Support Care Cancer (2016) 24:1251–1260
DOI 10.1007/s00520-015-2921-4

ORIGINAL ARTICLE

Presentation patterns and outcomes of patients with cancer accessing care in emergency departments in Victoria, Australia

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Received: 20 April 2015 / Accepted: 18 August 2015 / Published online: 26 August 2015

Abstract
Purpose People with cancer attend emergency departments (EDs) for many reasons. Improved understanding of the specific needs of these patients may assist in optimizing health service delivery. ED presentation and hospital utilization characteristics were explored for people with cancer and compared with those patients without cancer.
Methods This descriptive, retrospective, multicentre cohort study used hospital administrative data. Descriptive and inferential statistics were used to summarise and compare ED presentation characteristics amongst cancer and non-cancer groups. Predictive analyses were used to identify ED presentation features predictive of hospital admission for cancer patients. Outcomes of interest were level of acuity, ED and inpatient length of stay, re-presentation rates and admission rates amongst cancer patients and non-cancer patients.
Results A total of 529,377 ED presentations occurred over the 36 months, of which 2.4 % (n=12,489) were cancer-related. Compared with all other attendances, cancer-related attendances had a higher level of acuity, requiring longer management time and length of stay in ED. Re-presentation rates for people with cancer were nearly double those of others (64 vs 33 %, p<0.001), with twice the rate of hospital admission (90 vs 46 %, p<0.001), longer inpatient length of stay (5.6 vs 2.8 days, p<0.001) and higher inpatient mortality (7.9 vs 1.0 %, p<0.001). Acuity and arriving by ambulance were significant predictors of hospital admission, with cancer-related attendances having ten times the odds of admission compared to other attendances (OR=10.4, 95 % CI 9.8–11.1).
Conclusions ED presentations by people with cancer represent a more urgent, complex caseload frequently requiring hospital admission when compared to other presentations, suggesting that for optimal cancer care, close collaboration and integration of oncology, palliative care and emergency medicine providers are needed to improve pathways of care.

Keywords Cancer · Emergency department · Symptoms · Hospitalization · Admission · Mortality

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Introduction

Emergency departments (EDs) face overcrowding by a heterogeneous patient group. Australian data show that ED presentations increased by an average of 2.9 % per year between 2008–2009 and 2012–2013 [1]. People with cancer may contribute to this increase because of specific needs including new symptoms, the exacerbation of existing problems, complications of

treatment, problems associated with disease progression or difficulties with care and support systems [2–5].

People with cancer undergoing chemotherapy treatment or nearing end of life commonly experience acute symptoms, which may precipitate an ED visit and/or hospital admission. To the best of our knowledge, no Australian study has reported on the broad cancer patient population presenting to an ED, nor compared this cohort with non-cancer patients' use of the ED. Understanding the patterns of presentation and presenting complaints of all people with cancer and determining those more likely to present to the ED could guide service planning and provision and improve care. Therefore, we conducted a multicentre study to describe the frequency of ED presentations, and the clinical and demographic characteristics and outcomes amongst people with cancer, and compared these with non-cancer patients.

Methods

Design and data source

A retrospective analysis was undertaken of adult patients presenting to EDs of four metropolitan hospitals in Melbourne, Victoria: St. Vincent's Hospital Melbourne (SVHM), the Royal Melbourne Hospital (RMH), Footscray Hospital (FH) and Sunshine Hospital (SH) from September 2009 to August 2012. Analysis used hospital administrative datasets which contribute to the Victorian Emergency Minimum Dataset (VEMD) and the Victorian Admitted Episodes Dataset (VAED). The VEMD contains ED presentation data, while the VAED contains demographic and clinical information on each episode of patient care, with clinical information coded with the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) [6].

Australian model of care

In the Australian system, all patients presenting acutely to hospitals are seen, assessed and initially managed by ED medical staff prior to hospital admission, with direct admissions occurring only rarely in most hospitals.

Study participants

ED attendances were classified as either cancer-related or non-cancer-related. Cancer-related attendances were those where patients had an underlying diagnosis of cancer, defined as all malignant tumours, primary or secondary, local or metastatic. The complete list of cancer diagnoses documented in ICD-10 was searched for in each hospital's database from both 'ED discharge diagnoses' and 'inpatient discharge diagnoses' fields. The following ICD-10 code prefixes and their derivatives were searched for: C00-C97 (malignant neoplasms) and D37-D48 (neoplasms of uncertain or unknown behaviour). Prefixes specifically excluded were D00-D09 (in situ neoplasms) and D10-D36 (benign neoplasms).

Inpatient discharge diagnoses category of the hospitals' datasets was searched to identify people with cancer who were admitted from the ED to an inpatient ward. Many of these patients were not captured through the initial ED diagnosis category search, perhaps because the diagnosis of cancer was made during their admission or because the primary ED diagnosis was coded as the symptom (e.g. vomiting) or prevalent pathology (e.g. bowel obstruction).

The 'ED triage free-text' field provides a free-text statement of the patient's reason for presentation, and this was searched in each hospital's dataset to find people with cancer not previously identified. Search terms included the following, in addition to their abbreviations: cancer, metastasis, chemotherapy, oncology, brachytherapy, radiotherapy, palliative care, leucopoenia, pancytopenia, neutropoenia, lymphoma and leukaemia. ED triage free-text was not available from 12 September 2009–25 July 2011 (approx. 22 months) for FH and from 12 September 2009–3 October 2010 (approx. 12 months) for SH.

For those attendances whose ED triage free-text description relating to cancer was considered equivocal, an independent assessment was performed by three reviewers (palliative care physician [JP] and two emergency physicians [GJ, JK]). The following inclusion criteria identified a valid cancer case: (i) cancer type associated with low rate of curability, (ii) probable complications of the cancer or its treatment, (iii) active cancers or active cancer treatments and (iv) those patients with bowel problems/obstruction and a past history of bowel cancer.

Medical review of 100 case records selected at random was performed and did not identify discrepancies in case ascertainment.

Data collection

Demographic and clinical variables collected included age (≥17 years); gender; marital status; country of birth; Aboriginal or Torres Strait Islander status; preferred language; interpreter required; religion; postcode; usual accommodation; mode of arrival to hospital; arrival time; triage category (using the Australasian Triage Scale [ATS], a 5-point numerical scale with ATS 1 having a target maximum time to treatment of 0 min, ATS 2 having a target maximum time to treatment of 10 min and ATS 3, 4 and 5 having a target maximum time to treatment of 30, 60 and 120 min, respectively), presenting complaint, ED triage notes (free-text), ED discharge diagnoses (ICD-10), attendance source, time to review by ED clinician (ED wait time), time from commencement of ED clinician care until ED discharge (ED management time), ED

length of stay (LOS) being the time from triage to departure from the ED, ED discharge destination, inpatient LOS, inpatient discharge diagnoses (ICD-10), inhospital mortality and location of death (if relevant), day-of-the-week of attendance and hour of the day of attendance.

Inpatient 'admission' was an undefined variable and was therefore derived; those who had an inpatient discharge destination were deemed admitted as were those who died in hospital.

Data collapsing and definition

Data for presenting complaint were collapsed from 225 complaints into 25 broad groups by a senior emergency physician [GJ]. Patient age was supplied as a continuous measure and was collapsed into deciles, with the exception of the 17–30 years age group. Marital status was collapsed from six groups into five with married and de facto forming one group. Aboriginal or Torres Strait Islander (ATSI) status was collapsed from four possible groups to form a binary variable: ATSI (yes, no). Attendance source was collapsed from 13 categories into three (referred by self/family/friend, referred by health professional, other).

Destination from ED was collapsed from 38 possible categories into 11 categories (did not wait (DNW), advice or part treatment only, inpatient ward other than short-stay unit, inpatient ward at another hospital, short-stay unit, transition care or restorative bed-based program, procedural laboratory, theatre, home, community care facility, corrections facility). Mode of arrival was collapsed from 15 categories into five categories (ambulance, public transport, private car, police, other). Data for usual accommodation was collapsed from 13 to five groups (private residence, supported accommodation, hospital/health facility, prison/remand centre, other). Inpatient discharge destination was collapsed from 10 to 7 groups (private residence, other acute care hospital, statistical separation, community care facility, left against medical advice, transition care or restorative care bed-based program, transfer to non-acute care hospital). Time of day of ED presentation was categorised into four hourly blocks.

Ethics approval was granted by St. Vincent's Hospital Melbourne Human Research Ethics Committee (LRR 117/12) and Melbourne Health (2012.198) for RMH, FH and SH.

Outcomes of interest

The primary outcomes of interest were ED presentation characteristics and outcomes, in particular, level of acuity, ED and inpatient length of stay, re-presentation and admission rates and inhospital mortality amongst cancer patients and non-cancer patients. Secondary outcomes of interest were ED presentation factors predictive of hospital admission for cancer patients and those common diagnoses assigned to cancer patients following ED and inpatient discharge.

Data analysis

Data were analysed using IBM SPSS version 21.0 (IBM, Armonk, NY, USA). Univariate analyses were performed and continuous data reported using mean (95 % confidence intervals (CIs)) or median (interquartile range (IQR)) and categorical data using number and percentage. Independent samples *t* test (or its non-parametric alternative) was used to compare continuous data for two groups. Pearson's chi-squared was used to compare categorical variables or Fisher's exact test for two by two contingency tables. Adjusted standardised residuals were used to indicate under- or over-representation of groups with a cut-off set at ±2.0. ED variables that predict inpatient admission were explored using binary logistic regression (Enter method). Odds ratios and 95 % confidence intervals are provided for cancer-related attendance (Y/N), ATS category and mode of arrival. *P* values <0.05 were considered statistically significant, and two-tailed tests of significance were used in all instances.

Results

Patient sample characteristics

A total of 529,377 ED presentations occurred over the 36-month study period, of which 2.4 % ($n=12,489$) were cancer-related based on ED and inpatient discharge diagnosis codes (30.6 % by initial ED discharge diagnosis) and ED triage free-text (13.3 %). These cancer-related attendances were made by 7982 unique individuals, who were significantly more likely to be male and older (median age 69 years), compared with those without cancer (Table 1). The majority (94.0 %) of people with cancer lived in a private residence in the Melbourne metropolitan area (81.9 %). Nearly two thirds (63.8 %) of patients with cancer had a repeat presentation, significantly more than non-cancer patients (32.9 %). Cancer-related attendances were more urgent than non-cancer-related attendances and significantly more likely to have arrived by ambulance and to result in death during the hospital visit (Table 2).

While most attendances by people with cancer resulted from referral by a family member, friend or self-referral, they were significantly less likely to be referred by this route than non-cancer-related attendances. Around 10 % of cancer-related attendances resulted from a health professional referral (Table 2).

Table 1 Comparison of demographics and frequency of attendances of patients with and without cancer

Demographic variable	Individuals with cancer $n=7982$[a] (%)	Individuals without cancer $n=296{,}147$[a] (%)	*P* value
Gender, male	4474 (56.1)[f]	152,831 (51.6)[g]	<.001[c]
Age, median year (IQR; range)	69 (57–78; 17–104)	41 (28–61; 17–116)	<.001[d]
Marital status[b]			
Married/de facto	4298 (58.8)[f]	123,015 (46.6)[g]	<.001[e]
Divorced	539 (7.4)[f]	11,003 (4.2)[g]	
Separated	195 (2.7)	6689 (2.5)	
Widowed	1237 (16.9)[f]	18,025 (6.8)[g]	
Single	1041 (14.2)[g]	105,356 (39.9)[f]	
Interpreter required[b]	880 (11.0)[f]	10,019 (3.4)[g]	<.001[c]
Aboriginal or Torres Strait Islander	35 (0.4)[g]	2354 (0.8)[f]	<.001[c]
Usual accommodation[b]			
Private residence	2908 (94.0)	94,679 (94.8)	<.001[e]
Supported accommodation	153 (4.9)[f]	3615 (3.6)[g]	
Hospital/health facility	2 (0.1)	39 (0)	
Prison/remand centre	21 (0.7)	1031 (1.0)	
Other	9 (0.3)	539 (0.5)	
Locality			
Melbourne metropolitan	6537 (81.9)[g]	239,226 (80.8)[f]	<.001[e]
Victoria, outside Melbourne metro	1265 (15.8)[f]	39,183 (13.2)[g]	
Interstate/overseas	180 (2.3)[g]	17,738 (6.0)[f]	
Number of visits			
1	2893 (36.2)[g]	198,715 (67.1)[f]	<.001[e]
2	1699 (21.3)	53,741 (18.2)	
3+	3390 (42.5)[f]	43,691 (14.7)[g]	

[a] Data are for unique individuals at first or 'index' presentation only

[b] Excludes unknown and missing data (denominators adjusted to reflect only those hospitals that code for the variable)

[c] Fisher's exact test

[d] Mann–Whitney *U* test

[e] Pearson's chi-squared

[f] Denotes significantly over-represented based on adjusted standardised residuals

[g] Denotes significantly under-represented based on adjusted standardised residuals

ED presentation patterns

Day of the week of ED presentation was relatively equivalent amongst cancer and non-cancer ED attendances. Cancer-related attendances had significantly shorter times until medical assessment in the ED, though the 8 min was of doubtful clinical significance. Conversely, longer management time and LOS in the ED for cancer-related attendances were both clinically and statistically significant, with both more than double those attendances unrelated to cancer (Table 2).

Presenting complaints for cancer-related attendances were most commonly pain (17.2 %), respiratory symptoms (11.4 %) and neurological symptoms (11.2 %) (Tables 3 and 4).

Inpatient admissions and clinical characteristics for cancer-related attendances

The admission rate for cancer-related presentations was double that of unrelated presentations, and this group was less likely to leave the ED prematurely (Table 2) and less likely to be discharged home.

Inpatient LOS was significantly longer for cancer-related attendances, including those in a short-stay unit.

When inpatient diagnosis codes were considered collectively (i.e. multiple diagnosis codes assigned to individual patients), the most common IP diagnoses were external cause of morbidity, personal history of certain other diseases and encounter for palliative care. Of those inpatient diagnosis codes specific to cancer, the five most common broadly

Table 2 Comparison of ED clinical characteristics of patient attendances related and unrelated to cancer

Clinical variable	Cancer-related attendances n=12,489[a] (%)	Attendances unrelated to cancer n=516,888[a] (%)	P value
Acuity (ATS)[b]			
ATS1	149 (1.2)	5756 (1.1)	<.001[m]
ATS2	1809 (14.5)[p]	55,070 (10.7)[q]	
ATS3	6464 (51.8)[p]	189,569 (36.8)[q]	
ATS4	3878 (31.0)[q]	230,885 (44.8)[p]	
ATS5	189 (1.5)[q]	34,227 (6.6)[p]	
Arrival mode			
Ambulance	5816 (46.6)[p]	166,324 (32.3)[q]	<.001[m]
Public transport	203 (1.6)[q]	14,289 (2.8)[p]	
Private car	2837 (22.7)[q]	176,101 (34.2)[p]	
Police	10 (0.1)[q]	5063 (1.0)[p]	
Other	3623 (29.0)[q]	153,750 (29.8)[p]	
Attendance source[c]			
Self, family, friend	6905 (86.7)[q]	259,224 (90.5)[p]	<.001[m]
Health professional	904 (11.3)[p]	19,016 (6.6)[q]	
Other	157 (2.0)[q]	8073 (2.8)[p]	
ED time to doctor, median min (IQR)	51 (20–115)	59 (22–128)	<.001[n]
ED management time, median h:min (IQR)	5:49 (3:38–9:40)	2:44 (1:13–5:14)	<.001[n]
ED LOS, median h:min (IQR)	7:10 (4:43–11:22)	4:05 (2:25–6:41)	<.001[n]
Died during hospital visit[b]	991 (7.9)[p]	5352 (1.04)[q]	<.001°
Death location, ED	64 (6.5)	1950 (36.4)	<.001°
Death location, IP	927 (93.5)	3402 (63.6)	
Destination from ED[d]			
IP ward (other than SSU[e])	4756 (38.1)[p]	98,301 (19.1)[q]	<.001[m]
SSU[e]	1829 (14.7)	77,112 (15.0)	
Operating theatre	70 (0.6)[p]	2271 (0.4)[q]	
Procedural lab	4 (<0.03)	307 (0.1)	
Medihotel[f]	0 (0)	27 (<0.005)	
Did not wait	159 (1.3)[q]	14,131 (2.7)[p]	
Advice or part treatment only	81 (0.6)[q]	11,132 (2.2)[p]	
Other hospital (IP)	276 (2.2)	10,915 (2.1)	
Home (incl. hostel and outpatients)	4549 (36.5)[q]	271,983 (52.8)[p]	
Community care facility[g]	24 (0.2)[q]	1970 (0.4)[p]	
Prison facility	4 (<0.03)[q]	452 (0.1)[p]	
Unknown/other	715 (5.7)[p]	26,402 (5.1)[q]	
IP admission[h]	11,289 (90.4)	235,516 (45.6)	<.001°
IP LOS (SSU[e]), median h:min (IQR)[i]	7:19 (4:26–13:25)	6:15 (4:04–10:19)	<.001[n]
IP LOS, median days (IQR)[j]	5.6 (2.6–11.0)	2.8 (1.0–6.3)	<.001[n]
IP discharge destination[k,l]			
Private residence	7384 (71.7)[q]	194,205 (84.4)[p]	<.001[m]
Other acute care hospital	1438 (14.0)[p]	18,948 (8.2)[q]	
Community care facility	182 (1.8)[q]	4790 (2.1)[p]	
Left against medical advice	45 (0.4)[q]	2849 (1.2)[p]	
Transition or RBBP	30 (0.3)[p]	317 (0.1)[q]	
Transfer to non-acute care hospital	646 (6.3)[p]	4616 (2.0)[q]	

Data are number (%) unless otherwise specified

IP inpatient, *LOS* length of stay, *RBBP* restorative bed-based program

[a] Analysis based on attendances rather than individuals

[b] Excludes those coded as dead on arrival (DOA), n=0 for cancer-related attendances, n=1380 for other attendances

[c] Excludes unknown and missing data (denominators adjusted to reflect only those hospitals that code for the variable)

[d] Excludes those designated as mortuary. Denominator for cancer-related attendances is 12,467. Denominator for other attendances is 515,003

[e] Includes short-stay unit (SSU), emergency observation unit (EOU), emergency short-stay unit (ESSU), assessment and planning unit (APU), management and assessment planning unit (MAPU)

[f] Medihotel refers to a low acuity hotel-style accommodation within the hospital

[g] Includes aged care residential, mental health residential, respite

[h] Includes both IP admissions alive on departure and those that died during IP stay

[i] Patients designated for admission but stayed in SSU[e]

[j] Patients that were designated for admission and went on to an IP ward other than SSU[e]

[k] n=10,298 (cancer attendances); n=230,164 (others). IP admissions alive on departure only

[l] Excludes statistical separation which is the cessation of an episode of care for a patient within the one hospital stay (i.e. intra-hospital transfer of type of care), n=573 for cancer-related attendances, n=4439 for other attendances

[m] Pearson's chi-squared

[n] Mann–Whitney U test

[o] Fisher's exact test

[p] Denotes significantly over-represented based on adjusted standardised residuals

[q] Denotes significantly under-represented based on adjusted standardised residuals

grouped primary cancers were cancer of the digestive organs, lung cancer, lymphatic and haematopoietic cancer, breast cancer and neoplasms of uncertain or unknown behaviour (Table 5). These five most prevalent cancer diagnoses affected 6906 (62.6 %) cancer-related attendances (with an IP admission) or 4572 (62.9 %) cancer individuals (with an IP diagnosis) (Table 5). Only one primary cancer within each broad ICD-10 cancer category was counted per attendance.

The proportion of deaths in ED was similar between cancer-related and non-cancer-related presentations (0.5 vs 0.4 %, respectively, p=.459), but significantly more inpatient

Table 3 Most common presenting complaints for cancer-related attendances

Order of frequency	Presenting complaint	Frequency	%
1	Pain	1371	17.2
2	Respiratory	907	11.4
3	Neurological	888	11.2
4	Febrile illness	662	8.3
5	Planned review[a]	514	6.5
6	Nausea and/or vomiting	401	5.0
7	Immune[b]	374	4.7
8	Cardiovascular	316	4.0
9	Skin	247	3.1
10	Musculoskeletal	206	2.6

Denominator is total number of presenting complaints coded, $n=7953$

Data unavailable for FH.

[a] Planned review denotes a scheduled ED visit by a patient that has presented to ED previously

[b] Immune denotes presentation where chemotherapy-related immune suppression such as neutropenia is found

deaths occurred for cancer-related presentations (7.4 vs 0.7 %, $p<0.001$).

Predictors of hospital admission

After accounting for the effects of urgency and arrival mode, patients with a cancer-related diagnosis had 10 times the odds of admission compared with those without cancer (OR=10.4, 95 % CI 9.8–11.1). Regression analysis showed that the strongest independent predictor of admission was having an ATS of 1 (OR=43.7, 95 % CI 39.8–47.9) followed by ATS 2 (OR 25.1, 95 % CI 24.0–26.3). Those arriving by ambulance had 3.2 times (95 % CI 3.1–3.3) the odds of admission compared with those arriving by other unspecified means.

Discussion

Until recently, there has been little data on ED presentations by people with cancer. Recent international studies reporting epidemiological data have enabled better understanding of the reasons for ED presentation by people with cancer, including symptoms experienced and need for hospitalization [5, 7–11]. A recent systematic review showed that pain, respiratory concerns, fever and infection were the most common presenting complaints [12]. Others have highlighted gastrointestinal symptoms such as nausea and vomiting, as well as pain as common reasons for presentation [8, 10].

In Australia, the frequency and reasons for ED presentation by people with cancer have been reported only in sub-groups such as those with advanced disease [13, 14] or receiving chemotherapy treatment [15, 16]. Factors leading to ED visits for the former include respiratory distress, mental status changes, unresponsiveness or cardiac arrest [2]. Unexpected urgent medical problems for this cancer group may necessitate an ED visit; however, it has been suggested that many visits are avoidable [2] and may be more appropriately managed by palliative care services [17].

For people with cancer undergoing outpatient chemotherapy, unplanned hospital presentations likely suggest significant unmet or unanticipated needs [16, 18]. One Australian study showed that 70 % of ED visits made by outpatients with cancer occurred within 4 weeks of chemotherapy treatment, with 88 % resulting in hospital admission [16]. Nausea or vomiting, pain, fever or febrile neutropenia were the most common reasons for presentation. Another study reported 40 % of people with cancer receiving chemotherapy represented on two or more occasions with 59 % of ED presentations requiring hospital admission [15]. The most common hospital discharge diagnosis was neutropenia, which has been targeted by recent successful trials of outpatient management to reduce hospital presentations and admissions [19]. More common ED diagnoses of nausea/vomiting/dehydration were potentially less serious, and thus, ED presentations may be avoidable with community-based cancer support linked to primary care and educational support encouraging self-management of adverse events [20].

This is the first Australian study to compare people with cancer and those without in terms of ED utilization, clinical characteristics and subsequent outcome. Whilst only 2.4 % of all ED attendances were cancer-related, these presentations were more urgent and had higher utilization of ambulance services. Our findings are consistent with others reporting ATS category 2 and 3 patients to be predominant among cancer-related attendances [15]. Longer ED management time and LOS in ED also suggest a greater level of complexity.

Urgency and arrival by ambulance were strong predictors of hospital admission for cancer attendances and in regression analysis revealed significantly higher odds of admission compared with non-cancer attendances. In a study of lung cancer patients, arrival by ambulance was found to be the principal predictive factor for hospitalization [21], suggesting that ambulance calls are reserved for severe problems and are triaged accordingly. In a study of cancer patients undergoing chemotherapy, significant predictors of hospital admission included an ED discharge diagnosis of neutropenia (OR=5.83) and ED length of stay (OR=1.01) [15].

Almost two thirds (63.8 %) of people with cancer represented to an ED during the 3-year period, nearly double that seen for those without. Inadequate symptom management has been implicated in high re-presentation rates for cancer patients undergoing chemotherapy treatment [15]. However, in our non-specific cancer group, re-presentation likely indicates greater medical needs as most (88 %) cancer attendances

Table 4 Top 20 most common primary ED and inpatient diagnoses assigned to cancer-related attendances

ED primary diagnoses				Inpatient primary diagnoses			
ICD-10 code	Description	Frequency	%	ICD-10 code	Description	Frequency	%*
D432	Neoplasm of uncertain or unknown behaviour of brain	705	5.7	C795	Secondary malignant neoplasm of bone/bone marrow	403	3.2
D379	Neoplasm of uncertain or unknown behaviour of digestive organ	547	4.4	J189	Pneumonia	394	3.2
R104	Abdominal pain	466	3.8	C793	Secondary malignant neoplasm of brain/cerebral meninges	318	2.5
D386	Neoplasm of uncertain or unknown behaviour of respiratory organ	460	3.7	D70	Neutropenia	298	2.4
D70	Neutropenia	446	3.6	C787	Secondary malignant neoplasm of liver and intrahepatic bile duct	211	1.7
R509	Fever unspecified	432	3.5	A419	Sepsis	191	1.5
D649	Anaemia	280	2.2	C349	Malignant neoplasm of bronchus and lung	182	1.5
R53	Malaise and fatigue	274	2.2	C782	Secondary malignant neoplasm of pleura	181	1.4
J181	Lobar pneumonia	271	2.2	R11	Nausea and vomiting	155	1.2
R11	Nausea and vomiting	262	2.1	K566	Intestinal obstruction	152	1.2
K566	Other and unspecified intestinal obstruction	248	2.0	C786	Secondary malignant neoplasm of retroperitoneum/peritoneum	144	1.2
R060	Dyspnoea	242	1.9	C341	Malignant neoplasm of upper lobe, bronchus or lung	141	1.1
J90	Pleural effusion, not elsewhere classified	238	1.9	C711	Malignant neoplasm of frontal lobe	138	1.1
J22	Unspecified acute lower respiratory infection	234	1.9	R509	Fever	133	1.1
R074	Chest pain	179	1.4	D649	Anaemia, unspecified	127	1.0
R900	Intracranial space-occupying lesion found on diagnostic imaging of CNS	168	1.4	N179	Acute kidney failure	118	0.9
D486	Neoplasm of uncertain or unknown behaviour of breast	166	1.3	N390	Urinary tract infection	117	0.9
N390	Urinary tract infection	163	1.3	I500	Congestive heart failure	111	0.9
E86	Volume depletion	158	1.3	C9200	Acute myeloblastic leukaemia	104	0.8
C859	Non-Hodgkin lymphoma	144	1.2	C833	Diffuse large B cell lymphoma	103	0.8

Denominator n=12,434

*Percent of those assigned a primary diagnosis. Denominator=11,029

Table 5 Top five most prevalent primary cancers assigned to cancer-related inpatient episodes, by ED attendances and cancer individuals with an inpatient diagnosis

ICD-10 prefix	Description	Number of diagnoses[a]	Number of attendances[b]	Number of unique cases[c]	Mean (min, max)
C15-26	Malignant neoplasms of digestive organs	2596 (13.4)	2516 (22.8)	1678 (23.1)	1.50 (1, 9)
C30-39	Malignant neoplasms of respiratory and intrathoracic organs	1637 (8.5)	1610 (14.6)	1048 (14.4)	1.54 (1, 11)
C81-96	Malignant neoplasms of lymphoid, haematopoietic and related tissue	1525 (7.7)	1502 (13.6)	973 (13.4)	1.54 (1, 9)
C50	Malignant neoplasms of breast	736 (3.8)	733 (6.6)	466 (6.4)	1.57 (1, 10)
D37-48	Neoplasms of uncertain or unknown behaviour	588 (3.0)	545 (4.9)	407 (5.6)	1.34 (1, 10)

Data are number (%)

[a] Denominator is total number of cancer-related diagnoses, n=19,337

[b] Denominator is total cancer-related attendances with an IP diagnosis, n=11,029

[c] Denominator is total number of individual patients with cancer that received an IP diagnosis, n=7271

led to an inpatient admission, with longer hospital stays and lower rates of discharge home for those who survived. The high admission rate in our cancer group is considerably more than the 40–63 % reported by others [5, 7, 8, 12, 15]. Some report a high admission rate (72 %) for cancer patients during the final 2 weeks of life [2], those with neutropenia (100 %) [22, 23] and those recently undergoing chemotherapy treatment (88 %) [16]; however in our study, a primary diagnosis of cancer was frequently assigned to many people who had advanced cancer among other illnesses. This finding, together with a higher hospital mortality rate and older age group, reflects the likelihood that progression of disease and age-related comorbid conditions contributed to reasons for re-presentation and admission.

Other common primary diagnoses of a non-cancer nature included pneumonia and neutropenia, which often warrant hospital admission due to potential complications [24] and the need to administer antibiotics [4]. Symptoms experienced for people with cancer with these conditions included respiratory symptoms, fever and pain, which, together with neurological symptoms, collectively affected half (53 %) of the sample, similar to other studies [5, 8–10, 12]. In a systematic review of pain in people with cancer, as many as 50 % across all disease stages reported pain [25], with disease progression requiring pain control a common diagnosis [26].

Overall, our findings reveal that cancer-related attendances represent a more urgent, complex caseload by older patients requiring hospital admission compared with other ED presentations. The predictable trajectory of hospital admission after lengthy work-up suggests that alternative pathways of care, perhaps avoiding ED attendance altogether, may benefit many people with cancer and their receiving hospitals, although providing an alternative, high-quality service around the clock with access to senior specialist staff comparable to the ED would be challenging. Clinicians in emergency medicine, palliative care and oncology have previously called for improvements in access to hospital care, particularly for those with advanced cancer [27], but establishing these pathways may present significant practical difficulties.

Future research should explore the presenting complaints least likely to require admission or complex management, as well as the conditions leading to transfer to other facilities, death and failure to return home to enable more appropriate disposition for these patients. Further exploration of factors associated with long lengths of stay is also required as is mapping of the care trajectory through hospital and subsequent facilities; doing so may encourage patients to access alternate care facilities earlier in their disease.

Finally, future research must evaluate alternative care pathways for cancer patients with a focus on patient's needs' identification, staffing and economic implications, as well as satisfaction with care. Earlier recommendations for improved management of patients with cancer by providing acute oncology services within hospital EDs [28] have been successfully trialled by some groups, with significant reductions in inpatient admissions [29]. Nurse practitioner-led urgent care centres have also alleviated overcrowding of EDs by providing symptom management to cancer patients with non-urgent needs [30]. The multidisciplinary approach needed for optimum cancer care will involve a coordinated effort amongst various disciplines and cancer care settings that will ultimately result in high-quality care experiences for patients and families throughout their disease trajectory.

Limitations

The major strength of this study is the size of the dataset available for analysis. However, these data are retrospective and collected electronically through VEMD and VAED standard collection procedures for each hospital. Hospital-specific unique patient identification did not allow for inter-hospital patient linkage nor identification of re-presentations to other participating or indeed non-participating hospitals.

We cannot exclude the possibility of selection bias in the identification of cancer cases. Since there was no pre-existing variable, we relied on a combination of inpatient diagnoses, ED discharge diagnoses and ED triage free-text to make the cancer determination. This may have missed some cases. A large proportion (60 %) of cancer attendances were identified by inpatient diagnosis, potentially biasing towards the higher rate of admissions reported. However, admission rate remained high (72 %) amongst cancer attendances first identified in the ED. It should be noted that our data do not include patients that may be directly admitted by other departments, bypassing the ED, although this route is unusual in the hospitals sampled. This in itself may alter recorded admission rates.

Some patient visits requiring hospital admission resulted in multiple ICD-10 codes being assigned for IP discharge diagnoses. Chemotherapy status was unknown given the scale of the datasets, and we were unable to explore variations in cancer stage progression with frequency and duration of ED attendance, clinical symptoms and subsequent admission and hospital outcome. Nor were we able to detect which patients were diagnosed with cancer in the ED.

Data on treatment intent or cancer stage were not available, so we were unable to differentiate between relatively well patients on adjuvant chemotherapy and those with advanced cancer receiving palliative chemotherapy who were likely more unwell, with vastly different medical resource needs. There were also likely inaccuracies in a number of the clerical fields.

Conclusion

Cancer patients experience more urgent and complex care needs compared with non-cancer patients presenting to ED, reflected in a higher level of urgency and admission rate and longer length of inpatient stay. Understanding service use and the characteristics of patients with cancer is important in improving service delivery, managing clinical risk, identifying streamlined care pathways and educating clinicians. Future research should focus on closer collaboration and integration of oncology, palliative care and emergency medicine providers to improve pathways of care. Provided these pathways are in place, evaluation by clinicians based outside the ED may facilitate streamlined admissions.

Acknowledgments This study was supported financially by a grant from the Victorian Comprehensive Cancer Centre.

Conflict of interest The authors have no financial relationship with the funding agency and have no conflicts of interest to disclose. The authors have full control of all primary data and agree to allow the journal to review their data if requested.

Authorship contributions All authors contributed equally, and each was involved in study design, data acquisition or data analysis/interpretation and in drafting or critically revising the manuscript. All authors reviewed the final manuscript and gave approval for submission.

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