value. A physician's full-time equivalent status did not affect the performance of the algorithms (data not shown).

When we applied the algorithm to the entire GP/FP population using the 10% cut-off, we identified 276 palliative care physicians. Compared with the non–palliative care physicians, the palliative care physicians were significantly more likely to be female (48.9% v. 38.8%, $p < 0.01$), to practise in an urban setting (96.0% v. 87.2%, $p < 0.001$) and to work part time (52.5% v. 37.0%, $p < 0.001$) (Table 4). When we applied the algorithm, the number of physicians identified as practising mostly palliative care was felt to be rather large (impression from clinical and leadership roles on the team). As a result, we selected secondary cut-off and present data for both thresholds. When we stratified the palliative care physicians using the 50% cut-off, those above this threshold (n = 109) were significantly younger than physicians whose palliative care claims accounted for 10% to less than 50% of their claims

Table 3: Validation of algorithms using different cut-offs for proportion of claims that were palliative care claims*

Algorithm cut-off, % of claims that were palliative care claims	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)
≥ 50%	24.0 (9.4–45.1)	100.0 (96.1–100.0)	100.0 (54.1–100.0)	83.0 (74.8–89.5)
≥ 10%	76.0 (54.9–90.6)	97.8 (92.5–99.7)	90.5 (69.6–98.8)	93.8 (87.0–97.7)
≥ 5%	76.0 (54.9–90.6)	95.7 (89.4–98.8)	82.6 (61.2–95.1)	93.7 (86.8–97.7)
≥ 3%	76.0 (54.9–90.6)	88.2 (79.8–93.9)	67.9 (47.7–84.1)	93.2 (85.8–97.5)

Note: CI = confidence interval, NPV = negative predictive value, PPV = positive predictive value.
*Validation sample = physicians who participated in survey and self-identified as practising mostly palliative care (n = 118).

(Table 4). There were more women in the group above the 50% threshold, but this difference was not statistically significant. Almost 40% of the physicians in this group were in the Toronto Central health region.

Among the physicians whose claims for palliative care fell below the 10% threshold, 0.5% of their claims were for palliative care, as compared with 21.2% of claims among the palliative care physicians between the 10% and 50% thresholds and 82.8% of claims among those above the 50% threshold. About 3700 GP/FPs (range 3582–4147 depending on the year, or about 40%) did not bill for palliative care.

The non–palliative care physicians and the 2 groups of palliative care physicians (10% to < 50%, and ≥ 50%) relied on different fee codes. The non–palliative care physicians who did bill for palliative care used house-call codes or the weekly case-management code most often. By contrast, physicians above the 50% cut-off primarily used the weekly case-management or counselling code.

Table 4: Characteristics of GP/FPs who practised palliative care, as identified by the algorithm

Characteristic	Non–palliative care physicians, no. (%)* n = 9456	Palliative care physicians, no. (%)*		
		Overall† n = 276	10% to < 50%‡ n = 167	≥ 50%‡ n = 109
Age, yr		p = 0.8	p = 0.04	
Mean ± SD	50.4 ± 11.8	50.6 ± 13.1	51.9 ± 13.7	48.5 ± 11.9
Sex		p < 0.001	p = 0.1	
Female	3665 (38.8)	135 (48.9)	75 (44.9)	60 (55.0)
Male	5791 (61.2)	141 (51.1)	92 (55.1)	49 (45.0)
Practice location		p < 0.001	p = 0.5	
Urban	8250 (87.2)	265 (96.0)	159 (95.2)	106 (97.2)
Rural	1077 (11.4)	9 (3.3)	7 (4.2)	≤ 5
Missing data	129 (1.4)	≤ 5	≤ 5	≤ 5
Practice location by health region		p < 0.001	p < 0.001	
Erie St. Clair	358 (3.8)	7 (2.5)	≤ 5	≤ 5
South West	694 (7.3)	13 (4.7)	6 (3.6)	7 (6.4)
Waterloo Wellington	501 (5.3)	18 (6.5)	13 (7.8)	≤ 5
Hamilton Niagara Haldimand Brant	969 (10.2)	24 (8.7)	16 (9.6)	8 (7.3)
Central West	444 (4.7)	6 (2.2)	6 (3.6)	≤ 5
Mississauga Halton	687 (7.3)	17 (6.2)	10 (6.0)	7 (6.4)
Toronto Central	1092 (11.5)	73 (26.4)	30 (18.0)	43 (39.4)
Central	1107 (11.7)	28 (10.1)	21 (12.6)	7 (6.4)
Central East	901 (9.5)	22 (8.0)	18 (10.8)	≤ 5
South East	435 (4.6)	7 (2.5)	6 (3.6)	≤ 5
Champlain	1064 (11.3)	39 (14.1)	22 (13.2)	17 (15.6)
North Simcoe Muskoka	358 (3.8)	7 (2.5)	≤ 5	≤ 5
North East	477 (5.0)	10 (3.6)	9 (5.4)	≤ 5
North West	240 (2.5)	≤ 5	≤ 5	≤ 5
Missing data	129 (1.4)	≤ 5	≤ 5	≤ 5
Full-time equivalent		p < 0.001	p = 0.02	
≥ 1.0	5908 (62.5)	118 (42.8)	75 (44.9)	43 (39.4)
< 1.0	3496 (37.0)	145 (52.5)	89 (53.3)	56 (51.4)
Missing data	52 (0.5)	13 (4.7)	≤ 5	10 (9.2)
% of claims that were for palliative care	0.5	35.7	21.2	82.8

Note: GP/FP = general practitioner/family physician, SD = standard deviation.
*Unless stated otherwise. Differences in means were compared with analysis of variance; differences in proportions were compared with χ^2 test.
†Represents all palliative care physicians identified using the 10% algorithm (10% cut-off for proportion of claims being for palliative care); p values are for comparison between non–palliative care physicians and palliative care physicians.
‡Represents all palliative care physicians identified using the 10% algorithm, stratified by those with 10%–< 50% of claims and ≥ 50% of claims being for palliative care; p values are for comparisons between these 2 palliative care groups.

Interpretation

We successfully developed an algorithm using administrative claims data to identify physicians practising mostly palliative care. The algorithm performed with excellent specificity, an excellent positive predictive value and modest sensitivity against the validation sample using a data-driven cut-off of 10% of claims being for palliative care. Using this algorithm, we identified 276 GP/FPs who practised mostly palliative care, 109 of whom billed for palliative care more than 50% of the time.

Despite the high specificity and acceptable sensitivity of the 10% cut-off, the number of physicians across the province identified as palliative care physicians using this definition ($n = 276$) appeared large to us. This may have occurred because the survey sent to ascertain palliative care practices was not specific enough, in that "mostly" palliative care was not more specifically defined. It may be that our perspective under-appreciates the actual number of physicians practising an intermediate amount of palliative care. Physicians may be reluctant to disclose doing a significant amount of palliative care for fear the provincial college would deem them not doing enough general practice to maintain their certification in general family medicine.

The reporting of results for 3 groups of physicians rather than 2 may deviate from the original intent, but it does provide additional insight that is useful from a policy perspective. For example, palliative care physicians above the 50% cut-off differed from those in the 10%–50% cut-off group. They were younger and were clearly clustered in certain provincial health regions. By contrast, regardless of the cut-off used, physicians who are providing palliative care were primarily practising in urban settings. Furthermore, it is clear that physicians above the 50% cut-off are practising palliative care almost exclusively. The intermediate group (10%–50% of claims for palliative care) likely were running a regular family practice as well. These different groups reflect different models of providing palliative care. A palliative care approach need not be limited to specialists whose practise is exclusively in this area.[5] A recent study showed that different community-based team models in Ontario reduced hospital admissions and emergency department visits, provided certain key elements were present.[17]

About 40% of the GP/FPs in our study did not use a single palliative care fee code. If the intention is to increase the capacity of primary palliative care, this may represent a target group or metric. For example, if policy measures are implemented to increase primary palliative care, the patterns of billing for these physicians could be followed over time for change.

Our algorithm provides a tool to evaluate the number and distribution of palliative care physicians, to estimate the number of patients for whom they provide care and to project estimates of human resource needs. Physician:population ratios in England[11] and Australia[18] have ranged from 0.8 to 1.5 palliative care *specialists* per 100 000 population. Whether these estimates are applicable to Ontario is not known. In the US, Australia and England, shortages are feared.[10,11,18] An in-depth examination of this issue for Ontario was beyond the scope of our paper, but we hope the algorithm is a significant step toward finding the answer.

Strengths and limitations

The strength of this paper is that it begins to address a recognized gap in our knowledge of human resources in palliative care in Ontario. Although the specific fee codes and thresholds used in our study may not be generalizable to other settings, the methodologic approach could be readily applied in other jurisdictions.

A limitation of the study is that the billing system is unable to capture all possible types of palliative care activity accurately. The types of claims used for the algorithm were specifically related to the provision of palliative care; however, it is common for palliative care physicians to bill other types of claims that are more generic, even if the nature of the care provided was still palliative. As such, the algorithm is not able to quantify how much palliative care patients are receiving, and no physician would have 100% of their claims specifically related to palliative care. Although specialists and GP/FPs may be providing palliative care and billing with other fee codes, the lack of use of the codes used in our study indicates this is not the main focus of their practice.

Conclusion

The algorithm we developed and validated using administrative claims data readily identified and quantified the workforce of palliative care physicians in Ontario. Such a tool has numerous applications for both health service planners and researchers. Until there is a more rigorous definition of "palliative care physician" paired with a robust identifier, our algorithm may provide researchers with a useful tool to evaluate the number and distribution of palliative care physicians.

References

1. Temel JS, Greer JA, Muzikansky A, et al. Early palliative care for patients with metastatic non-small-cell lung cancer. *N Engl J Med* 2010;363:733-42.
2. Ferris, FD, Balfour, HM, Bowen, K, et al. *A model to guide hospice palliative care: based on national principles and norms of practice*. Ottawa: Canadian Hospice Palliative Care Association; 2002.
3. Shadd J. Should palliative care be a specialty?: Yes. *Can Fam Physician* 2008;54: 840, 842, 844, 846.
4. von Gunten CF, Lupu D. Recognizing palliative medicine as a subspecialty: What does it mean for oncology? *J Support Oncol* 2004;2:166-74.
5. Shadd JD, Burge F, Stajduhar KI, et al. Defining and measuring a palliative approach in primary care. *Can Fam Physician* 2013;59:1149-50.
6. Canadian Partnership Against Cancer Steering Committee of the Cancer Workforce Scoping Study. *The Cancer Workforce Scoping Study: a report from the front lines of Canada's cancer control workforce: summary report*. Toronto: Canadian Partnership Against Cancer. Public Health Agency of Canada; 2010. Available: www.cancerview.ca/idc/groups/public/documents/webcontent/hhr_cwss_summary_report.pdf (accessed 2015 July 8).
7. Slocum-Gori S, Hemsworth D, Chan WW, et al. Understanding compassion satisfaction, compassion fatigue and burnout: a survey of the hospice palliative care workforce. *Palliat Med* 2013; 27: 172-8.
8. Towns K, Dougherty E, Kevork N, et al. Availability of services in Ontario hospices and hospitals providing inpatient palliative care. *J Palliat Med* 2012;15: 527-34.
9. Sussman J, Barbera L, Bainbridge D, et al. Health system characteristics of quality care delivery: a comparative case study examination of palliative care for cancer patients in four regions in Ontario, Canada. *Palliat Med* 2012;26: 322-35.
10. Lupu D. Estimate of current hospice and palliative medicine physician workforce shortage. *J Pain Symptom Manage* 2010;40:899-911.
11. *Medical specialty workforce factsheet: palliative medicine*. London (UK): Centre for Workforce Intelligence. Available: www.cfwi.org.uk/publications/palliative-medicine-cfwi-medical-fact-sheet-and-summary-sheet-august-2010/attachment.pdf (accessed 2014 Sept. 15).
12. Monette M. Palliative care subspecialty in the offing. *CMAJ* 2012;184: E653-4.
13. Stukel TA, Glazier RH, Schultz SE, et al. Multispecialty physician networks in Ontario. *Open Med* 2013;7:e40-55.

14. Henry, DA, Schultz, SE, Glazier, RH, et al. *Payments to Ontario physicians from Ministry of Health and Long-Term Care sources, 1992/93 to 2009/10*. Toronto: Institute for Clinical Evaluative Sciences; 2012.
15. About the OMA. Ontario Medical Association; 2014. Available: www.oma.org/About/Pages/default.aspx (accessed 2014 June 3).
16. Newcombe RG. Two-sided confidence intervals for the single proportion: comparison of seven methods. *Stat Med* 1998;17:857-72.
17. Seow H, Brazil K, Sussman J, et al. Impact of community based, specialist palliative care teams on hospitalisations and emergency department visits late in life and hospital deaths: a pooled analysis. *BMJ* 2014;348:g3496.
18. *Health and Community Services Committee Inquiry into palliative care services and home and community care services in Queensland*. Sydney (Australia): The Royal Australasian College of Physicians; 2014.

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Contributors: All authors made contributions to the conception or design of the work or the acquisition, analysis or interpretation of the data. All authors participated in drafting the work, revising it critically for intellectual content and approved the final version of the manuscript.

Funding: This study was conducted with the support of the Canadian Centre for Applied Research in Cancer Control.

Acknowledgements: This study was supported by the Institute for Clinical Evaluative Sciences (ICES), which is funded by an annual grant from the Ontario Ministry of Health and Long-Term Care (MOHLTC). The opinions, results and conclusions reported in this paper are those of the authors and are independent from the funding sources. No endorsement by ICES or the MOHLTC is intended or should be inferred. The authors would like to acknowledge all the survey respondents whose replies facilitated this work. An abstract of this work was presented at the Canadian Centre for Applied Research in Cancer Control's Annual Scientific Meeting in Toronto, May, 2014.

Supplemental information: For reviewer comments and the original submission of this manuscript, please see www.cmajopen.ca/content/3/3/E292/suppl/DC1