



Research article

Predictive factors of basic palliative and hospice care among patients with cancer visiting the emergency department in a Hungarian tertiary care center

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ABSTRACT

Introduction: Patients with advanced cancer tend to utilize the services of the health care system, particularly emergency departments (EDs), more often, however EDs aren't necessarily the most ideal environments for providing care to these patients. The objective of our study was to analyze the clinical and demographic characteristics of advanced patients with cancer receiving basic palliative care (BPC) or hospice care (HC), and to identify predictive factors of BPC and HC prior to their visit to the ED, in a large tertiary care center in Hungary.

Methods: A retrospective, detailed analysis of patients receiving only BPC or HC, out of 1512 patients with cancer visiting the ED in 2018, was carried out. Sociodemographic and clinical data were collected via automated and manual chart review. Patients were followed up to determine length of survival. Descriptive and exploratory statistical analyses were performed.

Results: Hospital admission, multiple ($\geq 4x$) ED visits, and respiratory cancer were independent risk factors for receiving only BPC (OR: 3.10, CI: 1.90–5.04; OR: 2.97, CI: 1.50–5.84; OR: 1.82, CI: 1.03–3.22, respectively), or HC (OR: 2.15, CI: 1.26–3.67; OR: 4.94, CI: 2.51–9.71; OR: 2.07, CI: 1.10–3.91). Visiting the ED only once was found to be a negative predictive factor for BPC (OR: 0.28, CI: 0.18–0.45) and HC (OR: 0.18, 0.10–0.31) among patients with cancer visiting the ED.

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Conclusions: Our study is the first from this European region to provide information regarding the characteristics of patients with cancer receiving BPC and HC who visited the ED, as well as to identify possible predictive factors of receiving BPC and HC. Our study may have relevant implications for health care planning strategies in practice.

List of Abbreviations

ED	Emergency Department
EoL	End of Life
BSC	Best Supportive Care
BPC	Basic palliative care
HC	Hospice care
CTAS	Canadian Triage and Acuity Scale
MSTR	Magyar Sürgősségi Triage Rendszer = Hungarian Emergency Triage System
NHIF	Hungarian National Health Insurance Fund
ICD-10	International Classification of Diseases, 10th Revision
OR	Odds Ratio

1. Introduction

Cancer diseases present a significant burden on health care systems worldwide, which – with the ageing of the population – is expected to increase further. Patients with advanced cancer tend to utilize the services of the health care system, particularly emergency departments (ED), more often due to the progression or complication of their cancer [1]. Yet, patients with cancer visiting the ED with urgent symptoms have been found to have worse outcomes [2] and to have significantly higher hospital admission rates, compared to other patients without cancer [1,3–5]. According to previous studies, up to 83 % of patients with cancer nearing the end of life (EoL) visited the ED at least once within the final 6 months of their lives [6,7].

EDs are designed to provide around the clock acute care to patients with any medical condition across a large variety of diseases. These institutions are fast-paced environments with large patient turnover, therefore, the special multidisciplinary care necessary for patients with advanced cancer is generally not available [8]. Furthermore, healthcare professionals at EDs, burdened by their immense workload are often not properly trained to provide optimal care for these patients with cancer [5,9].

In order to provide patients with cancer with the best type of care, palliative care should be introduced as early as possible, preferably when the patient is still undergoing curative treatment, but latest, when curative treatment of the disease is no longer possible [10]. The primary goals of palliative care are to prevent and relieve patients' suffering with a holistic attitude (considering the physical, psychological, social and spiritual aspects of suffering), to support the patient's family, thus ultimately to provide the best quality of life possible [11]. As part of palliative care, the aims of hospice care are similar, but directed at patients with an expected life expectancy of 6 months or less [12].

According to the development levels of palliative care services available in a region, countries can be assigned into one of six categories [13,14]. Countries in category 1 do not have any form of palliative care, those in category 2 have capacity-building palliative care activity and categories 3a and 3b mean that the country has isolated (3a) or generalized (3b) palliative care provision. Category 4b indicates the availability of the highest, most advanced level of palliative care services in the given country, meaning that a significant provision of palliative care service development had been achieved in multiple places and by several providers within the country, that guidelines for palliative care exist and have a significant impact on health policy [13,14].

Hungary has been assigned to the slightly lower '4a' category, meaning the palliative care services are at a preliminary stage of integration [13–15]. While basic palliative care (BPC), provided by primary care physicians and oncologists, and hospice care (HC) is available throughout the country, other forms of specialist palliative care (SPC), integrated and implemented into oncological care early on in the disease progression is only available in less than a handful of cancer centers [15]. As a result, when further oncological curative treatment is not recommended for patients with cancer, and "best supportive care" (BSC) is assigned by the decision-making Oncology Multidisciplinary Team (the interdisciplinary team, which decides on the oncological treatment of the patient) only BPC or ultimately hospice care are the forms of supportive care available for patients with cancer [16].

Receiving only BPC or HC indicates a state where the patient's disease is incurable, similarly to having advanced cancer, which also implies that the disease is no longer curable. Repeated ED visits made by patients with advanced cancer imply a deficiency in their supportive care, however EDs aren't necessarily the most ideal environments for providing care to patients with advanced cancer. Aggressive medical interventions and hospital admissions are increasingly considered as poor-quality cancer care [17], since the focus should be placed on patient preferences, symptom prevention and maximizing the quality of life. Furthermore, hospital admissions at this stage of the disease also add to the financial burden of cancer care [17]. Therefore, to prevent ED visits by offering optimal supportive care to patients with advanced cancer, as well as to decrease the patient burden of the EDs it would be of the utmost

importance to identify possible predictive factors of their visits.

To our knowledge no study has investigated the characteristics of patients receiving only basic palliative care and hospice care presenting to the ED from this European region, since most studies have been reported from Western countries.

As part of a larger research project investigating the characteristics of patients with cancer visiting the ED described in previous papers [18,19], the aims of the present study were to (1) analyze the clinical and demographic characteristics of patients receiving basic palliative care or hospice care prior to their visit to the ED, and to (2) identify predictive factors of BPC and HC, in a large tertiary care cancer center in Hungary.

2. Materials and methods

2.1. Setting and study Context

Before carrying out the research project, ethical approval was obtained from the Regional Ethical Committee (Reference number: 8280-PTE2020).

The study was conducted in a large, public tertiary care institution, the Somogy County Kaposi Mór Teaching Hospital in Kaposvár, Hungary. This facility includes a Level 3 Emergency and Trauma Center (ED) and a specialized cancer center. The hospital's cancer center, tasked with serving patients with cancer in Somogy county and accepting referrals from adjacent counties, encompasses an inpatient unit, a day oncology unit, and a radiotherapy unit. The hospital operates a single-gate system, wherein all patients, including those with cancer, initially present to the ED for assessment. No outpatient phone triage system is available in Hungary, therefore all (including cancer) patients presenting to the ED are admitted and examined, however patients with minor health issues may also present at the 24-h GP on-call system if they choose to do so. Following assessment by an emergency physician, patients are either discharged home, admitted to an inpatient ward of the hospital or admitted to the short-term ward of the emergency department (for up to 1 day) after which -based on their medical status-they are either admitted to the hospital or discharged. The Hungarian Emergency Triage System (MSTR) [20], adapted from the Canadian Triage and Acuity Scale (CTAS) [21], is used for patient triage upon arrival at the ED. The ED in the study annually handles approximately 35 000 patients, with adults constituting 80 % of this population.

In Hungary, the decision to provide oncological treatment for patients with cancer is determined by an inter-disciplinary team, called a Oncology Multidisciplinary Team (Oncology MDT), made up of oncologists, surgeons and other specialists involved in the treatment of patients with a certain type of cancer. Once the Oncology Multidisciplinary Team decides that the patient's cancer disease is in its final stage and/or if the patient's medical status would make the patient incapable of tolerating further oncological therapy, the decision to stop all active oncological treatment with a curative intent is made and "best supportive care" (BSC) is recommended from then on. Since the Oncology MDT takes into account the patients' tumor type, stage, general health and ECOG status [22] the Oncology MDT's decision provides a complex assessment of the individual's medical status. "BSC" indicates that only supportive care: meaning basic palliative care (BPC) or hospice care (HC) [23] can be provided from then on, but no further active oncological treatment with a curative intent will be carried out. Both forms of supportive care includes symptom management (including for eg. pain management), which may in some cases also include for e.g. also palliative radiation therapy. BPC is routinely provided at the primary care level by family physicians, however less frequently -as in the example of palliative radiation therapy-can also be provided by oncologists. The other form of supportive care, hospice care is provided once a cancer patient's life expectancy is considered less than six month, and is provided by a hospice team. Hospice care can be provided at home (home hospice care) or in insitutions, as inpatient hospice care. (The Hungarian National Health Insurance Fund (NHIF) reimburses both forms of hospice services: home hospice care and inpatient hospice care.)

Besides the provision of basic palliative care and hospice care, other specialist palliative care -excepting three centers in Hungary-is unavailable, since specialist palliative care services, like palliative outpatient clinics and consult services (hospital mobile teams) are not reimbursed by the NHIF [15]. Furthermore, there is a lack of specialized palliative physicians and other resources, therefore even home hospice care predominantly involves specialized nursing care (65 %), with less than 10 % involvement of specialized palliative physicians [24]. The number of hospice beds in the country is only 63.8 % as that recommended by the World Health Organization recommendations for a country with a population of almost 10 million like Hungary [24]. Thus, although technically considered specialized palliative care, the available hospice care in Hungary, particularly in home hospice care, is limited and requires further resources and development.

In the region of the study, basic palliative care and hospice care were available for patients with cancer but no other forms of specialized palliative care were available. Thus, all patients with cancer who had been assigned only BSC by the Oncology Multidisciplinary Team, received basic palliative care, and all those, whom the oncologists or primary physicians considered to have a life expectancy of probably less than 6 months were offered hospice care. Inpatient hospice care was accessible in three locations, while a single healthcare provider facilitated home hospice care [24]. When these patients experienced acute symptoms, they could call or visit the 24-h GP on-call system or could visit the ED, based on their own decision.

2.2. Participants

Inclusion criteria included all patients aged 18 and above, who visited the ED between January 1st and December 31st, 2018, and received their cancer diagnosis within five years prior to their first ED visit in 2018 or within the study year itself. The International Classification of Diseases, 10th Revision (ICD-10) which is the official system for assigning codes to diagnoses and procedures in

Hungarian hospitals was utilized, with codes ranging from C0000 to C9670 to screen for cancer patients in our study, as described previously [18,19].

2.3. Study design

As part of a larger research study, we initially undertook a retrospective analysis of patients having an International Classification of Diseases, 10th Revision (ICD-10) code of cancer, who presented to the ED in 2018 (18, 19). The inclusion criteria encompassed patients who had visited the ED from January 1 to December 31, 2018, and had been diagnosed with cancer (C0000–C9670) within the preceding 5 years or during the study year.

The project began by the screening of the hospital's electronic database for all patients who met the inclusion criteria. Altogether 27 010 visits were made by patients 18 years and older at the ED in 2018, from which 2383 cases were made by 1512 patients with cancer, thus constituting 8.8 % of all adult ED visits [18,19].

Then, via detailed automated and manual chart review (see description of process below), demographic and clinical data of patients who had received either basic palliative care or hospice care (following the recommendation of only “BSC” by the Oncology Multidisciplinary Team) were screened.

An exhaustive chart review of all patients with cancer [18,19] - including patients who had received BPC and hospice care - was executed through automated data extraction, followed by manual review by the research team. Demographic data (patient's, age at first ED visit, place of residence), number of ED visits per patient, type of cancer, type and number of comorbidities, time and type of prior oncological care – including best supportive and hospice care-, disposition (admitted to inpatient care or discharged), place of inpatient care following ED presentation and -where applicable-time of death of the patient. Place of residence included the following options: county seat, city, village and nursing home, with ‘county seat’ indicating the administrative center or the governmental headquarters of Somogy county in Hungary, with ‘city’ indicating any other city (having a population of more than 5000 inhabitants) within the studied county, with ‘village’ meaning a place of residence as having a population of fewer than 5000 inhabitants and the ‘nursing home’ meaning any nursing home within the county. Cancer types and comorbidities were documented according to the ICD-10. The comorbidities that were documented were those listed in the Charlson comorbidity index [25], including the following diseases: myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, rheumatologic disease, peptic ulcer disease, liver disease, diabetes mellitus, hemiplegia or paraplegia, renal disease, malignancy leukemia, lymphoma, AIDS.

Patients were considered to have advanced cancer in our study, if the cancer patient (1) had been recommended BSC by the Oncology Multidisciplinary Team, and so was only provided basic palliative care and (2) those who had been offered (inpatient or home) hospice care, prior to the ED visit.

Given the limitations of automated data collection, a manual chart review was conducted post-automation, as also described

Table 1
The terminology and principles of categorization of patient data [18,19].

Demographic and Clinical Data	Definition/Categorization
Oncology Multidisciplinary Team	An interdisciplinary team, made up of oncologists, surgeons and other specialists involved in the treatment of patients with a certain type of cancer. The Oncology Multidisciplinary Team makes the decisions regarding the type and length of oncological treatment that the patient should receive and also if the treatment should be stopped. In the course of decision-making the Oncology Multidisciplinary Team takes into account the patients' tumor type, stage, general health and ECOG status, thus providing a complex assessment of the individual's medical status.
Best supportive care (BSC)	This is the decision of the Oncology Multidisciplinary Team, that active oncological treatment (with a curative intent) is stopped, and only supportive care will be provided to the patient from then on. BSC indicates that the patient can (and should) receive symptom-management (eg. pain management) but no further oncological treatment. BSC in practice therefore indicates, that the patient can only receive supportive care: BPC or HC.
Basic palliative care (BPC)	This form of supportive care is available to patients with cancer once the Oncology Multidisciplinary Team's recommendation has been “BSC”. It includes symptom-management (eg. pain management) and can be provided by any physician, but most commonly at home by the family physician.
Hospice care (HC)	This form of supportive care is available to patients with cancer with a life expectancy of less than six months. It also includes symptom-management (eg. pain management) and can be provided by a hospice team at home (called home hospice care) or at an institution (called inpatient hospice care)
Supportive care	Supportive care includes BPC and HC. It means symptom-management (eg. pain) of the patient, and its aim is to optimize comfort, function and social support of the patient. Therefore, in our study, if the patient received “only supportive care”, they received either only “BPC” or “HC”
Age (years)	≤65 or >65 years
Number of comorbidities	0, 1, ≥2
Oncological care prior to ED visit	Any type of inpatient or outpatient oncological care (BSC, palliative care, hospice) or treatment (chemo-, radio-, immunotherapy or surgery), which the patient received closest to the current ED visit's date.
Types of Oncological care	Surgical-, radio-, chemo-, immune- or biological- and hormone treatments as well as supportive care: BSC/palliative care and hospice
Cancer-related ED visit	patients whose visit was unambiguously related to their cancer and not to any other disease/medical condition, i.e. who visited the ED due to the complications or progression of their cancer
Destination from ED	Grouped into 3 categories: discharged to place of primary residence, admitted to the inpatient area or discharged against medical advice.

previously [18,19]. This review of medical charts was performed by the research team, including emergency medicine specialists.

To ensure accuracy of the manual chart review, two emergency physicians independently assessed each case, considering factors such as the patient's oncological history, stage, comorbidities, and recent treatments. A standardized evaluation guideline was established to guide the review process, with a third reviewer consulted in cases of disagreement regarding the reason for the ED visit.

Table 1 describes the principles of categorization of demographic and clinical patient data and the terminology which was used.

The primary outcome measure for this study was the distribution of the demographic and clinical characteristics of patients receiving basic palliative care or hospice care and who subsequently visited the ED. The secondary outcome measures for this study were the predictive factors of receiving basic palliative care or hospice care by patients with cancer who visited the ED.

Patients were followed up for 36 months following their last ED visit and the death of the patients was recorded. The number of deaths within 30 days, and over 30 days from the last ED presentation were also registered.

Our study followed the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines for observational studies when designing and describing this study [26].

Table 2

The demographic^b and clinical characteristics of patients with cancer (N = 1512) visiting the ED in 2018 [18,19].

	n	%
Total number of patients with cancer at the ED in 2018	1512	100 %
Age (years)		
≤65	571	37.8 %
	941	62.2 %
Sex		
Male	754	49.9 %
Female	758	50.1 %
Place of residence		
County seat	742	49.1 %
City	160	10.6 %
Village	560	37.0 %
Nursing home	50	3.3 %
Tumor type		
Colorectal	243	16.1 %
Breast	194	12.8 %
Urogenital (except prostate)	193	12.8 %
Respiratory	184	12.2 %
Non-melanoma skin cancer	169	11.2 %
Prostate	125	8.3 %
Hematological	93	6.2 %
Pancreas, Small intestine, Liver, Gallbladder and Biliary tract	75	5.0 %
Head and Neck	62	4.1 %
Gastroesophageal	57	3.8 %
Melanoma	37	2.4 %
Other	80	5.3 %
Number of comorbidities		
None	250	16.5 %
1	353	23.3 %
≥2	909	60.1 %
Prior oncological care		
No	207	13.7 %
Yes	1305	86.3 %
Surgery	422	27.9 %
Chemotherapy	298	19.7 %
Radiotherapy	209	13.8 %
Hormone therapy	165	10.9 %
Immune/Biological therapy	69	4.6 %
Basic palliative care	82	5.4 %
Hospice care ^a	60	4 %
Frequency of ED visits		
1x	1024	67.7 %
2-3x	406	26.9 %
4x or more	82	5.4 %
Treatment requirement following ED visit		
Admission to inpatient care	685	45.3 %
Discharge home	827	54.7 %
Death		
< 30 days	252	16.7 %
>30 days	1260	83.3 %

^a Hospice care: included patients receiving home hospice care (n = 51 patients) and inpatient hospice care (n = 9 patients).

^b Data regarding race is not specifically described, since 100 % of patients was Caucasian.

Table 2 shows the demographic and clinical characteristics of all the ED visits made by patients with cancer in 2018, as described previously [18,19].

2.4. Data analysis

A data analysis framework was devised to address the study's research questions, using both descriptive and exploratory approaches. Frequency tables were used to describe the number of ED visits made by patients and their demographic and clinical characteristics. For the investigation of patients, the Chi-squared test, and Fischer's exact test for low case numbers were used to identify significant differences between the patients receiving BPC or HC and the rest of the patients with cancer. Differences and associations were considered statistically significant if $p \leq 0.05$. Then, stratified analysis was performed - and checked for confounders (age, sex)- to determine predictive factors for BSC and hospice care. Statistical analyses were conducted using Jamovi 2.2.5 software.

3. Results

3.1. The demographic and clinical characteristics of patients with cancer receiving basic palliative care or hospice care

Out of 1512 patients with cancer, 82 patients were assigned basic palliative care, and 60 patients hospice care prior to their visit to the ED. (Table 3). A little over half of the patients in both groups lived in the county seat of the hospital. There was a slightly higher female participation in both types of care, and the majority of the patients were above 65 years. The most common cancers were respiratory and colorectal cancers in both groups and most patients had ≥ 2 comorbidities. Most of the patients in both groups had > 2 ED visits in the study year, with 61 % of BPC patients and 71.7 % of the hospice patients visiting the ED more than twice within the study year, and the highest percentage of ≥ 4 ED visits among the patients receiving hospice care (20 %). More than three-quarters of

Table 3
The demographic and clinical characteristics of patients with cancer receiving only basic palliative or hospice care, visiting the ED in 2018.

	Basic palliative care	Hospice care
Total number of patients	82 (100 %)	60 (100 %)
Age (years)		
≤ 65	21 (25.6 %)	27 (45 %)
> 65	61 (74.4 %)	33 (55 %)
Sex		
Male	35 (42.7 %)	28 (46.7 %)
Female	47 (57.3 %)	32 (53.3 %)
Place of residence		
County seat	43 (52.4 %)	33 (55.0 %)
Town	5 (6.1 %)	4 (6.7 %)
Village	30 (36.6 %)	23 (38.3 %)
Nursing Home	4 (4.9 %)	–
Tumor type		
Colorectal	16 (19.5 %)	13 (21.7 %)
Breast	7 (8.5 %)	4 (6.7 %)
Urogenital (except prostate)	11 (13.4 %)	10 (16.7 %)
Respiratory	16 (19.5 %)	13 (21.7 %)
Non-melanoma skin cancer	1 (1.2 %)	0 (0.0 %)
Prostate	1 (1.2 %)	0 (0.0 %)
Hematological	1 (1.2 %)	0 (0.0 %)
Pancreas, Small intestine, Liver, Gallbladder and Biliary tract	18 (22.0 %)	2 (3.3 %)
Head and Neck	1 (1.2 %)	3 (5.0 %)
Gastroesophageal	5 (6.1 %)	8 (13.3 %)
Melanoma	0 (0.0 %)	0 (0.0 %)
Others	5 (6.1 %)	7 (11.7 %)
Number of comorbidities		
None	7 (8.5 %)	13 (21.7 %)
1	17 (20.7 %)	8 (13.3 %)
≥ 2	58 (70.7 %)	39 (65.0 %)
Frequency of ED visits		
1x	32 (39.0 %)	17 (28.3 %)
2-3x	39 (47.6 %)	31 (51.7 %)
$\geq 4x$	11 (13.4 %)	12 (20.0 %)
Treatment requirement following ED visit		
Admission to inpatient care	58 (70.7 %)	38 (63.3 %)
Discharge to home	24 (29.3 %)	22 (36.7 %)
Death		
< 30 days	49 (59.8 %)	32 (53.3 %)
> 30 days	33 (40.2 %)	29 (46.7 %)

the patients' ED visits were due to the progression or complications of their cancer disease (cancer-related ED visit), 75.6 % and 78.3 % in the BPC and hospice care groups, respectively. Furthermore, over half of the patients in both groups were admitted to inpatient care (70.7 % and 63.3 % of the BPC and hospice patient group, respectively) following their ED visit. More than half of the patients in both groups died within 30 days of their ED visit (Table 3).

3.2. Comparison of the demographic and clinical characteristics of patients receiving BPC or HC with the rest of the cancer patient population visiting the ED in 2018

We compared the demographic and clinical characteristics of the patients receiving BPC or HC prior to their ED visit (Table 3) with the rest of the patients with cancer that visited the ED in the study as shown in Table 2 [18,19]. Of the total number of patients with cancer ($n = 1512$) that visited the ED, 5.42 % had received BPC and 3.97 % had received some form of hospice care prior to their ED visit. The frequency of multiple (2-3x) ED visits among patients receiving hospice care was almost twice that of the total cancer patient population, and only marginally less for the BPC group (51.7 % for hospice care, 47.6 % for BPC care vs. 26.9 %, among the rest of the cancer population visiting the ED). Only 5.4 % of the total cancer population visited the ED $\geq 4x$ times, which is less than half of that of the BPC group (13.4 %), and only about one-fourth as much as patients in hospice care (20.0 %). There was no significant difference in the place of residence among the groups, with the majority of patients living in the chief city of the county. Based on their frequency, all patients' malignant diseases were colorectal, breast, urogenital, respiratory, and non-melanoma skin cancers (16.1 %, 12.8 %, 12.8 %, 12.2 %, 11.2 % respectively). The majority of all the patients with cancer was above 65 years, and there was no noteworthy difference between the gender distribution of the patients. A little less than a quarter of the total cancer patient population (23.2 %) had cancer-related ED visits, which is significantly less than among the patients that were assigned BPC (75.6 %) and those that received hospice care (78.3 %). Patients of both BPC and HC were admitted to inpatient care following their ED visit in 70.7 % (BPC) and 63.3 % (HC) of the cases, whereas only 45.7 % of the overall patients with cancer were admitted to the hospital following their ED visit.

3.3. Predictive factors for being assigned only BPC and visiting the ED

When we investigated which factors predicted that patients with cancer only received BPC, we found that if the main reason was a cancer-related ED visit, it dramatically increased the odds (OR: 13.44, CI 95 %: 7.98–22.64) of the patient receiving BPC prior to the ED visit. Hospitalization more than tripled the odds (OR: 3.10) of being assigned only BPC. Having a repeated ED visit also almost tripled the odds, with an OR of 2.97 for $\geq 4x$ ED visits and an OR of 2.63 for 2-3x ED visits within the study year, for the patient receiving BPC. Finally, having respiratory cancer increased the odds by 82 % in this group (Table 4).

Factors which decreased the odds of the patient being provided only BPC, were having only one ED visit, and living in a town or a village (Table 4).

3.4. Predictive factors for receiving hospice care and visiting the ED

The odds for the patient to be in hospice care were considerably increased if the ED visit was cancer-related (OR: 14.93, CI95 %: 7.97–27.98). Having 4x or more ED visits increased the odds almost five times (OR: 4.94), and repeated ED visits of 2–3 times more than tripled the odds (OR: 3.07) that the patient had received hospice care. If the underlying disease was a gastroesophageal cancer the odds were more than quadrupled, with an OR of 4.41. Lastly presenting with any 'other' type of cancer, having respiratory cancer or being hospitalized more than doubled the odds of the patient having received hospice care, with ORs of 2.50, 2.07, 2,15 respectively (Table 5).

Living in a town or village, as well as having only one ED visit reduced the odds of the patient being in hospice care (Table 5).

4. Discussion

To our knowledge, ours is the first study from this European region to analyze the demographic and clinical characteristics of patients with cancer who had received only basic palliative care or hospice care and had visited the ED. We showed that approximately 9% of patients with cancer visiting the ED had previously received only basic palliative care or hospice care prior to their ED visit. We

Table 4
Predictive factors for patients with cancer receiving only basic palliative care visiting the ED.

Predictors	Odds Ratio (OR)	Confidence Interval (CI)
Factors increasing the odds		
Hospitalization	3.10	1.90–5.04
ED visit 4x or more	2.97	1.50–5.84
ED visit 2-3x	2.63	1.68–4.12
Respiratory cancer	1.82	1.03–3.22
2 or more comorbidities	1.64	1.10–2.68
Factors decreasing the odds		
Town or village residence	0.81	0.52–1.27
ED visit 1x	0.28	0.18–0.45

Table 5
Predictive factors for patients with cancer receiving hospice care visiting the ED.

Predictors	Odds Ratio (OR)	Confidence Interval (CI)
Factors increasing the odds		
ED visit 4x or more	4.94	2.51–9.71
Gastroesophageal cancer	4.41	1.99–9.77
ED visit 2-3x	3.07	1.83–5.16
'Other' type cancer	2.50	1.10–5.68
Hospitalization	2.15	1.26–3.67
Respiratory cancer	2.07	1.10–3.91
Factors decreasing the odds		
ED visit 1x	0.18	0.10–0.31

also identified novel predictive factors of their ED presentation: repeated ED visits and having respiratory cancer significantly increased, while having only one ED visit and living in a town or village significantly decreased the odds of the patient receiving only BPC or HC prior to ED presentation.

In our study, the majority of patients receiving BPC or HC were over 65 years old, and slightly more female patients (55 %) visited the ED according. A recent investigation regarding the emergency department visits of patients with cancer receiving palliative care found that the mean age of patients was 65.5 years and there was a slight majority of men (50.7 %) [27] as was also found in other previous studies that men were more likely to visit the ED at the end of life [28,29].

Yilmaz et al. and Elsayem et al. both noted the higher mortality of patients with advanced cancer [30,31]. Conditions in patients with advanced cancer, such as dyspnea, delirium and poor ECOG status have been shown to be significantly associated with death within 30 days of ED presentation [32]. We found similarly high mortality rates among our patients, with the majority having died within 30 days of their last ED visit (59.9 % and 53.8, among our BPC and HC patients, respectively.) The frequency of cancer type distribution among our patient population, with colorectal, respiratory, and urogenital cancer being most common among them, was similar to other studies [33], and is in line with the most common causes of cancer mortality in the developed world.

Having respiratory cancer significantly increased the odds of BPC and HC (by 87 % in BPC patients and by 107 % in patients receiving HC). Our finding is supported by previous studies [2,3,34]. A study in Australia reported, that having lung cancer was independently related to making an unplanned ED presentation within one month of receiving oncological treatment [2], while another investigation in the Netherlands showed that patients with metastasized bronchial or lung cancer received a larger amount of in-hospital medical care, had more ED admissions, and more often received end-of-life statement than patients with advanced colon cancer [34].

We discovered that having two or more comorbidities in addition to cancer increased the odds of the patient having been assigned only BPC, however, it did not significantly influence the odds of HC. A possible reason for this difference may have been, that BPC patients received only outpatient care, whilst hospice care included inpatient care as well, with more staff-involvement, and more specialist care, which may have resulted in more efficient symptomatic treatment. Despite this difference, however, the predictive factors of BPC and HC for cancer patient visiting the ED were almost the same in both studied subgroups of patients with cancer.

Patients with advanced cancer have been shown to utilize the ED and inpatient healthcare services, even despite high utilization of other outpatient support services [35]. According to a recent study in the US, patients with advanced cancer presented to the ED despite recommendations for early provision of palliative care, from which 6.5 % of the patients had received palliative and 1.3 % prior hospice care [36]. The proportion of patients receiving BPC or HC in our study was comparable to this (with 5.42 % having received only BPC and 3.97 % having received HC), but due to the different original population source of our investigation focusing on all patients with cancer -instead of just patients with advanced cancer-visiting the ED-the interpretation of the comparison may be limited.

Previous retrospective studies have examined the predictive factors of hospital care in patients with advanced cancer. According to a large study conducted in the US, 71 % of patients with advanced cancer were admitted to hospital at least once 12 months following their diagnosis, and approximately two-thirds of the patients who were hospitalized had had an ED visit prior to hospital admission [37]. These findings correspond to ours, the hospitalization rates following the ED visits of the patients in our study were likewise high: 70.7 % and 63.3 % for BPC and HC, respectively. Furthermore, we identified hospitalization as a predictive factor of BPC and HC patients visiting the ED, thus implying that the former two subgroups of patients with cancer caused a comparatively larger burden for the ED, than the rest of the patients with cancer.

Our results showed that besides hospitalization, repeated ED admissions were also significant predictors of receiving BPC or HC. According to a large Canadian investigation, patients with advanced cancer presented to the ED approximately 2.5 times within the final six months of their life and 30.7–60 % of patients with cancer visited the ED during their final month of life [29,38]. In line with these reports, 71.7 % of our patients with prior hospice care visited the ED 2 or more times. Furthermore, the odds ratios for patients to have received BPC or HC were 2.63 and 2.97, and 3.07 and 4.94 for repeated ED visits of 2 or more and 4 or more, respectively.

Hospital admission significantly increased the odds of receiving only BPC or HC, by 210 % and 115 % for BPC and HC, respectively. These somewhat lower odds and lower hospitalization rates among hospice patients (63.3 % vs.70.7 % among BPC patients), can possibly be explained by the proportion of patients receiving inpatient care at hospice institutions -and somewhat more specialized care-as opposed to BPC patients who did not have access to inpatient care.

Rehospitalization rates among patients with advanced cancer have been found to be associated with black race/ethnicity and lower socioeconomic status as a possible consequence of these individuals having less comprehensive access to medical care and lower health

literacy [39–41]. Despite our study not specifically assessing socioeconomic status, we identified 'town or village residence' as a negative predictive factor for both prior BPC in patients with cancer visiting the ED. It is possible that accessing the ED located in the county seat may have been more difficult for these patients living in rural areas of the studied county. Another contributing factor may have been that patients with advanced cancer living in rural areas more often consider their symptoms less urgent and seek medical help more rarely than residents of larger cities [18]. The exact reasons for the observed differences in our study warrants further investigation.

Our study has several important implications for health management policies in practice. Patients with cancer have a remarkably high ED visit rate in the advanced or end stage of their disease—as supported by our study—yet, they are not always optimal settings for patients with cancer, where they are at risk for acquiring nosocomial infections, and healthcare professionals are often not trained or do not have the time to care for the special needs of patients with cancer with palliative care needs. Furthermore, utilizing the ED instead of other forms of supportive care, such as BPC and HC is potentially financially more burdensome as well [15]. Our investigation highlights the importance of the availability of specialized palliative care services once patients have been assigned only BSC (and possibly even sooner), to possibly avoid multiple ED visits, particularly in a “4a” PC development level country, like Hungary, where specialized palliative care services are limited, home hospice care suffers from a shortage of hospice workers (nurses, physicians and other team members) and other resources [24]. Strategy-based and planned interventions, with special emphasis on the health policy aspect of planning, and central funding, can contribute to achieving these aims [42]. Furthermore, as a way to combat the high ED visit rate of patients with cancer, in some centers in Western countries, like the UK, US and Canada, special cancer support initiatives, such as urgent cancer care centers have been adopted to treat the patients with cancer' urgent and symptom-related conditions, to provide more optimal care and to alleviate the burden of the already overburdened EDs [43,44]. Finally, providing adequate training of healthcare professionals at EDs in palliative care, could also possibly improve the quality of cancer patient care [45].

4.1. Limitations

Our study has certain limitations. It was a retrospective investigation performed at a single site, therefore further analyses need to be made in multiple sites for the confirmation of our findings. Due to the categorization of certain data with a large number of possibilities (for eg. types of cancer) classification bias cannot completely be excluded. Finally, a more in-depth investigation regarding the distribution of patients in inpatient hospice care vs. home hospice care would have fine-tuned the interpretation of our results regarding hospice patients.

5. Conclusions

In the present work, we investigated and provided a description of patients with cancer who had received only basic palliative care or hospice care prior to their ED visit through a cross-sectional analysis of patients with cancer visiting the ED.

Despite multiple reports from developed, Western countries, to our knowledge this is the first study to evaluate predictors of receiving BPC or HC among patients with cancer visiting the ED in this region of Europe.

We showed that hospital admission, having multiple (2 or more) ED visits, or respiratory cancer were independent risk factors of receiving only supportive (BPC or HC) care. We identified rural (village or town) residency as a negative predictive factor of receiving BPC.

Thus, our study provided information about the characteristics of patients with cancer receiving BPC or HC visiting the ED in this region and identified possible predictive factors of supportive care. Our findings indicated a heightened need for supportive, preventive measures aimed at particularly vulnerable patients - patients with certain characteristics like respiratory cancer for example—within these two subgroups of patients with palliative care needs.

Ethical approval statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Ethics Committee of the University of Pécs Medical School, with the approval number 8280-PTE2020.

Data availability statement

Data will be made available on request.

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CRedit authorship contribution statement

Csaba Varga: Writing – review & editing, Investigation, Conceptualization. **Zsolt Springó:** Writing – original draft, Methodology,

Conceptualization. Márton Koch: Validation, Methodology. **Lilla Prenek:** Validation, Methodology. **Lili Porcsa:** Validation, Methodology. **Szabolcs Bellyei:** Supervision, Investigation. **László Rumi:** Investigation, Formal analysis. **Éva Szabó:** Investigation, Formal analysis. **Zoltan Ungvari:** Writing – review & editing, Supervision. **Kyra Girán:** Investigation, Formal analysis. **István Kiss:** Writing – review & editing, Supervision, Conceptualization. **Éva Pozsgai:** Writing – original draft, Project administration, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] A.D. Vandyk, M.B. Harrison, G. Macartney, A. Ross-White, D. Stacey, Emergency department visits for symptoms experienced by oncology patients: a systematic review, *Support. Care Cancer* 20 (8) (2012) 1589–1599.
- [2] P.H. Dufton, A. Drosdowsky, M.F. Gerdtz, M. Krishnasamy, Socio-demographic and disease related characteristics associated with unplanned emergency department visits by cancer patients: a retrospective cohort study, *BMC Health Serv. Res.* 19 (1) (2019) 647.
- [3] J.M. Caterino, D. Adler, D.D. Durham, S.J. Yeung, M.F. Hudson, A. Bastani, S.L. Bernstein, C.W. Baugh, C.J. Coyne, C.R. Grudzen, et al., Analysis of diagnoses, symptoms, Medications, and admissions among patients with cancer presenting to emergency departments, *JAMA Netw. Open* 2 (3) (2019) e190979.
- [4] J. Hsu, J.P. Donnelly, J.X. Moore, K. Meneses, G. Williams, H.E. Wang, National characteristics of Emergency Department visits by patients with cancer in the United States, *Am. J. Emerg. Med.* 36 (11) (2018) 2038–2043.
- [5] D.R. Rivera, L. Gallicchio, J. Brown, B. Liu, D.N. Kyriacou, N. Shelburne, Trends in adult cancer-related emergency department utilization: an analysis of data from the nationwide emergency department sample, *JAMA Oncol.* 3 (10) (2017) e172450.
- [6] D. Hui, S.H. Kim, J. Roquemore, R. Dev, G. Chisholm, E. Bruera, Impact of timing and setting of palliative care referral on quality of end-of-life care in cancer patients, *Cancer* 120 (11) (2014) 1743–1749.
- [7] S.A. Alsirafy, A.A. Raheem, A.S. Al-Zahrani, A.A. Mohammed, M.A. Sherisher, A.T. El-Kashif, H.M. Ghanem, Emergency department visits at the end of life of patients with terminal cancer: pattern, causes, and avoidability, *Am J Hosp Palliat Care* 33 (7) (2016) 658–662.
- [8] T.J. Weiland, H. Lane, G.A. Jelínek, C.H. Marck, J. Weil, M. Boughey, J. Philip, Managing the advanced cancer patient in the Australian emergency department environment: findings from a national survey of emergency department clinicians, *Int. J. Emerg. Med.* 8 (2015) 14.
- [9] J. Brown, C. Grudzen, D.N. Kyriacou, Z. Obermeyer, T. Quest, D. Rivera, S. Stone, J. Wright, N. Shelburne, The emergency care of patients with cancer: setting the research agenda, *Ann. Emerg. Med.* 68 (6) (2016) 706–711.
- [10] C. Zimmermann, N. Swami, M. Krzyzanowska, N. Leighl, A. Rydall, G. Rodin, I. Tannock, B. Hannon, Perceptions of palliative care among patients with advanced cancer and their caregivers, *CMAJ (Can. Med. Assoc. J.)* 188 (10) (2016) E217–e227.
- [11] M.S. Boddaert, J. Douma, A.Q. Dijkhoorn, R. Héman, C.C.D. van der Rijt, S. Teunissen, P.C. Huijgens, K.C.P. Vissers, Development of a national quality framework for palliative care in a mixed generalist and specialist care model: a whole-sector approach and a modified Delphi technique, *PLoS One* 17 (3) (2022) e0265726.
- [12] P.E. Tatum, S.S. Mills, Hospice and palliative care: an overview, *Med Clin North Am* 104 (3) (2020) 359–373.
- [13] D. Clark, N. Baur, D. Clelland, E. Garralda, J. López-Fidalgo, S. Connor, C. Centeno, Mapping levels of palliative care development in 198 countries: the situation in 2017, *J. Pain Symptom Manag.* 59 (4) (2020) 794–807, e794.
- [14] T. Lynch, S. Connor, D. Clark, Mapping levels of palliative care development: a global update, *J. Pain Symptom Manag.* 45 (6) (2013) 1094–1106.
- [15] A. Csikos, C. Busa, K. Muszbek, Hospice palliative care development in Hungary, *J. Pain Symptom Manag.* 55 (2s) (2018) S30–s35.
- [16] H. Kitazawa, Y. Takeda, G. Naka, H. Sugiyama, Decision-making factors for best supportive care alone and prognostic factors after best supportive care in non-small cell lung cancer patients, *Sci. Rep.* 9 (1) (2019) 19872.
- [17] A.A. Wright, N.L. Keating, J.Z. Ayanian, E.A. Chrischilles, K.L. Kahn, C.S. Ritchie, J.C. Weeks, C.C. Earle, M.B. Landrum, Family perspectives on aggressive cancer care near the end of life, *JAMA* 315 (3) (2016) 284–292.
- [18] M. Koch, É. Szabó, C. Varga, V. Soós, L. Prenek, L. Porcsa, S. Bellyei, K. Girán, J. Girán, I. Kiss, et al., Retrospective study of cancer patients' predictive factors of care in a large, Hungarian tertiary care centre, *BMJ Open* 13 (5) (2023) e070320.
- [19] M. Koch, C. Varga, V. Soós, L. Prenek, L. Porcsa, A. Szakáll, G. Bilics, B. Hunka, S. Bellyei, J. Girán, et al., Main reasons and predictive factors of cancer-related emergency department visits in a Hungarian tertiary care center, *BMC Emerg. Med.* 22 (1) (2022) 114.
- [20] Norbert Pasek ESzLA, Triage quality survey with clinical audit in the Emergency Department of MilitaTri Triage Triage survey with clinical audit in the Emergency Department of TriMilitary Hospital Medical Centre, Hungarian Défense Forces ry Hospital Medical Centre, Hungarian Défense Forces Available from: <https://ojs.mtak.hu/index.php/ime/article/view/8519/7497>.
- [21] M.J. Bullard, E. Musgrave, D. Warren, B. Unger, T. Skeldon, R. Grierson, et al., Revisions to the Canadian Emergency Department Triage and Acuity Scale (CTAS) Guidelines 2016, *Cjem* 19 (S2) (2017) S18–s27.
- [22] F. Azam, M.F. Latif, A. Farooq, S.H. Tirmazy, S. AlShahrani, S. Bashir, et al., Performance status assessment by using ECOG (Eastern Cooperative Oncology Group) score for cancer patients by oncology healthcare professionals, *Case Rep. Oncol.* 12 (2019) 728–736. Switzerland: Copyright © 2019 by S. Karger AG, Basel.
- [23] T.E. Quill, A.P. Abernethy, Generalist plus specialist palliative care—creating a more sustainable model, *N. Engl. J. Med.* 368 (13) (2013) 1173–1175.
- [24] Hospice Betegellátás, A nemzeti egészségbiztosítási adatkezelő (NEAK) és a magyar hospice-palliatív egyesület felmérése alapján. https://hospice.hu/docu/Osszefoglalas_a_2018_evi_hospice_betegellatasrol.pdf, 2018.
- [25] M.E. Charlson, P. Pompei, K.L. Ales, C.R. MacKenzie, A new method of classifying prognostic comorbidity in longitudinal studies: development and validation, *J. Chronic Dis* 40 (5) (1987) 373–383.
- [26] E. von Elm, D.G. Altman, M. Egger, S.J. Pocock, P.C. Gøtzsche, J.P. Vandenbroucke, The strengthening of reporting of observational studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies, *Int. J. Surg.* 12 (12) (2014) 1495–1499.
- [27] N. Dumnu, K. Nagaviroj, T. Anothaisintawee, A study of the factors associated with emergency department visits in advanced cancer patients receiving palliative care, *BMC Palliat. Care* 21 (1) (2022) 197. <https://doi.org/10.1186/s12904-022-01098-w>. PMID: 36376908.
- [28] L.A. Henson, W. Gao, L.J. Higginson, M. Smith, J.M. Davies, C. Ellis-Smith, B.A. Daveson, Emergency department attendance by patients with cancer in their last month of life: a systematic review and meta-analysis, *J. Clin. Oncol.* 33 (4) (2015) 370–376.
- [29] L.A. Henson, L.J. Higginson, W. Gao, What factors influence emergency department visits by patients with cancer at the end of life? Analysis of a 124,030 patient cohort, *Palliat. Med.* 32 (2) (2018) 426–438.
- [30] M.J. Verhoef, E. de Nijs, N. Horeweg, J. Fogteloo, C. Heringhaus, A. Jochems, M. Fiocco, Y. van der Linden, Palliative care needs of advanced cancer patients in the emergency department at the end of life: an observational cohort study, *Support. Care Cancer* 28 (3) (2020) 1097–1107.
- [31] A.F. Elsayem, C.L. Warneke, C.C. Reyes-Gibby, L.J. Buffardi, H. Sadaf, P.S. Chافتari, P.A. Brock, V.D. Page, J. Viets-Upchurch, D. Lipe, et al., "Triple Threat" conditions predict mortality among patients with advanced cancer who present to the emergency department, *J. Emerg. Med.* 63 (3) (2022) 355–362.
- [32] A.F. Elsayem, C.L. Warneke, C.C. Reyes-Gibby, L.J. Buffardi, H. Sadaf, P.S. Chافتari, et al., "Triple Threat" conditions predict mortality among patients with advanced cancer who present to the emergency department, *J. Emerg. Med.* 63 (3) (2022) 355–362. <https://doi.org/10.1016/j.jemermed.2022.05.014>. PMID: 36220672.

- [33] N. Dumnui, K. Nagaviroj, T. Anothaisintawee, A study of the factors associated with emergency department visits in advanced cancer patients receiving palliative care, *BMC Palliat. Care* 21 (1) (2022) 197.
- [34] I.S.L. van Brakel, M.M. Stuijver, S.M. Euser, G.J. de Klerk, K.J. van Stralen, The use of in-hospital medical care for patients with metastasized colon, bronchus, or lung cancer, *Support. Care Cancer* 29 (11) (2021) 6579–6588.
- [35] C.H. McNaughton, M. Horst, E. Gehron, S. Sivendran, J. Nguyen, R. Holliday, K. Newport, Patterns of support service, emergency department, and hospital utilization in patients with advanced cancer: a descriptive study, *J. Palliat. Care* 35 (1) (2020) 34–39.
- [36] S. Yilmaz, C.R. Grudzen, D.D. Durham, C. McNaughton, I. Marcelin, B. Abar, D. Adler, A. Bastani, C.W. Baugh, S.L. Bernstein, et al., Palliative care needs and clinical outcomes of patients with advanced cancer in the emergency department, *J. Palliat. Med.* 25 (7) (2022) 1115–1121.
- [37] R.L. Whitney, J.F. Bell, D.J. Tancredi, P.S. Romano, R.J. Bold, J.G. Joseph, Hospitalization rates and predictors of rehospitalization among individuals with advanced cancer in the year after diagnosis, *J. Clin. Oncol.* 35 (31) (2017) 3610–3617.
- [38] L. Barbera, C. Taylor, D. Dudgeon, Why do patients with cancer visit the emergency department near the end of life? *CMAJ (Can. Med. Assoc. J.)* 182 (6) (2010) 563–568.
- [39] M.E. Kurtz, J.C. Kurtz, C.W. Given, B. Given, Predictors of use of health care services among elderly lung cancer patients: the first year after diagnosis, *Support. Care Cancer* 14 (3) (2006) 243–250.
- [40] L.A. Henson, B. Gomes, J. Koffman, B.A. Daveson, L.J. Higginson, W. Gao, Factors associated with aggressive end of life cancer care, *Support. Care Cancer* 24 (3) (2016) 1079–1089.
- [41] A. Legler, E.H. Bradley, M.D. Carlson, The effect of comorbidity burden on health care utilization for patients with cancer using hospice, *J. Palliat. Med.* 14 (6) (2011) 751–756.
- [42] A. de Blasio, J. Girán, Z. Nagy, Potentials of health impact assessment as a local health policy supporting tool, *Perspect Public Health* 132 (5) (2012) 216–220.
- [43] K. Decker, P. Lambert, K. Galloway, O. Bucher, M. Pitz, B. Goldenberg, H. Singh, M. Kristjanson, T. Fatoye, E.J. Bow, Predictors of urgent cancer care clinic and emergency department visits for individuals diagnosed with cancer, *Curr. Oncol.* 28 (3) (2021) 1773–1789.
- [44] H. Hansagi, M. Olsson, S. Sjöberg, Y. Tomson, S. Göransson, Frequent use of the hospital emergency department is indicative of high use of other health care services, *Ann. Emerg. Med.* 37 (6) (2001) 561–567.
- [45] A.J. Alqahtani, G. Mitchell, End-of-Life care challenges from staff viewpoints in emergency departments: systematic review, *Healthcare (Basel)* 7 (3) (2019).