Ann Surg Oncol (2018) 25:1478–1487
https://doi.org/10.1245/s10434-018-6430-9

Annals of
SURGICAL ONCOLOGY
OFFICIAL JOURNAL OF THE SOCIETY OF SURGICAL ONCOLOGY

ORIGINAL ARTICLE – HEALTH SERVICES RESEARCH AND GLOBAL ONCOLOGY

Palliative Care is Associated with Reduced Aggressive End-of-Life Care in Patients with Gastrointestinal Cancer

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ABSTRACT

Background. We examined the delivery of physician palliative care (PC) services and its association with aggressive end-of-life care (EOLC) in patients with gastrointestinal (GI) cancer in Ontario, Canada.

Methods. All patients with primary cause of death from esophageal, gastric, colon, and anorectal cancer from January 2003 to December 2013 were identified. PC services within 2 years of death were classified: (1) any PC; (2) timing of first PC ($\leq$ 7, 8–90, 91–180, and 181–730 days before death); and (3) intensity of PC measured by number of days used (1st–25th, 26th–50th, 51st–75th, and 76th–100th percentiles). Aggressive EOLC was defined as any of the following: chemotherapy, emergency department visits, hospital or intensive care unit (ICU) admissions (all $\leq$ 30 days of death), and death in hospital and in the ICU; these were combined as a composite outcome (any aggressive EOLC).

Results. The cohort included 34,630 patients, of whom 74% had at least one PC service. Timing of the first PC service varied: $\leq$ 7 (12%), 8–90 (42%), 91–180 (16%), and 181–730 (30%) days before death. Compared with patients not receiving PC, any PC was associated with a reduction in any aggressive EOLC (risk ratio [RR] 0.75, 95% confidence interval [CI] 0.74–0.76); this association was similar regardless of timing of the first PC service. The most dramatic reduction in aggressive EOLC occurred in patients who received the greatest number of days of PC (RR 0.65, 95% CI 0.63–0.67).

Conclusions. The majority of patients received PC within 2 years of death. A larger number of days of PC was associated with a greater reduction in aggressive EOLC.

Despite the somewhat negative stigma associated with palliative care (PC) among cancer patients and their caregivers,[1] PC interventions at the end of life improve quality of life and cancer symptom control.[2–5] Major societies recommend that PC be offered early in the disease process.[6–8] Despite this, referrals to PC are typically made late.[9–11] Furthermore, there is no clear guidance pertaining to the ideal timing of PC, although many providers agree that early is better than late. Late PC reduces the time available to provide interventions and to receive their benefits,[12] but PC too early in the process may represent an inefficient use of a limited resource.

Many studies have described the beneficial effects of PC interventions on quality of life;[2–5] however, there is limited information on the relationship between PC and aggressive care at the end of life. Studies have reported aggressive end-of-life care (EOLC) in a variety of populations, including cancer patients.[13–17] Increasing trends in outcomes related to aggressive EOLC have been reported.[13,16,18] Furthermore, utilization of such health care resources at the end of life is expensive.[19–21] We

First Received: 22 December 2017;
Published Online: 22 March 2018

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previously reported that two-thirds of gastrointestinal (GI) cancer patients in Ontario, Canada, received some form of aggressive EOLC.[22] Few studies have examined the association between PC and aggressive EOLC at the population level.[23,24] The objective of this study was to examine the association between timing and intensity of PC and aggressive EOLC in a large population of patients with GI cancer.

METHODS

Cohort

We conducted a population-based cohort study of all patients in Ontario, Canada, who died of an alimentary canal GI cancer between 1 January 2003 and 31 December 2013. Ontario has a population of approximately 14 million and a universal single-payer health care system, which covers most health care services (i.e. physician visits, inpatient hospitalizations, and procedures), but does not comprehensively cover all medications and supportive services such as home care. Cases with a primary cause of death from esophageal, gastric, colon, and anorectal cancer recorded in the Ontario Cancer Registry (OCR) were included in the study cohort. Diagnoses of esophageal, gastric, colon, and anorectal cancers were derived from the International Classification of Diseases, Tenth Revision (ICD-10) codes ("Appendix 1"). Patients were excluded if they had multiple cancer diagnoses, non-GI cancer diagnoses, died within 30 days of cancer diagnosis, were younger than 18 years of age at death, were not residents of Ontario at the time of death, or did not have a valid Ontario provincial health card number. This study was approved by the Health Sciences Research Ethics Board, Queen's University, Kingston, ON, Canada.

Administrative Health Care Databases

We used the linked administrative healthcare databases at the Institute for Clinical Evaluative Sciences (ICES). The Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD) contains information on Ontario patients discharged from a hospital; the National Ambulatory Care Reporting System (NACRS) provides information on emergency department (ED) visits; the Ontario Health Insurance Plan (OHIP) database holds physician billing claims for services, including procedure and consultation visits; and the OCR includes information on all incident cancers diagnosed since 1964.[25] Reporting is provincially mandated and over 95% complete.[26] The Vital Statistics Registry (VSR) provides information regarding date and cause of death. All data sets were held securely at the ICES.

Palliative Care (PC)

We explored the receipt of PC within 2 years of death using PC billing codes specific for physician consultations, follow-up visits, telephone management, and other services recorded in the OHIP; these codes were based on a published and validated algorithm[27] and were carefully reviewed by two authors with clinical expertise in surgical oncology (SM) and PC (CG). We included only codes that indicated that a PC service had been rendered ("Appendix 1").

The 2 year window before death was selected as a clinically meaningful time period. PC was classified based on (1) occurrence (any PC/no PC); (2) timing of first PC with respect to death (none, ≤ 7, 8–90, 91–180, and 181–730 days); and (3) intensity of PC (none, 1st–25th, 26th–50th, 51st–75th, and 76th–100th percentiles). We determined the number of days during which a patient received PC, based on billing codes, and categorized the intensity of PC into percentiles based on the number of days [1–25th percentile (1–3 days); 26th–50th percentile (4–8 days); 51st–75th percentile (9–20 days), and 76th–100th percentile (21 + days)]. We limited the analyses to include only one billing code per patient per day; therefore, a patient in the 1–25th percentile would have had one to three separate PC services (or 1–3 days of PC) within 2 years of death.

Aggressive End-of-Life Care (EOLC)

Measures of aggressive EOLC selected were based on previous studies,[13,14,28] including our own,[22] and included death in hospital and in the intensive care unit (ICU), or any of the following, within 30 days of death: receipt of chemotherapy, ED visits, and admissions to hospital or ICU. The outcomes were examined individually and as a composite measure (any aggressive EOLC). Billing, service, and event codes from the OHIP, DAD, and NACRS databases were used to identify EOLC. Our previous work has shown that the OHIP chemotherapy codes capture 98.5% of chemotherapy administration in Ontario[29] ("Appendix 1").

Potential Confounders

Potential confounders of the association between PC and aggressive EOLC were analyzed at the time of death and included patient age, sex, comorbidity, socioeconomic deprivation, location of residence, local health integration

network (LHIN), institution type, and time since cancer diagnosis.

Age at the time of death was categorized (< 50, 50–64, 65–80, and > 81 years). Comorbidity in the 12 months prior to death was modeled as a continuous variable using the Aggregated Diagnosis Groups (ADG),[30,31] and was analyzed using the major ADG variable, which includes eight diagnoses typically associated with high healthcare resource use, where a higher number indicates greater comorbidity. Socioeconomic deprivation was measured in quintiles using the Ontario Marginalization Index (ON-Marg), a tool derived from census data that illustrates levels of marginalization across geographic units in the province.[32] Those in the highest quintile represent the most marginalized. Residence was defined as either rural (community size < 10,000) or urban. Ontario has 14 LHINs, which are regional health authorities responsible for the administration of public health care services. Institutions were defined as those providing instruction to medical students (teaching hospitals) and those who do not [small (< 100 beds) and community (≥ 100 beds) hospitals]. The institution where the patient died was used for the institution classification; when a patient did not die in hospital, the institution type was based on characteristics of the last hospital admission. Time from cancer diagnosis to death was categorized as < 6 months, 6 months–1 year, > 1–3 years, > 3–5 years, and > 5 years.

Statistical Analyses

Descriptive frequencies were reported. Trends in receipt of PC over the study period were assessed statistically using the Cochran–Armitage test. In the final trend analysis, the G512 code (PC case management fee) was removed as it had been introduced part way through the study period. Furthermore, the billing frequencies for this were extremely high compared with other billing codes, which may disproportionately influence trends in PC over the study period. Analyses were also performed, with the G512 code included for comparison. Modified Poisson regression[33] was used to determine associations between PC (any, timing of first service, and intensity) and aggressive EOLC (specific elements and composite outcome), adjusting for potential confounders. In these analyses we excluded patients who had received any aggressive EOLC within 30 days of death prior to their first PC service (n = 4094). Risk ratios (RRs) with 95% confidence intervals (CIs) are presented. All statistical analyses were completed using SAS version 9.3 (SAS Institute, Inc., Cary, NC, USA) at ICES Queens.

RESULTS

Characteristics of the Cohort

Demographic and clinical characteristics of the study cohort are summarized in Table 1. We identified 34,630 patients who died of a GI malignancy; patients had esophageal (n = 4149, 12%), gastric (n = 6728, 19%), colon (n = 14,801, 43%), and anorectal cancers (n = 8952, 26%). Most patients were male (60%), ≥ 65 years of age at death (73%), and lived in an urban setting (86%). Of these patients, 74% had at least one PC service within 2 years of death.

Patients who received PC within 2 years of death were significantly younger (mean age at death 70.9 vs. 76.2 years, $p < 0.001$) and were more likely to reside in an urban setting (87 vs. 81%, $p < 0.001$) than those who did not receive PC. Other patient characteristics were similar based on receipt of PC.

Palliative Care

Of the patients who received PC services within 2 years of death, the timing of the first service was ≤ 7 days (n = 3036, 12%), 8–90 days (n = 10,735, 42%), 91–180 days (n = 3945, 16%), and 181–730 days (n = 7730, 30%) before death. The median length of time between first PC service and death was 76 days (interquartile range [IQR] 23–230), and the median number of PC services per patient within 2 years of death was 7 (IQR 2–17).

Trends in PC over the study period (2003–2013) are shown in Fig. 1. During the study period, there was a statistically significant increase in the proportion of patients receiving any PC within 2 years of death, from 63.2 to 84.4% ($p < 0.0001$), and there was no significant change in the proportion of patients receiving their first PC service within 7 days of death (9.2–8.6%, $p = 0.67$). When the G512 billing code was included in the analysis the results were similar (not shown).

Association Between PC and Any Aggressive EOLC

Associations between PC and any aggressive care are shown in Table 2. The receipt of any PC service within 2 years of death was associated with a reduction in any aggressive EOLC (RR 0.75, 95% CI 0.74–0.76). Compared with no PC, first PC at all assessed time points was associated with a similar reduction in aggressive EOLC. With respect to the intensity of PC, the greatest reduction in aggressive EOLC was observed in patients who received the most number of days of PC (RR 0.65, 95% CI 0.63–0.67) compared with no PC.

TABLE 1 Demographic and clinical characteristics of patients who died of gastrointestinal cancer in Ontario, Canada, based on receipt of any palliative care services within 2 years of death

Characteristic	Total [N = 34,630]	No palliative care [n = 9184 (26.7%)]	Palliative care [n = 25,446 (73.5%)]
Age, years			
Mean ± SD	72.30 ± 13.14	76.23 ± 12.22	70.88 ± 13.17
< 50	1953 (5.6)	272 (3.0)	1681 (6.6)
50–64	7505 (21.7)	1312 (14.3)	6193 (24.3)
65–80	14,631 (42.2)	3764 (41.0)	10,867 (42.7)
> 81	10,541 (30.4)	3836 (41.8)	6705 (26.3)
Sex			
Female	14,036 (40.5)	3777 (41.1)	10,259 (40.3)
Male	20,594 (59.5)	5407 (58.9)	15,187 (59.7)
Cancer type			
Colon	14,801 (42.7)	4248 (46.3)	10,553 (41.5)
Esophageal	4149 (12.0)	980 (10.7)	3169 (12.5)
Gastric	6728 (19.4)	1417 (15.4)	5311 (20.9)
Anorectal	8952 (25.9)	2539 (27.6)	6413 (25.2)
Sum of major ADGs			
Mean ± SD	3.33 ± 1.44	3.40 ± 1.53	3.30 ± 1.41
Deprivation, percentile			
0–20th	5888 (17.0)	1300 (14.2)	4588 (18.0)
21st–40th	6173 (17.8)	1520 (16.6)	4653 (18.3)
41st–60th	6460 (18.7)	1673 (18.2)	4787 (18.8)
61st–80th	6832 (19.7)	1830 (19.9)	5002 (19.7)
81st–100th	7355 (21.2)	2072 (22.6)	5283 (20.8)
Missing	1922 (5.6)	789 (41.1)	1133 (58.9)
Location[a]			
Urban	29,701 (85.8)	7449 (81.1)	22,252 (87.4)
Rural	4915 (14.2)	1733 (18.9)	3182 (12.5)
LHIN[a]			
1	1865 (5.4)	692 (7.5)	1173 (4.6)
2	2725 (7.9)	767 (8.4)	1958 (7.7)
3	1815 (5.2)	370 (4.0)	1445 (5.7)
4	4618 (13.3)	1519 (16.5)	3099 (12.2)
5	1384 (4.0)	257 (2.8)	1127 (4.4)
6	2366 (6.8)	516 (5.6)	1850 (7.3)
7	3088 (8.9)	762 (8.3)	2326 (9.1)
8	3769 (10.9)	771 (8.4)	2998 (11.8)
9	3906 (11.3)	868 (9.5)	3038 (11.9)
10	1690 (4.9)	609 (6.6)	1081 (4.2)
11	3372 (9.7)	751 (8.2)	2621 (10.3)
12	1292 (3.7)	308 (3.4)	984 (3.9)
13	1985 (5.7)	768 (8.4)	1217 (4.8)
14	741 (2.1)	224 (2.4)	517 (2.0)
Time since diagnosis			
< 6 months	9266 (26.8)	2834 (30.9)	6432 (25.3)
6 months–1 year	5467 (15.8)	1190 (13.0)	4277 (16.8)
> 1 year–3 years	10,647 (30.7)	2191 (23.9)	8456 (33.2)
> 3 years–5 years	4075 (11.8)	927 (10.1)	3148 (12.4)
> 5 years	5175 (14.9)	2042 (22.2)	3133 (12.3)

TABLE 1 continued

Characteristic	Total [N = 34,630]	No palliative care [n = 9184 (26.7%)]	Palliative care [n = 25,446 (73.5%)]
Hospital type			
Community	19,881 (57.4)	5212 (56.8)	14,669 (57.6)
Small	1357 (3.9)	487 (5.3)	870 (3.4)
Teaching	8733 (25.2)	1979 (21.5)	6754 (26.5)
Missing	4659 (13.5)	1506 (16.4)	3153 (12.4)

ADG Aggregated Diagnosis Groups, *LHIN* Local Health Integration Network, *SD* standard deviation

[a]14 missing cases

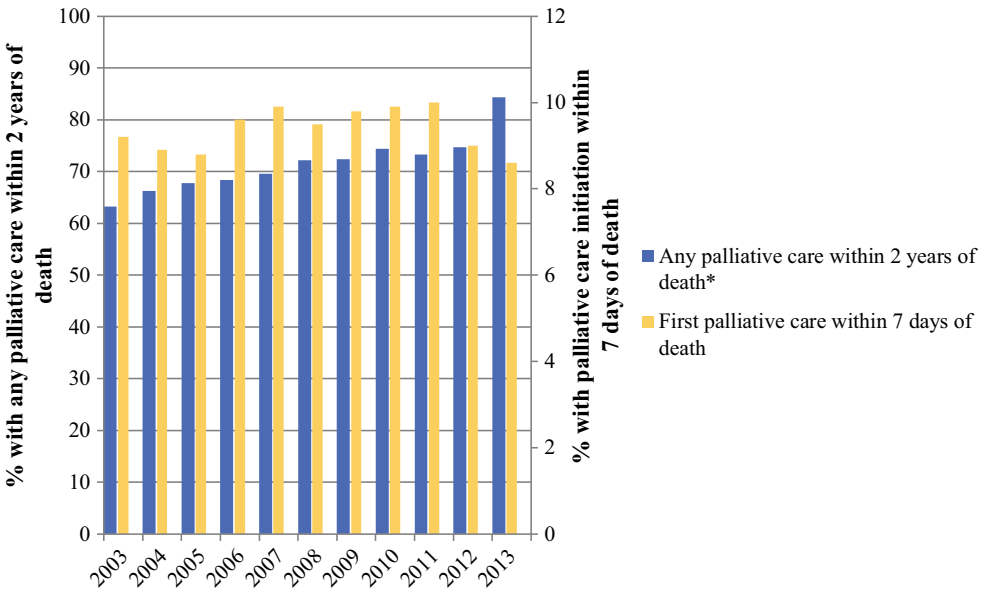

FIG. 1 Trends in palliative care services over the study period (2003–2013) in patients who died of gastrointestinal cancer in Ontario, Canada. Bar graphs denote the percentage of patients who received any palliative care service within 2 years of death (blue) and those who received first palliative care service within 7 days of death (yellow). *Indicates significantly increasing trend over study period by Cochran-Armitage test

Association Between PC and Specific Elements of Aggressive EOLC

Associations between PC and specific elements of EOLC are shown in Table 3. The receipt of any PC service within 2 years of death was associated with a reduction in the likelihood of all specific elements of aggressive EOLC, including chemotherapy (RR 0.69, 95% CI 0.62–0.76), ED visits (RR 0.71, 95% CI 0.69–0.73), hospitalizations (0.67, 95% CI 0.65–0.68), ICU admissions (RR 0.20, 95% CI 0.18–0.22), death in hospital (RR 0.67, 95% CI 0.65–0.69), and death in the ICU (RR 0.19, 95% CI 0.17–0.21). A reduction in these specific elements of aggressive EOLC was observed at all assessed time points. With respect to the intensity of PC, the greatest reduction in all specific elements of aggressive EOLC was observed in patients who received the most number of days of PC compared with no PC.

DISCUSSION

PC interventions in a variety of populations and settings have been shown to improve quality of life,[2,4,5] satisfaction,[5] and survival;[4] however, literature pertaining to their association with aggressive EOLC is currently limited.[23,34] Our study provides new data on the association between PC and aggressive EOLC in a large population of GI cancer patients. Notably, a majority of patients (74%) received at least one PC service within 2 years of death and there was a statistically significant increase over the study period. The receipt of any PC within 2 years of death was associated with a reduction in any and all specific elements of aggressive EOLC, with the most reduction observed in patients who received the greatest number of days of PC. Finally, although 12% of patients received their first PC within 7 days of death, even this was associated with a reduction in aggressive EOLC.

Our findings are in keeping with another retrospective population-level analysis of patients with advanced

TABLE 2 Association between palliative care within 2 years of death as (a) any palliative care; (b) timing of first palliative care; and (c) intensity of palliative care and any aggressive EOLC, adjusted for patient and clinical factors

Palliative care	Any aggressive EOLC [RR (95% CI)][a]
Any palliative care	
No	Reference
Yes	0.75 (0.74–0.76)
Timing of first palliative care, days	
No palliative care	Reference
≤ 7	0.73 (0.69–0.78)
8–90	0.74 (0.72–0.76)
91–180	0.71 (0.68–0.73)
180–730	0.80 (0.78–0.81)
Intensity of palliative care, percentile	
No palliative care	Reference
1st–25th	0.81 (0.79–0.83)
26th–50th	0.79 (0.77–0.82)
51st–75th	0.73 (0.71–0.75)
76th–100th	0.65 (0.63–0.67)

Adjusted for age, sex, comorbidity, socioeconomic deprivation, location, local health integration network, time since diagnosis, institution type

EOLC end-of-life care, *ICU* intensive care unit, *RR* risk ratio, *CI* confidence interval

[a]Those who received aggressive EOLC (chemotherapy, emergency department visit, hospital admission, and/or ICU admission) prior to their first palliative care service were excluded from all analyses (n = 4094)

pancreatic cancer in whom PC consultation was associated with decreased use of chemotherapy and lower risk of ED visits, ICU admission, and multiple hospitalizations at the end of life.[23] Pancreatic cancer patients represent a very specific cohort of patients with likely different care needs at the end of life; our study results provide new information on a broader cohort of GI cancer patients. In addition, our study used a comprehensive definition of PC, including consultations, follow-ups, and telephone services, and we examined PC in three different ways, with consistent results. In a matched retrospective cohort study using population-level data, Triplett et al.[24] reported that PC consultation was associated with lower rates of hospitalization, invasive procedures, and chemotherapy administration in a broad cohort (prostate, breast, lung, and colorectal cancer) of advanced cancer patients in the US. Our data are in keeping with their findings. Notably, our study includes a significant proportion of younger (< 65 years of age) patients, unlike the Triplett study, which included only Medicare beneficiaries.

Our data show that the proportion of GI cancer patients receiving PC services within 2 years of death steadily increased over the study period. This is encouraging and may stem from a growing body of literature that supports the benefits of PC. There is an impetus to integrate PC into standard oncology care, early in the disease course and concurrent with active treatment.[6–8] Although early involvement of PC is endorsed,[3–5,35] late referrals to PC are reported.[9–11,36] The ideal timing of referral to and amount of time spent receiving PC services prior to death is unclear; however, recent guidelines have suggested PC involvement should be initiated within 8 weeks of diagnosis.[6] While the literature suggests that late PC reduces the length of time available to experience the benefits of PC, our data suggest that receipt of first PC, even within 7 days of death, is associated with a reduction in aggressive EOLC.

We previously reported that 6% of GI cancer patients were admitted to the ICU in the final 30 days of life; however, the majority of these patients ultimately died in the ICU, with a significant increasing trend in this phenomenon over the study period.[22] In the current study, we report that any PC within 2 years of death is associated with a reduced likelihood of ICU admission and death in the ICU. This is critical as ICU admission in the very final days of life may be inappropriate[37] and costly. We propose that patients who have not previously been seen by a PC physician be assessed, even while in the ICU, as a first service even within 7 days of death is associated with a reduction in aggressive interventions.

The strengths of this study include a contemporary and specific cohort of patients, inclusion of younger patients, and the population-level nature of the data, generalizable to GI cancer patients treated in a variety of settings. Nevertheless, there are limitations. There may be unmeasured confounders that affect the association between PC and aggressive EOLC. While we adjusted for a number of demographic and clinical characteristics that could confound this association, factors such as family and social support and patient willingness to accept PC and decline aggressive EOLC are not captured. Those who accept PC are also those who are most likely to accept comfort measures in the last 30 days of life, which would affect our study outcomes. There are limitations to our definition of aggressive EOLC and what is aggressive versus what is consistent with appropriate care, for example in patients with severe symptoms who may need to be evaluated in an inpatient setting or in the ED. We identified PC services using physician billing codes;[27] PC services provided by nurses, social workers, and other ancillary personnel were not captured and are likely important.[6] Use of billing codes fails to capture detailed information on what was discussed or done at a specific visit. Finally, our data are limited to patients in Ontario and there are known differences in the

TABLE 3 Association between palliative care within 2 years of death as (a) any palliative care; (b) timing of first palliative care; and (c) intensity of palliative care and specific elements of aggressive EOLC, adjusted for patient and clinical factors

Palliative care	Chemotherapy[a] RR (95% CI)	ED visit[a] RR (95% CI)	Hospital admission[a] RR (95% CI)	ICU admission[a] RR (95% CI)	Death in hospital RR (95% CI)	Death in ICU RR (95% CI)
Any palliative care						
No	Reference	Reference	Reference	Reference	Reference	Reference
Yes	0.69 (0.62–0.76)	0.71 (0.69–0.73)	0.67 (0.65–0.68)	0.20 (0.18–0.22)	0.67 (0.65–0.69)	0.19 (0.17–0.21)
Timing of first palliative care, days						
No palliative care	Reference	Reference	Reference	Reference	Reference	Reference
≤ 7	0.05 (0.02–0.16)	0.49 (0.43–0.56)	0.41 (0.36–0.47)	0.08 (0.04–0.16)	0.79 (0.73–0.85)	0.33 (0.24–0.47)
8–90	0.61 (0.55–0.69)	0.66 (0.64–0.69)	0.63 (0.61–0.65)	0.16 (0.14–0.19)	0.67 (0.65–0.69)	0.17 (0.14–0.20)
91–180	0.82 (0.71–0.93)	0.72 (0.69–0.75)	0.67 (0.64–0.70)	0.22 (0.18–0.27)	0.61 (0.58–0.63)	0.18 (0.14–0.22)
181–730	0.81 (0.71–0.92)	0.78 (0.75–0.81)	0.75 (0.73–0.78)	0.25 (0.22–0.30)	0.69 (0.66–0.71)	0.21 (0.17–0.25)
Intensity of palliative care, percentile						
No palliative care	Reference	Reference	Reference	Reference	Reference	Reference
1st–25th	0.71 (0.63–0.81)	0.80 (0.77–0.83)	0.72 (0.69–0.74)	0.33 (0.29–0.38)	0.78 (0.75–0.80)	0.41 (0.36–0.47)
26th–50th	0.77 (0.68–0.88)	0.79 (0.76–0.83)	0.74 (0.71–0.76)	0.19 (0.16–0.23)	0.68 (0.65–0.70)	0.14 (0.11–0.18)
51st–75th	0.67 (0.59–0.77)	0.69 (0.66–0.72)	0.67 (0.64–0.69)	0.12 (0.10–0.15)	0.60 (0.58–0.63)	0.08 (0.06–0.11)
76th–100th	0.57 (0.49–0.65)	0.51 (0.48–0.53)	0.52 (0.50–0.54)	0.13 (0.10–0.16)	0.59 (0.57–0.62)	0.10 (0.07–0.13)

Adjusted for age, sex, comorbidity, socioeconomic deprivation, location, local health integration network, time since diagnosis, institution type

ICU intensive care unit, *ED* emergency department, *RR* risk ratio, *CI* confidence interval

[a]Those who received aggressive end-of-life care (chemotherapy, ED visit, hospital admission, and/or ICU admission) prior to their first palliative care service were excluded from all analyses (n = 4094)

availability of PC services across provinces in Canada[8,38,39] and the US.[6]

CONCLUSION

PC services were received by the majority of Ontario patients with GI cancer within 2 years of death. The increasing trend in patients receiving PC is encouraging. Our data support that PC is associated with a reduction in potentially futile aggressive care at the end of life, which may be beneficial to patients, care providers, and the health care system.

ACKNOWLEDGMENTS This study was funded by the Faculty of Health Sciences Research Initiation Grant (SM) and the Department of Surgery at Queen's University, and was supported by the 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 Ontario MOHLTC is intended or should be inferred. Parts of this material are based on data and information compiled and provided by the CIHI; however, the analyses, conclusions, opinions, and statements expressed herein are those of the authors and not necessarily those of the CIHI.

AUTHOR CONTRIBUTIONS All authors contributed to the following elements of the study: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing of the original draft, and review and editing.

DISCLOSURES None.

APPENDIX 1

ICD-10 codes used to identify the study cohort

Cancer type	ICD-10 Code
Esophageal	C15, C150–155, C158–159
Gastric	C16, C160–166, C168–169
Colon	C18, C180–190
Anorectal	C20, C21, C210–212, C218

Codes used to identify study outcomes

Outcome	Database	Codes	Values
Receipt of last dose of chemotherapy within 30 days of death	OHIP	G075, G281, G381, G345, G359, G382, G388, G390	Notavailable
Any emergency department visit within 30 days of death	NACRS	SERVDATE	Notavailable
Any hospital admission within 30 days of death	DAD	ADMDATE	Notavailable
Any intensive care unit admission within 30 days of death	DAD	SCU, SCU 1–6	(a) Value 10—Medical intensive care nursing unit (b) Value 20—Surgical intensive care nursing unit (c) Value 25—Trauma intensive care nursing unit (d) Value 30—Combined medical and surgical intensive care nursing unit (e) Value 35—Burn intensive care nursing unit (f) Value 40—Cardiac intensive care nursing unit, surgery (g) Value 45—Coronary intensive care nursing unit, medical
Death in an acute-care hospital	DAD	DISDISP	(a) Value 07—died
Death in a special care unit	DAD	DTHSCU	(a) Value 1—patient died within $\leq$ 48 h of admission to the unit (b) Value 2—patient died within $>$ 48 h of admission to the unit (c) Value Y—yes

Frequency listing of palliative care OHIP billing codes used in the study[a]

Fee code	Fee code description	No. of patients with code (*n*)	Percentage of patients with palliative care (%)[a]	No. of occurrences of code (*n*)	Percentage of all occurrences (%)
A901	Housecall assessment (only when billed with B997 and B998)[b]	995	3.9	3014	0.8
A902	Housecall assessment—pronouncement of death in home (only when billed with B997 and B998)[b]	1076	4.2	1079	0.3
A945	Special palliative care consultation	6395	25.1	7306	1.9
C882	Palliative care subsequent visit in inpatient hospital	6375	25.1	69,272	18.1
C945	Special palliative care consultation	5819	22.9	6402	1.7
C982	Palliative care subsequent visit in inpatient hospital	731	2.9	5181	1.4
G511	Telephone management of palliative care at home	1017	4.0	2870	0.7
G512	Palliative care case management fee	10,609	41.7	132,590	34.6
K015	Counselling of relatives of a terminally ill patient	9339	36.7	14,585	3.8
K023	Palliative care support	18,961	74.5	125,213	32.7
K700	Palliative care out-patient case conference	281	1.1	610	0.2
W872	Palliative care subsequent visit in nursing home	141	0.6	690	0.2
W882	Palliative care subsequent visit in covalescent hospital	1174	4.6	9922	2.6
W982	Palliative care subsequent visit in covalescent hospital	169	0.7	5087	1.3

Frequency listing of palliative care OHIP billing codes considered but ultimately excluded due to lack of use

Fee code	Fee code description	No. of patients with code (*n*)	Percentage of patients with palliative care (%)[a]	No. of occurrences of code (*n*)	Percentage of all occurrences (%)
G063	Initiation of outpatient continuous nerve block infusion	< 6	0	< 6	0
G064	Management and supervision of outpatient continuous nerve block infusion	< 6	0	< 6	0
K001	Detention fee (for extra time)	72	0.1	75	0.1
W972	Palliative care subsequent visit in nursing home	< 6	0	< 6	0
Z361	Insertion of indwelling catheter	64	0.1	71	0.1
Z362	Removal of indwelling catheter	12	0	12	0

[a]Includes all patients who received palliative care, including those who received their first palliative care after the occurrence of aggressive end-of-life care

[b]B codes are modifier codes that indicate a palliative care service was provided when billed in conjunction with A901 and A902, as shown below:

B997	Palliative care home visit, nights
B998	Palliative care home visit, days, evenings and weekends

ICD-10 International Classification of Diseases, Tenth Revision, *OHIP* Ontario Health Insurance Plan Claims Database, *NACRS* National Ambulatory Care Reporting System, *DAD* discharge abstract database, *NA* not available

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