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Palliative care consultation and aggressive care at end of life in unresectable pancreatic cancer

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ABSTRACT

Background Palliative care (PC) consultation has been associated with less aggressive care at end of life in a number of malignancies, but the effect of the consultation timing has not yet been fully characterized. For patients with unresectable pancreatic cancer (UPCC), aggressive and resource-intensive treatment at the end of life can be costly, but not necessarily of better quality. In the present study, we investigated the association, if any, between the timing of specialist PC consultation and indicators of aggressive care at end of life in patients with UPCC.

Methods This retrospective cohort study examined the potential effect of the timing of specialist PC consultation on key indicators of aggressive care at end of life in all patients diagnosed with UPCC in Nova Scotia between 1 January 2010 and 31 December 2015. Statistical analysis included univariable and multivariable logistic regression.

Results In the 365 patients identified for inclusion in the study, specialist PC consultation was found to be associated with decreased odds of experiencing an indicator of aggressive care at end of life; however, the timing of the consultation was not significant. Residency in an urban area was associated with decreased odds of experiencing an indicator of aggressive care at end of life. We observed no association between experiencing an indicator of aggressive care at end of life and consultation with medical oncology or radiation oncology.

Conclusions Regardless of timing, specialist PC consultation was associated with decreased odds of experiencing an indicator of aggressive care at end of life. That finding provides further evidence to support the integral role of PC in managing patients with a life-limiting malignancy.

Key Words Pancreatic cancer, palliative care, aggressive care

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BACKGROUND

Of all cancers in Canada, pancreatic cancer is associated with the lowest overall 5-year survival rate, at just 8%[1]. That dismal survival rate explains pancreatic cancer's rank as the 4th most common cause of cancer death in Canada, despite the disease accounting for just slightly more 2% of all new cancer diagnoses[1]. The only potentially curative treatment for pancreatic cancer is surgical resection. However, because of advanced disease stage at presentation, 80%–85% of people diagnosed are not eligible for such potentially curative treatment[2].

In addition to its poor prognosis, pancreatic cancer is also associated with a significant symptom burden that can negatively affect quality of life and performance status for patients[3]. The role of palliative care (PC) in the management of those patients as they approach end of life is therefore critical. Palliative care is intended to "improve the quality of living and dying for those facing life-threatening illness" and "strives to minimize unnecessary suffering" through the management of pain and other symptoms[4]. In 2010, a study of patients with a similar life-limiting diagnosis of metastatic non-small-cell lung cancer compared survival rates and quality of life for patients who received oncologic care only and for patients who received early PC intervention together with standard oncologic care. Patients receiving a PC consultation shortly after diagnosis were observed to undergo less aggressive treatment at end of life,

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and yet to experience longer overall survival[5]. Aggressive care at end of life was defined as receipt of chemotherapy within 14 days of death, no hospice care, or admission to hospice within 3 days of death. The study authors found that a smaller proportion of patients receiving early PC intervention than of those receiving standard oncologic care received aggressive end-of-life care: 33% (16 of 49 patients) compared with 54% (30 of 56 patients)[5].

Other studies have used specific quality indicators to investigate the association between PC consultation and the aggressiveness of end-of-life care. Many of those studies have adapted the indicators developed by Earle *et al.*[6,7], which were identified using a literature review and patient and family member focus groups, and which were subsequently reviewed and ranked by an expert panel using a modified Delphi approach. Numerous subsequent studies have used those indicators as a metric for aggressive care at end of life, typically defining an "aggressive event" as being any of death in an acute-care setting, chemotherapy within 30 (or 14) days of death, admission to an intensive care unit within 30 days of death, more than 1 hospital admission within 30 days of death, more than 1 emergency room visit within 30 days of death, and more than 14 inpatient days within 30 days of death[8–17]. Those indicators are intended to identify potentially poor-quality care at end of life[6]. As the U.S. Institute of Medicine writes[18], high-quality health care must be effective, safe, equitable, efficient, timely, and patient-centred. Anticancer therapy given with palliative intent and within the final 30 days of life might represent overuse of that treatment modality at a time when a patient is unlikely to further benefit and is at risk of significant toxicity[7]. Similarly, high rates of emergency room use, hospitalization, intensive care unit admission, and death in an acute-care setting might reflect a focus on overly aggressive care that is incongruent with disease status or that reflects inadequate and untimely access to PC or hospice care services, when the use of those acute-care resources might be mitigated by ongoing preventive management or discussion of goals of care[7].

Previous studies have found relationships between health care expenditures, patient and family satisfaction, and the indicators of aggressive care at end of life. One previous study found that the mean per-patient cost in the last 30 days of life was higher for patients experiencing 1 or more indicators of aggressive care at end of life than for patients receiving nonaggressive care. Additionally, access to PC was predictive of lower costs[8]. Other studies have found an association between family-reported "excellent" end-of-life care and the absence of indicators of aggressive care at end of life[19,20].

Given the potential cost savings and improvements in patient care associated with less aggressive care at end of life, measuring aggressiveness of care at end of life represents an important metric of quality. Numerous studies have used the indicators developed by Earle *et al.*[6,7] to examine the relationship between PC intervention and aggressiveness of end-of-life care within the last 30 days of life in adults with advanced cancer; however, those studies differ greatly in their adaptation of the indicators, study design, definition of PC intervention, statistical analyses, and patient population[5,8–17]. Few have focussed specifically on how PC consultation early in the trajectory of disease might affect the aggressiveness of end-of-life care, and results of studies with that focus have been heterogeneous[5,12,15]. To date, a single randomized controlled trial[15] has examined the effect of early PC intervention on indicators of aggressive care at end of life in patients diagnosed with pancreatic cancer in Italy. The authors found that patients seen by the PC service within 10 weeks of diagnosis of metastatic or locally advanced pancreatic cancer were less likely to receive chemotherapy within 30 days of death (18.7% vs. 27.8%, $p = 0.036$), but found no significant differences in the incidence of emergency room visits, hospitalizations, or death in hospital.

In the present retrospective cohort study, we set out to further explore the potential effects of the timing of specialist PC consultation on aggressiveness of care at end of life in patients diagnosed with unresectable pancreatic cancer in Nova Scotia. Pancreatic cancer was chosen specifically for its high mortality rate and relatively short natural history, its high symptom burden, and the adverse effects commonly associated with its chemotherapeutic treatment.

METHODS

Study Cohort

All patients in Nova Scotia diagnosed with unresectable pancreatic adenocarcinoma between 1 January 2010 and 31 December 2015 were considered for the study. Those dates were chosen based on the availability of electronic charting and to allow adequate follow-up time for the survival analysis.

The study cohort was identified through the Nova Scotia Cancer Registry (a provincial dataset maintained by the Nova Scotia Cancer Care Program) and electronic medical records. All patients 19 years of age and older who were diagnosed with pancreatic adenocarcinoma, including those with metastatic or locally advanced disease not amenable to surgical resection, were included. Patients were excluded if they received treatment outside of Nova Scotia between the time of diagnosis and death (because data would be incomplete on account of an inability to access medical records outside of Nova Scotia); if they were still living at the time of data analysis (1 January 2018), because events in the last 30 days of life would not be able to be examined; if the pancreatic adenocarcinoma was initially thought to be surgically resectable, which could have resulted in delayed referral to PC; if documentation of the diagnosis of pancreatic adenocarcinoma either by imaging or pathology confirmation was absent; or if a concurrent active malignancy other than non-melanoma skin cancer or *in situ* cervical cancer was present. A pre-existing malignancy was considered "active" if the patient had received any medical treatment for that malignancy in the preceding year or if a pre-existing malignancy diagnosed in the preceding 5 years had been treated without curative intent and was expected to recur.

A PC consultation was defined as a consultation with a specialist PC physician in any setting (inpatient or outpatient). Such a consultation is clearly defined in the patient's medical record, where dictated consultation letters identify the providing service. Patients were classified into three

subgroups defined by PC consultation. For the study, we defined "early" PC (EPC) consultation as occurring within 8 weeks of diagnosis (the median duration of time defined as "early" in the existing literature). Early intervention has been defined in other studies as occurring from the time of diagnosis[21], within 3 weeks of diagnosis[5,22], and within 4–8 weeks[23], 8–11 weeks[5], or 8–12 weeks[24] of diagnosis. The EPC group consisted of patients seen by the PC service within 8 weeks of diagnosis. The "late PC" (LPC) group consisted of patients referred to PC more than 8 weeks after diagnosis, and the "no PC" (NPC) group consisted of those patients never seen by PC.

Data Analysis

Independent variables for the statistical analysis included age, sex, residency in an urban or rural area (defined by the forward sortation area of the postal code)[25], health authority (defined by the postal code), score on the Charlson comorbidity index (CCI)[26], Eastern Cooperative Oncology Group (ECOG) performance status[27], date of diagnosis (as determined by the Facility Oncology Registry Data Standards criteria)[28], method of diagnosis, stage[29], date and type of attempted pathology confirmation of diagnosis, date of consultation with radiation oncology, treatment with radiotherapy, date of consultation with surgery, date of consultation with medical oncology, and chemotherapeutic treatment (including type and dates of administration and any grade 3 or 4 toxicities).

The outcome variables for the analysis were the indicators of aggressive care at end of life (scored as 1 if experienced, and 0 otherwise) previously developed by Earle *et al.*[6,7], which included these events occurring in the last 30 days of life:

- More than 14 inpatient days (excluding those in the PC inpatient unit)
- 2 or more hospitalizations (excluding those in the PC inpatient unit)
- 2 or more emergency room visits
- Receipt of chemotherapy
- Intensive care unit admission
- Death in hospital (excluding that in the PC inpatient unit)

Given the lack of inpatient hospice care available in Nova Scotia, hospital admissions and inpatient days on specifically designated PC inpatient units were excluded. Admissions and inpatient days on PC units were identifiable using admission and transfer orders and discharge summaries, all of which designate the location, type of unit, and most responsible physician.

Statistical Analysis

Descriptive statistics are reported using means with standard deviation for continuous variables, and frequencies and percentages for categorical variables. Differences in population characteristics were determined using analysis of variance for continuous variables and chi-square tests for categorical variables. In the case of descriptive statistics for very small subgroups (values < 5), the Fisher exact test was used. Statistical significance was determined at an alpha of 0.05 or less.

Simple logistic regression was then used to identify the odds of experiencing 1 or more indicators of aggressive care at end of life, with the timing of a PC consultation as the main exposure of interest. Multivariable logistic regression used the timing of a PC consultation as the main exposure and adjusted for other potentially significant variables (as defined by a p value of 0.15 or less on single-variable logistic regression) used as covariates in the model.

All statistical analyses were performed using the R (version 3.3.2: The R Foundation, Vienna, Austria) and R Studio (version 1.0.136: RStudio, Boston, MA, U.S.A.) statistical software packages.

RESULTS

Once the inclusion and exclusion criteria had been applied to the initial cohort of 487 patients identified by Nova Scotia Cancer Care Program, a study population of 365 patients for analysis was identified (Figure 1). The three subgroups differed significantly in terms of group size, demographics, clinical characteristics, method of diagnosis, and treatment received (Table I).

Patient Characteristics: Demographics

The EPC group was the largest (58.9%, n = 215); the LPC (25.2%, n = 92) and NPC groups (15.9%, n = 58) included fewer patients. Compared with patients in the EPC (mean age: 68.7 ± 12.0 years) and LPC groups (mean age: 68.2 ± 9.8 years), patients in the NPC group were significantly older (mean age: 74.9 ± 10.8 years; p = 0.002). Compared with patients in the NPC (22.4%, n = 13) and LPC groups (39.1%, n = 36), more patients in the EPC group resided in an area served by a tertiary care centre (48.4%, n = 104, p = 0.001). More patients in the EPC group also resided in an urban area (EPC: 69.8%, n = 150; NPC: 46.6%, n = 27; LPC: 59.8%, n = 55; p = 0.003).

At the time of diagnosis, score on the CCI differed significantly between the exposure subgroups. Patients in the NPC group had the highest score (mean: 7.05 vs. 6.41 for the EPC group vs. 6.15 for the LPC group; p = 0.001). The proportion of patients with an ECOG performance status of 0 or 1 (low) compared with 2 or better also differed significantly (ECOG 0–1: 27.2% LPC vs. 10.7% EPC vs. 6.9% NPC; p = 0.022). However, ECOG was not documented for most patients, and the proportion of missing ECOG values varied significantly between the subcohorts (NPC group: 84.5%, n = 49; EPC group: 67.9%, n = 146; LPC group: 55.4%, n = 51; p = 0.001).

Patient Characteristics: Cancer Care

Metastatic disease at diagnosis was present in more patients in the NPC group (98.3%, n = 57) than in those in the EPC group (86.5%, n = 186) or in the LPC group (82.6%, n = 76, p = 0.017). More patients in the LPC group (13.0%, n = 12) than in the NPC group (1.7%, n = 1) or the EPC group (5.1%, n = 11, p = 0.011) received radiotherapy. Similarly, more patients in the LPC group (44.6%, n = 41) than in the NPC group (8.6%, n = 5) or the EPC group (18.1%, n = 39, p < 0.001) received chemotherapy. Of the 85 patients who received chemotherapy, relatively few patients (n = 15, 17.6%) received either FOLFIRINOX (5-fluorouracil, leucovorin, irinotecan, oxaliplatin) or gemcitabine–nab-paclitaxel, the regimens shown to most significantly improve survival in patients

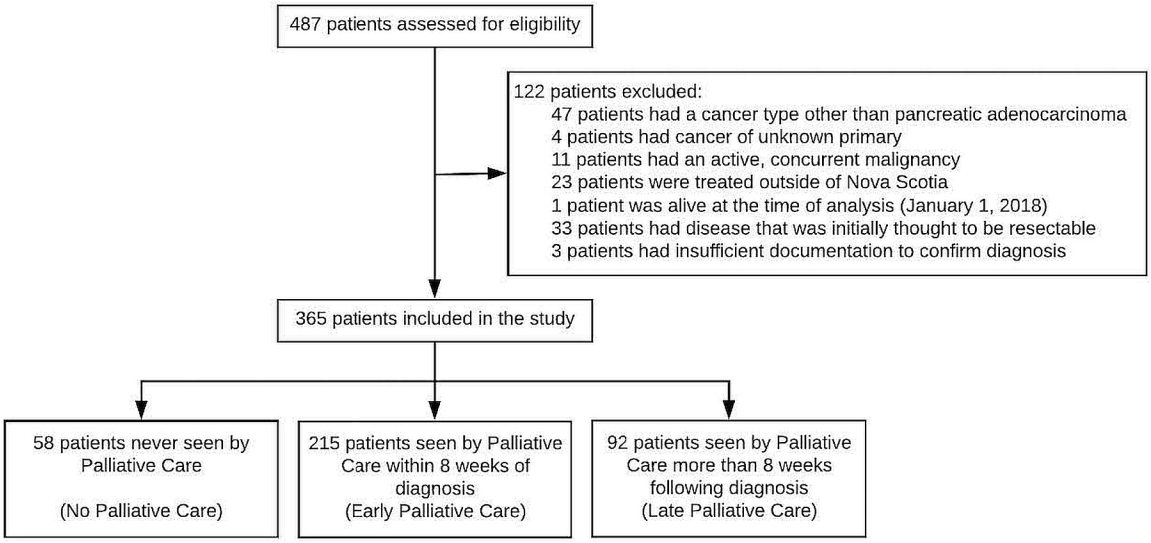

FIGURE 1 Cohort selection.

with unresectable pancreatic cancer[30,31]. Significantly fewer patients in the NPC group (8.6%, $n = 5$) than in the EPC group (18.1%, $n = 39$) or the LPC group (44.6%, $n = 41$, $p < 0.001$) received chemotherapy of any kind.

Indicators of Aggressive Care at End of Life

Table II presents the frequency of indicators of aggressive care at end of life for each study subgroup. Death in hospital (excluding in an inpatient PC unit) was recorded for 172 patients, making that indicator of aggressive care at end of life the one most commonly found in our study population. Admission to an intensive care unit in the last 30 days of life was the least common indicator, being recorded for just 1 patient from each subgroup. With the exception of death in hospital (79.3%, $n = 46$ in the NPC group; 41.9%, $n = 90$ in the EPC group; 39.1%, $n = 36$ in the LPC group; $p < 0.001$), the subgroups showed no statistically significant difference in the frequency of indicators of aggressive care at end of life.

Table III compares descriptive statistics for patients having 1 or more indicators of aggressive care at end of life ($n = 204$) and for those having no such indicators ($n = 161$). Patients who did and did not receive aggressive care at end of life were comparable in terms of age ($p = 0.672$), sex ($p = 1.000$), residency in an area served by a community centre compared with a tertiary care centre ($p = 0.199$), year of diagnosis ($p = 0.166$), presence of metastatic disease at diagnosis ($p = 0.483$), score on the CCI ($p = 0.539$), and ECOG performance status ($p = 0.917$). However, a greater proportion of patients without any indicators of aggressive care received radiotherapy (9.9%, $n = 16$, vs. 3.9%, $n = 8$; $p = 0.037$) and resided in an urban centre (71.4%, $n = 115$, vs. 57.4%, $n = 117$; $p = 0.007$).

The univariable analysis (Table IV) found that early [odds ratio (OR): 0.13; 95% confidence interval (CI): 0.07 to 0.33; $p < 0.001$] and late PC consultation (OR: 0.17; 95% CI: 0.07 to 0.37; $p < 0.001$) were both associated with decreased odds of 1 or more indicators of aggressive care at end of life. Residency in an urban area (OR: 0.54; 95% CI: 0.34 to 0.83; $p = 0.005$), consultation with radiation oncology (OR: 0.53; 95% CI: 0.27 to 1.00; $p = 0.051$), receipt of radiotherapy (OR: 0.37; 95% CI: 0.15 to 0.86; $p = 0.026$), and consultation with medical oncology (OR: 0.66; 95% CI: 0.43 to 0.99; $p = 0.047$) were also associated with decreased odds of 1 or more indicators of aggressive care at end of life. The multivariable logistic regression model therefore adjusted for those variables.

The multivariable analysis (Table IV) identified that early (OR: 0.18; 95% CI: 0.08 to 0.39; $p < 0.001$) and late PC consultation (OR: 0.20; 95% CI: 0.08 to 0.47; $p < 0.001$) were both associated with decreased odds of a patient having 1 or more indicators of aggressive care within the last 30 days of life. Residency in an urban area was also found to be associated with decreased odds of having 1 or more indicators of aggressive care at end of life (OR: 0.61; 95% CI: 0.38 to 0.97; $p = 0.038$). Consultation with radiation oncology, receipt of radiotherapy, and consultation with medical oncology were all found to be insignificant in the multivariable model.

DISCUSSION

In multivariable logistic regression analysis, PC consultation, regardless of timing, was associated with decreased odds of experiencing 1 or more indicators of aggressive care at end of life (Table IV). Our findings are consistent with other studies that have found PC consultation to be associated with decreased odds of experiencing indicators of aggressive care at end of life[5,8,9,13,15,17]. Given significant differences in statistical analyses and methods, our study results are difficult to compare with those of Maltoni *et al.*[15], who also conducted a study examining the effect of early PC consultation for patients with pancreatic cancer. However, it is worth noting that our results differ significantly. Although we found an association between early PC consultation and decreased incidence of any indicator of aggressive care at end of life, Maltoni *et al.* found that patients receiving early PC were less likely to receive chemotherapy within the last

TABLE I Characteristics of the study population

Characteristic	Palliative care group			*p* Value
	None	Early	Late	
Patients *(n)*	58	215	92	
Mean age (years)	74.9±10.8	68.7±12.0	68.2±9.8	0.001
Age >65 years [*n* (%)]	48 (82.8)	134 (62.3)	50 (54.3)	0.002
Sex [*n* (%) women]	36 (62.1)	103 (47.9)	49 (53.3)	0.153
Residency [*n* (%)]				
In tertiary care centre area	13 (22.4)	104 (48.4)	36 (39.1)	0.001
In urban centre	27 (46.6)	150 (69.8)	55 (59.8)	0.003
Score on the CCI				
Mean	7.05±1.00	6.41±1.64	6.15±1.68	0.001
≤6 [*n* (%)]	21 (36.2)	109 (50.7)	55 (59.8)	0.016
>6 [*n* (%)]	37 (63.8)	106 (49.3)	37 (39.8)	0.016
ECOG PS [*n* (%)]				
Not documented	49 (84.5)	146 (67.9)	51 (55.4)	0.001
0 or 1	4 (6.9)	23 (10.7)	25 (27.2)	0.022[a]
≥2	5 (8.6)	46 (21.4)	16 (17.4)	0.022[a]
Year of Dx [*n* (%)]				0.495
2010	6 (10.3)	26 (12.1)	13 (14.1)	
2011	12 (20.7)	35 (16.3)	16 (17.4)	
2012	10 (17.2)	49 (22.8)	13 (14.1)	
2013	8 (13.8)	34 (15.8)	23 (25.0)	
2014	12 (20.7)	34 (15.8)	18 (19.6)	
2015	10 (17.2)	37 (17.2)	9 (9.8)	
2014 or after	22 (37.9)	71 (33.0)	27 (29.3)	0.523
Metastatic disease at Dx[b] [*n* (%)]	57 (98.3)	186 (86.5)	76 (82.6)	0.017
Attempted pathology confirmation of Dx [*n* (%)]	20 (34.5)	88 (40.9)	51 (55.4)	0.020
Anticancer therapy [*n* (%)]				
Any chemotherapy	5 (8.6)	39 (18.1)	41 (44.6)	0.001
Gemcitabine–nab-paclitaxel or FOLFIRINOX	3 (5.2)	7 (3.3)	5 (5.4)	0.048[a]
Grade 3 or 4 toxicity event	2 (3.4)	17 (7.9)	22 (23.9)	0.732[a]
Radiotherapy	1 (1.7)	11 (5.1)	12 (13.0)	0.011
Mean survival (days)	75.6±164.1	97.0±125.1	238.3±178.9	<0.001
Mean aggressiveness of care score	1.33±0.78	0.80±0.93	0.88±1.04	<0.001

[a] By Fisher exact test.
[b] Compared with locally advanced.
CCI = Charlson comorbidity index; ECOG PS = Eastern Cooperative Oncology Group performance status; Dx = diagnosis; FOLFIRINOX = fluorouracil–irinotecan–leucovorin–oxaliplatin.

30 days of life (27.8% vs. 18.7%, $p = 0.036$), but found no significant difference between their cohorts for death in hospital, hospital admissions, or emergency room visits in the last 30 days of life.

In contrast to other studies finding that early PC consultation was associated with a decreased incidence of aggressive care at end of life, we found that both early and late PC consultation had comparable effects on the odds of experiencing an indicator of aggressive care at end of life[12,15]. Given that the outcomes considered were measured only within the last 30 days of life, it is possible that the timing of a PC intervention is less important than whether it takes place at all, such that advance care planning can take place. Along those lines, Nevadunsky *et al.*[16] defined "timely palliative care consultation" as a PC consultation occurring more than 30 days before death, and compared it with no PC consultation or with a PC consultation occurring within 30 days of death. Those authors found a lower incidence of all measured indicators of aggressive care at end of life, although statistical significance was not calculated.

Residency in an urban area—as opposed to a rural area—was the only other factor found to be significant in

TABLE II Frequency of indicators[a] of aggressive care at end-of-life

Indicator	Palliative care group [*n* (%)]			*p* Value
	None (*n*=58)	Early (*n*=215)	Late (*n*=92)	
ICU admission	1 (1.7)	1 (0.5)	1 (1.1)	0.368[b]
≥2 ER visits	7 (12.1)	23 (10.7)	13 (14.1)	0.692
Inpatient stay of ≥14 days	17 (29.3)	38 (17.7)	17 (18.5)	0.134
≥2 Hospitalizations	4 (6.9)	15 (7.0)	8 (8.7)	0.818[b]
Death in hospital	46 (79.3)	90 (41.9)	36 (39.1)	<0.001
Chemotherapy	2 (3.4)	4 (1.9)	6 (6.5)	0.104[b]

[a] Event occurring in the last 30 days of life.
[b] By Fisher exact test.
ICU = intensive care unit; ER = emergency room.

multivariable analysis. Residency in an urban area was associated with decreased odds of experiencing 1 or more indicators of aggressive care at end of life. Previous research has shown that, in comparison with Nova Scotians residing in urban areas, Nova Scotians residing in rural areas are less likely to die at home[32]. Death in hospital constituted more than half of the 329 indicators of aggressive care at end of life that occurred in our study population (52.3%, *n* = 172). It is plausible that the association between residency in an urban area and decreased odds of experiencing 1 or more indicators of aggressive care at end of life is at least in part a result of that relationship. Notably, many specialist services from which patients with pancreatic adenocarcinoma would benefit—such as hepatobiliary surgery, medical oncology, and radiation oncology—are located in urban areas only. In comparison with their rural counterparts, Nova Scotians residing in urban areas or in areas closer to PC program sites have increased access to comprehensive PC programs and home care supports, which might increase the likelihood of dying outside an acute care setting and decrease the likelihood of experiencing an indicator of aggressive care at end of life[32–34].

It is also worthwhile noting that several factors—notably, consultation with radiation oncology or medical oncology—had no association with the odds of experiencing indicators of aggressive care at end of life. Our findings suggest that consultation with an oncologist does not lead to needlessly intensive treatment; however, further investigation in this area is necessary.

Our study has a number of limitations. As with any observational study, it has the inherent limitation of being able to assess only association and not causality. Because patients were not randomized at diagnosis, it is likely that the timing of PC consultation (or lack of PC consultation) was directly related to each individual patient's prognosis and treatment preferences. Patients with the poorest prognosis might have died before a PC consultation and appropriate supports (such as home care or elective admission to a PC unit) could be arranged to avoid several indicators of aggressive care at end of life, including 2 or more emergency room visits, 2 or more hospitalizations, more than 14 inpatient days, and death in hospital. Given that limitation, the benefit of specialist PC consultation could be overestimated. Conversely, some patients might have received appropriate PC from either a family physician or an oncologist, and patients referred to a specialist PC team might have had more-difficult-to-manage symptoms, which, by nature, resulted in more presentations to acute-care settings. In that case, the benefit of specialist

TABLE III Characteristics of patients with and without indicators of aggressive care at end of life

Characteristic	Aggressiveness of care score		*p* Value
	0 (*n*=161)	≥1 (*n*=204)	
Palliative care [*n* (%)]			<0.001
None	8 (5.0)	50 (24.5)	
Early	108 (67.1)	107 (52.5)	
Late	45 (28.0)	47 (23.0)	
Mean age (years)	69.3±12.2	69.8±10.9	0.672
Age >65 years [*n* (%)]	98 (60.9)	134 (65.7)	0.401
Sex [*n* (%) women]	83 (51.6)	105 (51.5)	1.000
Residency [*n* (%)]			
In a tertiary care centre service area	74 (46.0)	79 (38.7)	0.199
In an urban centre	115 (71.4)	117 (57.4)	0.008
Score on the CCI			
Mean	6.39±1.66	6.50±1.53	0.539
≤6 [*n* (%)]	82 (50.9)	103 (50.5)	1.000
>6 [*n* (%)]	79 (49.1)	101 (49.5)	1.000
ECOG PS [*n* (%)]			
0 or 1	27 (16.8)	25 (12.3)	0.917
≥2	33 (20.5)	34 (16.7)	0.917
Not documented	101 (62.7)	145 (71.1)	0.115
Year of Dx [*n* (%)]			0.166
2010	18 (11.2)	27 (13.2)	
2011	25 (15.5)	38 (18.6)	
2012	30 (18.6)	42 (20.6)	
2013	31 (19.3)	34 (16.7)	
2014	28 (17.4)	36 (17.6)	
2015	29 (18.0)	27 (13.2)	
2014 or after	57 (35.4)	63 (30.9)	0.423
Metastatic disease at Dx[a]	138 (85.7)	181 (88.7)	0.483
Attempted pathology confirmation of Dx [*n* (%)]	67 (41.6)	92 (45.1)	0.575
Anticancer therapy [*n* (%)]			
Any chemotherapy	44 (27.3)	41 (20.1)	0.126
Gemcitabine–nab-paclitaxel or FOLFIRINOX	8 (5.0)	7 (3.4)	1.000
Grade 3 or 4 toxicity event	23 (14.3)	17 (8.3)	0.497
Radiotherapy	16 (9.9)	8 (3.9)	0.037

[a] Compared with locally advanced disease.
CCI = Charlson comorbidity index; ECOG PS = Eastern Cooperative Oncology Group performance status; Dx = diagnosis; FOLFIRINOX = fluorouracil–irinotecan–leucovorin–oxaliplatin.

TABLE IV Predictors of 1 or more indicators of aggressiveness of end-of-life care

Predictor	Logistic regression analysis					
	Unadjusted		*p* Value[a]	Adjusted		*p* Value[a]
	OR	95% CI		OR[b]	95% CI	
Palliative care						
None	Reference			Reference		
Early	0.16	0.07 to 0.33	**<0.001**	0.18	0.08 to 0.39	**<0.001**
Late	0.17	0.07 to 0.37	**<0.001**	0.20	0.08 to 0.47	**<0.001**
Age						
≤65 Years	Reference					
>65 Years	1.23	0.80 to 1.89	0.343			
Sex						
Men	Reference					
Women	1.00	0.66 to 1.51	0.988			
Residency						
In tertiary care centre service area	Reference					
In community hospital service area	1.35	0.89 to 2.05	0.165			
Rural	Reference			Reference		
Urban	0.54	0.34 to 0.83	**0.005**	0.61	0.38 to 0.97	**0.038**
Score on the CCI						
≤6	Reference					
>6	1.02	0.67 to 1.54	0.933			
ECOG PS						
0 or 1	Reference					
≥2	1.11	0.54 to 2.30	0.773			
Year of Dx						
Before 2014	Reference					
In 2014 or after	0.82	0.53 to 1.27	0.362			
Stage at Dx						
Nonmetastatic disease	Reference					
Metastatic disease	1.31	0.70 to 2.44	0.390			
Attempted pathology confirmation of Dx	1.15	0.76 to 1.75	0.505			
Treatment						
Consultation with radiation oncology	0.53	0.27 to 1.00	0.051	1.00	0.38 to 2.64	0.996
Radiotherapy	0.37	0.15 to 0.86	**0.026**	0.42	0.12 to 1.50	0.186
Consultation with medical oncology	0.66	0.43 to 0.99	0.047	0.92	0.58 to 1.47	0.723

[a] Significant values shown in boldface type.
[b] Adjusted for consultation with palliative care, residency in an urban area, consultation with radiation oncology, radiotherapy, and consultation with medical oncology.
OR = odds ratio; CI = confidence interval; CCI = Charlson comorbidity index; ECOG PS = Eastern Cooperative Oncology Group performance status; Dx = diagnosis.

PC consultation could have been underestimated. However, to our knowledge, the present study is the first of its kind to examine survival and aggressiveness of care in pancreatic adenocarcinoma patients in Nova Scotia. The inclusion of all patients, regardless of treatment centre, allows for the findings to be generalized and applied to patients across the province and in a variety of settings. Further, although many family physicians within the province might provide PC as part of their practice, and medical oncologists might also provide treatment within the context of a PC approach, our study defined PC consultation with the aim of evaluating the effects of specialist consultation on patient care. That focus has important implications for physician resource planning, and it outlines the benefit of specialist teams in providing care for these patients. Our dataset was comprehensive, with a number of covariates included in the analysis, including important potential confounders such as score on the CCI, the presence of metastatic disease at the time of diagnosis, and age. It is, however, worth noting that, despite the comprehensiveness of the dataset, many patients lacked a documented ECOG performance status, limiting our ability to use that variable as a covariate.

CONCLUSIONS

A PC consultation at any time was found to be associated with decreased odds of experiencing an indicator of aggressive care at end of life, but the timing of the consultation was nonsignificant. That finding has important clinical implications and provides insight into the merits of a multidisciplinary specialist PC consultation team in a provincial context. Research shows that overly aggressive care at end of life can be incongruent with family or patient preferences and might be more costly and resource-intensive[8,19,20]. In the context of a publicly funded health care system, a cost-saving intervention that is associated with improved patient and family satisfaction is of clear benefit. Physicians should strive to ensure that all patients with a diagnosis of life-limiting cancer are referred to specialist PC services.

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CONFLICT OF INTEREST DISCLOSURES

We have read and understood *Current Oncology*'s policy on disclosing conflicts of interest, and we declare that we have none.

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