Supportive Care in Cancer (2018) 26:3951–3958
https://doi.org/10.1007/s00520-018-4274-2

ORIGINAL ARTICLE

Factors associated with discharge disposition on an acute palliative care unit

David Hausner[1,2] · Nanor Kevork[2] · Ashley Pope[2] · Breffni Hannon[1,2] · John Bryson[1,2] · Jenny Lau[2,3] · Gary Rodin[2,4,5] · Lisa W. Le[6] · Camilla Zimmermann[1,2,4,5]

Received: 19 February 2018 / Accepted: 15 May 2018 / Published online: 30 May 2018

Abstract

Purpose Acute palliative care units (APCUs) admit patients with cancer for symptom control, transition to community palliative care units or hospice (CPCU/H), or end-of-life care. Prognostication early in the course of admission is crucial for decision-making. We retrospectively evaluated factors associated with patients' discharge disposition on an APCU in a cancer center.

Methods We evaluated demographic, administrative, and clinical data for all patients admitted to the APCU in 2015. Clinical data included cancer diagnosis, delirium screening, and Edmonton Symptom Assessment System (ESAS) symptoms. An ESAS sub-score composed of fatigue, drowsiness, shortness of breath, and appetite (FDSA) was also investigated. Factors associated with patients' discharge disposition (home, CPCU/H, died on APCU) were identified using three-level multinomial logistic regression.

Results Among 280 patients, the median age was 65.5 and median length of stay was 10 days; 155 (55.4%) were admitted for symptom control, 65 (23.2%) for transition to CPCU/H, and 60 (21.4%) for terminal care. Discharge dispositions were as follows: 156 (55.7%) died, 63 (22.5%) returned home, and 61 (21.8%) were transferred to CPCU/H. On multivariable analysis, patients who died were less likely to be older (OR 0.97, $p = 0.01$), or to be admitted for symptom control (OR 0.06, $p < 0.0001$), and more likely to have a higher FDSA score 21–40 (OR 3.02, $p = 0.004$). Patients discharged to CPCU/H were less likely to have been admitted for symptom control (OR 0.06, $p < 0.0001$).

Conclusion Age, reason for admission, and the FDSA symptom cluster on admission are variables that can inform clinicians about probable discharge disposition on an APCU.

Keywords Cancer · Palliative care · Mortality · Symptom cluster · Patient discharge · Transitional care

Introduction

Acute palliative care units (APCUs) are inpatient units in cancer centers and other tertiary care facilities that are specialized in the management of complex physical and psychosocial symptoms [1]. Patients with cancer may be admitted to APCUs for symptom control, transition to hospice or to community palliative care units, or end-of-life care. Admissions to these units often serve as a juncture for decision-making and for the determination or revision of patients' goals of care. Prognostication early in the course of admission to APCUs and its review with patients and families are crucial for clinical management, discharge planning, and decision-making at the end of life [2].

There have been several retrospective studies describing predictors of inpatient mortality and discharge disposition on

✉ Camilla Zimmermann
camilla.zimmermann@uhn.ca

1 Division of Medical Oncology, Department of Medicine, University of Toronto, Toronto, Canada

2 Department of Supportive Care, Princess Margaret Cancer Centre, University Health Network, 610 University Ave., 16-712, Toronto, Ontario M5G 2M9, Canada

3 Division of Palliative Care, Department of Family and Community Medicine, University of Toronto, Toronto, Canada

4 Department of Psychiatry, University of Toronto, Toronto, Canada

5 Princess Margaret Cancer Research Institute, Princess Margaret Cancer Centre, University Health Network, Toronto, Canada

6 Department of Biostatistics, Princess Margaret Cancer Centre, University Health Network, Toronto, Canada

an APCU, although most originated from a single cancer center [3–6]. In one study, age < 65, admission from oncology unit, hypo- or hypernatremia, high blood urea nitrogen (BUN), high heart or respiration rates, and supplemental oxygen use were associated with death on the APCU [3]. In another study, mortality risk was associated with high baseline dyspnea and drowsiness, low baseline anxiety, and transfer from the emergency department [4]. In a third study, male gender, hematologic malignancy, and admission from other oncology units were associated with APCU mortality [6]. Smaller preliminary prospective studies have demonstrated similar predictors of death on an APCU, including higher education, overall symptom burden, delirium, hematologic malignancy, poor performance status, anorexia, dyspnea, edema, high BUN, low platelets, and clinician's prediction of low probability of discharge [7–9].

Although previous studies provide useful information about predictors of inpatient discharge disposition on an APCU, they do not account for all possible outcomes at discharge. Patients on APCUs may die on the unit, be discharged home, or be transferred to another facility. However, previous studies on APCUs have examined binary outcomes combining the category of transfer either with home discharge [3, 4, 6] or death on the APCU [6], or comparing home versus hospice discharge [5]. As well, the symptom cluster of fatigue, drowsiness, shortness of breath, and lack of appetite (FDSA) has been found to predict time to death in outpatient and inpatient samples [10–12] and may be an important predictor of discharge disposition. However, these symptoms have been examined as determinants of APCU discharge disposition only individually [9] or as part of a larger symptom scale [7], rather than as a distinct symptom cluster.

Our aim in this study was to evaluate factors associated with patients' discharge disposition. Specifically, we wished to examine the impact of the FDSA symptom cluster as well as other clinical and demographic characteristics.

Patients and methods

Study setting

The Princess Margaret Cancer Centre (PM) is a comprehensive cancer center, which is part of the University Health Network (UHN) in Toronto, Canada, and is affiliated with the University of Toronto. The 12-bed APCU at PM admits approximately 350 patients per year for an average stay of 10 days. Patients with advanced cancer are admitted to the APCU for pain and symptom control, terminal care, or transitional care to a community palliative care unit or hospice (CPCU/H). All patients admitted to the APCU must have a no cardio-pulmonary resuscitation (no CPR) code status; those with an estimated prognosis of more than 2 weeks are required to complete applications for CPCU/H, either before or immediately after admission [13].

Study design

This retrospective cohort study examined data for patients admitted to the APCU between January 1, 2015 and December 31, 2015. The main source of data was the APCU computerized database (FileMaker Pro 7, FileMaker, Inc., Santa Clara, CA), which records date and source of admission (home, emergency department, inpatient ward, or outpatient clinic), reason for admission (symptom control, transitional care, or terminal care), length of stay, and discharge destination (home, CPCU/H, acute care unit, or death on the APCU). The reason for admission is routinely specified by the palliative care physician who approves the patient for admission; this is generally the physician who has been following the patient in the inpatient or outpatient setting. If there were several reasons for admission, then the primary reason was used for this study. Symptom assessment scores were recorded on paper and then entered into the APCU database. In addition, the electronic patient record (EPR) provided demographic data such as date of birth, gender, cancer diagnosis, and date of diagnosis, as well as nurses' documentation of delirium screening.

Measures

The Edmonton Symptom Assessment System (ESAS) questionnaire is a valid, comprehensive tool for assessing the severity of the most common symptoms among patients with advanced cancer: pain, fatigue, drowsiness, nausea, anxiety, depression, appetite, dyspnea, and well-being, plus one blank scale for "other problem" as needed [14, 15]. Each symptom is scored on a 10-point scale with higher scores representing worse symptom severity. We used a revised, validated version, the ESAS-r-CS, which also includes constipation and insomnia and refers to the time window of "last 24 h" rather than "now" [16]. In the APCU, the ESAS-r-CS was completed routinely by the patients on admission, once a week (every Sunday morning) and before discharge.

The short confusion assessment method (CAM) is an instrument that is widely used to screen for delirium. It evaluates patients' cognition on four dimensions: acute onset of abnormal behavior, difficulty maintaining attention, evidence of disorganized thinking, and level of consciousness [17, 18]. In the presence of delirium, it is scored as positive. The short CAM has been validated in various clinical settings, including palliative care [19]. It was recorded by the nurses during each shift.

Statistical analysis

The ESAS distress score (EDS) was calculated by summing nine symptom intensity scores, excluding insomnia and constipation, and the ESAS total distress score (TDS) was calculated by summing all 11 symptom intensity scores [20, 21]. We also evaluated a sub-score composed of fatigue, drowsiness, shortness of breath, and appetite (FDSA), as these symptoms have been shown to be associated with shorter survival [10–12]. For cases in which the questionnaire was not completed fully, these scores were prorated, provided that a minimum of 50% of items in the respective category were answered [20]. Baseline EDS on admission was divided into three groups: low (0–30), mid (31–60), and high (61–90) [7], while baseline FDSA on admission was divided into two groups: low (0–20) and high (21–40). Missing scores on EDS and FDSA were kept as a separate category in the analysis because of the concern that they were not at random, and often occur in patients with poor outcome [7, 22]. The main outcome was discharge disposition, with three nominal levels: death, home, and CPCU/H. Patients discharged to acute care units represented a small minority ($n = 2$) and were therefore excluded from the study. A three-level multinomial logistic model was used to identify factors associated with patients' discharge disposition. All variables with overall p value < 0.10 on univariable logistic regression were included in a stepwise selection, and those variables with $p < 0.05$ were included in the final multivariable model. The statistical analysis was carried out using SAS v9.4 (Cary, NC).

Results

Study sample characteristics

There were 308 admissions in the year 2015, representing 282 unique patients; two patients were excluded because they were discharged to acute care units, leaving 280 patients in the sample. For the analysis, we used one record (the most recent admission) per patient. Patients' characteristics are shown in Table 1. The median age was 65.5, and the most prevalent cancer sites were gastrointestinal (24.6%) and lung (21.1%). One hundred and nine patients (38.9%) were admitted from an inpatient ward: 93 (33.2%) directly from home, 67 (23.9%) from palliative care or oncology outpatient clinics at PM, and 11 (3.9%) from the emergency department or intensive care unit at UHN. Patients' dispositions at discharge were as follows: 156 (55.7%) died on the unit, 63 (22.5%) returned home, and 61 (21.8%) were transferred to CPCU/H. The median length of stay on the APCU was 10 days for the whole sample: 8 days for those who died on the unit, 11 days for those who returned home, and 15 days for those who were transferred to CPCU/H.

Clinical measurements

Of 280 patients, ESAS results were available for 206 (73.6%). Mean TDS and EDS scores were 49.9 and 41.2, respectively. Of the 280 patients, 143 (51.1%) had EDS 31–60, 46 (16.4%) had EDS 0–30, and 17 (6.1%) had EDS 61–90 (Table 1). Those with a missing ESAS (74, 26.4%) had a shorter length of stay (median 6 vs 13 days) and a higher death rate (68.1 vs 51.4%). EDS and FDSA scores were highly correlated: patients with EDS score of 0–30 had also FDSA score of 0–20 (45 patients, 97.8%) and all patients with the highest symptom burden of EDS 61–90 (17 patients, 100%) had FDSA score 21–40.

Discharge disposition according to reason for admission, FDSA, and CAM is described in Table 2. Overall, 155 patients (55.4%) were admitted for symptom control, 65 patients (23.2%) were admitted for transition to CPCU/H, and 60 patients (21.4%) were admitted for terminal care. Of patients admitted for symptom control, 57 (36.8%) were discharged home, compared to only 5% of those admitted for transition and terminal care, respectively. Of the 65 patients admitted for transition, 21 (32%) were transferred to CPCU/H, while 41 (63%) died on the unit and 3 (5%) were discharged home. Of the 60 patients admitted for terminal care, 52 (87%) died on the APCU, while 3 (5%) and 5 (8%) were discharged home and transferred to CPCU/H, respectively.

Of the total sample, 97 (35%) had FDSA 0–20, 110 (39%) FDSA 21–40, and 73 (26%) had missing FDSA scores (Table 2). Of those with FDSA 0–20, 33% were discharged home, while this was the case for only 18% with FDSA 21–40 and 15% of those with missing data. Of those with FDSA 21–40, 60% died on the unit, while this was the case for 41% with FDSA 0–20 and 69% of those with missing data. Thirty patients (10.7%) were diagnosed with delirium during their admission. Twenty-two (73.3%) died on the unit, 6 (20%) were discharged to CPCU/H, and 2 (6.6%) returned home (Table 2).

Predictors of discharge disposition

Results of the univariable analysis are shown in Table 3. Older patients were less likely to die on the unit than to be discharged home. As well, patients admitted from an inpatient ward were more likely to die on the unit or to be transferred to CPCU/H. Patients admitted for symptom control were more likely to be discharged home than die on the unit or be transferred to CPCU/H. Patients with a positive CAM score were more likely to die on the unit than to be discharged home. Patients with high symptom burden (FDSA score 21–40 or EDS score 31–60), and those with missing EDS and FDSA scores, were more likely to die on the unit than be discharged home, compared to patients with lower scores.

The results of the multivariable analysis are shown in Table 4. Discharge home was set first as the reference.

Table 1 Patient characteristics

Characteristic	*N* (%)
Gender	
Female	131 (46.8)
Male	149 (53.2)
Age in years, median (range)	65.5 (19.0–96.0)
Cancer diagnosis	
Gastrointestinal	69 (24.6)
Lung	59 (21.1)
Genitourinary	32 (11.4)
Gynecologic	31 (11.1)
Hematologic	26 (9.3)
Breast	20 (7.1)
Head and neck	12 (4.3)
Other[a]	31 (11.1)
Source of admission to APCU	
Inpatient ward	109 (38.9)
Home	93 (33.2)
Outpatient clinic	67 (23.9)
Emergency department or intensive care unit	11 (3.9)
Reason for admission to APCU	
Symptom control	155 (55.4)
Transitional care	65 (23.2)
Terminal care	60 (21.4)
Length of stay in days, median (range)	10 (1.0–105.0)
Discharge disposition	
Died on APCU	156 (55.7%)
Home	63 (22.5%)
Community palliative care unit/hospice	61 (21.8%)
ESAS scores	
TDS (mean ± SD)[b]	49.9 ± 16.9
EDS (mean ± SD)[c]	41.2 ± 14.8
EDS 0–30	46 (16.4%)
EDS 31–60	143 (51.1%)
EDS 61–90	17 (6.1%)
EDS missing	74 (26.4%)
FDSA (mean ± SD)[d]	21.5 ± 8.5
FDSA 0–20	97 (34.6%)
FDSA 21–40	110 (39.3%)
FDSA missing	73 (26.1%)
Delirium screening[e]	
CAM negative	250 (89.3%)
CAM positive	30 (10.7%)

APCU acute palliative care unit; *ESAS* Edmonton Symptom Assessment System; *TDS* total distress score; *EDS* ESAS distress score; *FDSA* ESAS subscore composed of the items fatigue, drowsiness, shortness of breath, and appetite; *CAM* short confusion assessment method

[a] Other disease sites: central nervous system, endocrine, sarcoma, skin, unknown primary

[b] TDS is calculated by summing all ESAS-r-CS items. TDS range is 0–110, with higher numbers representing worse symptom severity

[c] EDS is calculated by summing all items except constipation and sleep. EDS range is 0–90, with higher numbers representing worse symptom severity

[d] FDSA range is 0–40, with higher numbers representing worse symptom severity

[e] A positive CAM score indicates the presence of delirium

Table 2 Discharge disposition according to reason for admission and clinical data

Characteristic	Discharge disposition			
	Died	Home	CPCU/H	Total
Reason for admission				
Symptom control	63 (40.6%)	57 (36.8%)	35 (22.6%)	155
Transition	41 (63.1%)	3 (4.6%)	21 (32.3%)	65
Terminal care	52 (86.7%)	3 (5.0%)	5 (8.3%)	60
FDSA[a]				
FDSA 0–20	40 (41.2%)	32 (33.0%)	25 (25.8%)	97
FDSA 21–40	66 (60.0%)	20 (18.2%)	24 (21.8%)	110
Missing	50 (68.5%)	11 (15.1%)	12 (16.4%)	73
CAM[b]				
CAM positive	22 (73.3%)	2 (6.6%)	6 (20%)	30
CAM negative	134 (53.6%)	61 (24.4%)	55 (22.0%)	250
Total	156	63	61	280

CPCU/H community palliative care unit or hospice; *FDSA* ESAS sub-score composed of the items fatigue, drowsiness, shortness of breath, and appetite; *CAM* short confusion assessment method

[a] FDSA range is 0–40, with higher numbers representing worse symptom severity

[b] A positive CAM score indicates the presence of delirium

Compared to patients who were discharged home, those who died on the APCU were less likely to be older (OR 0.97, $p = 0.01$), or to be admitted for symptom control (OR 0.06, $p < 0.0001$), and more likely to have a higher FDSA score 21–40 (OR 3.02, $p = 0.004$). Compared with patients who were discharged home, those who were discharged to CPCU/H were less likely to have been admitted for symptom control (OR 0.06, $p < 0.0001$). When CPCU/H was set as the reference, those who died on the APCU were less likely to be older (OR 0.97, $p = 0.01$) and more likely to have been admitted for terminal care (OR 5.44, $p = 0.002$).

Discussion

In this retrospective analysis, we found that age, reason for admission, and symptom burden were significant predictors of patient outcome on the APCU. Specifically, younger patients were more likely to die on the APCU than to be discharged home or to be transferred to CPCU/H. Patients who were admitted for symptom control were most likely to be discharged home, whereas those admitted for terminal care were most likely to die on the APCU. Additionally, the FDSA symptom cluster was a strong predictor of death on the APCU.

In the current study, younger age was associated with increased mortality on the APCU. This finding is in keeping with other studies that have shown a greater likelihood of hospital death among younger cancer patients, in APCU [3] or in acute care settings [23]. In contrast, two studies found an association between younger age and discharge home [5, 6]. However, one of these studies evaluated home discharge versus hospice discharge and excluded those who died [5], while the other used non-home discharge as the comparator (including those who were transferred to hospices or other institutions as well as those who died) [6]. There are several possible reasons for increased death on the APCU among younger patients. These patients, as well as their family members, often have complex psychosocial needs which may be best met in an inpatient APCU setting [24, 25]. As well, the focus for younger patients is often on prolonging life, resulting in more aggressive care at the end of life and later referrals to palliative care [23, 26, 27]. Barriers to referral for this population include misperceptions of the meaning and role of palliative care, difficulties discussing end-of-life issues, and a reluctance to increase the number of health care providers [24, 25, 28]. Thus, young patients may be admitted at a more advanced stage to APCUs and not have enough time to plan for a death outside the hospital. Further research is warranted to characterize palliative care in younger patient populations and determine the role of age in patients' outcomes.

The reason for admission indicated in our administrative database was also predictive of discharge disposition. Similar results were found in a prospective study on an Austrian APCU. In this study, the head nurse of the APCU or the palliative care physician in charge estimated immediately upon admission whether the patient would be discharged or would die on the unit [8]. These assessments were highly

Table 3 Univariable analysis of factors associated with discharge disposition

Variable[a]	CPCU/H vs. home		Died vs. home		Died vs. CPCU/H		Overall *p*
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*	
Age	1.00 (0.97–1.03)	1.00	0.97 (0.95–0.995)	0.02	0.97 (0.95–0.995)	0.02	0.01
Gender, female	1.68 (0.82–3.41)	0.15	1.22 (0.68–2.21)	0.51	7.30 (0.40–1.32)	0.29	0.35
Source of admission to APCU							< 0.0001
Inpatient ward vs. home	5.00 (1.96–12.79)	0.0008	7.21 (3.24–16.01)	< 0.0001	1.44 (0.69–3.01)	0.08	
Outpatient clinics vs. home	2.45 (1.01–5.93)	0.05	1.96 (0.93–4.13)	0.08	0.80 (0.36–1.79)	0.29	
Reason for admission to APCU							0.03
Symptom control vs. transition	0.09 (0.02–0.32)	0.0002	0.08 (0.02–0.28)	< 0.0001	0.92 (0.47–1.80)	0.81	
Terminal care vs. transition	0.24 (0.04–1.55)	0.13	1.27 (0.24–6.62)	0.78	5.33 (1.85–15.34)	0.002	
Delirium screening							0.09
CAM positive[b]	3.33 (0.65–17.17)	0.15	5.01 (1.14–21.97)	0.03	1.51 (0.58–3.91)	0.40	
EDS[c]							0.02
EDS 31–60 vs 0–30	1.29 (0.54–3.08)	0.56	3.06 (1.36–6.88)	0.007	2.36 (1.03–5.45)	0.04	
EDS 61–90 vs 0–30	0.73 (0.15–3.60)	0.70	2.04 (0.56–7.45)	0.28	2.80 (0.63–12.50)	0.18	
EDS missing vs 0–30	1.33 (0.45–3.91)	0.61	5.26 (2.03–13.62)	0.0006	3.97 (1.52–10.38)	0.005	
FDSA[d]							0.005
FDSA 21–40 vs 0–20	1.54 (0.70–3.39)	0.29	2.64 (1.33–5.23)	0.005	1.72 (0.87–3.41)	0.12	
FDSA missing vs 0–20	1.40 (0.53–3.69)	0.50	3.64 (1.63–8.10)	0.002	2.60 (1.17–5.82)	0.02	

CPCU/H community palliative care unit or hospice; *APCU* acute palliative care unit; *CAM* short confusion assessment method; *EDS* ESAS distress score; *FDSA* ESAS sub-score composed of the items fatigue, drowsiness, shortness of breath, and appetite

[a] Cancer diagnosis was not significant in affecting discharge disposition

[b] A positive CAM score indicates the presence of delirium

[c] EDS is calculated by summing all items except constipation and sleep. EDS range is 0–90, with higher numbers representing worse symptom severity

[d] FDSA range is 0–40, with higher numbers representing worse symptom severity

predictive of discharge disposition. In our study, the reason for admission selected by the palliative care physician approving the admission may be considered analogous to a rough clinical prediction of discharge disposition. Those admitted for terminal care were expected to die on the APCU, those admitted for transitional care were expected to be transferred to CPCU/H, and those admitted for symptom control were generally expected to return home. Indeed, close to 90% of admissions for terminal care died on the APCU. However, only one third of patients admitted for transition were transferred to CPCU/H (the majority died on the APCU), and 37% of patients admitted for symptom control were discharged home (41% died on the APCU and 23% were transferred to CPCU/H). These results likely reflect a number of factors, including difficulty

Table 4 Multivariable analysis of factors associated with discharge disposition

Variable	CPCU/H vs. home		Died vs. home		Died vs. CPCU/H		Overall *p*
	OR (95% CI)	*p*	OR (95% CI)	*p*	OR (95% CI)	*p*	
Age	1.00 (0.97–1.03)	0.77	0.97 (0.94–0.99)	0.01	0.97 (0.95–0.99)	0.01	0.008
Reason for admission to APCU							< 0.0001
Symptom control vs. transition	0.06 (0.02–0.25)	< 0.0001	0.06 (0.02–0.23)	< 0.0001	0.98 (0.47–2.05)	0.96	
Terminal care vs. transition	0.24 (0.04–1.58)	0.14	1.31 (0.25–6.94)	0.75	5.44 (1.85–15.97)	0.002	
FDSA[a]							0.03
FDSA 21–40 vs 0–20	1.73 (0.76–3.91)	0.19	3.02 (1.43–6.39)	0.004	1.75 (0.86–3.57)	0.12	
FDSA missing vs 0–20	0.59 (0.19–1.82)	0.36	1.18 (0.44–3.13)	0.75	1.99 (0.82–4.84)	0.13	

CPCU/H community palliative care unit or hospice; *APCU* acute palliative care unit; *FDSA* ESAS sub-score composed of the items fatigue, drowsiness, shortness of breath, and appetite

[a] FDSA range is 0–40, with higher numbers representing worse symptom severity

prognosticating in this population [29]; the lack of efficient access to CPCU/H beds, particularly for patients with complex needs [30]; and the challenges of managing patients with advanced illness at home, particularly without an able primary caregiver [5].

In our study, patients who had a higher FDSA symptom cluster were more likely to die on the unit than to return home. Previous studies on APCUs have shown that overall symptom burden as expressed by ESAS distress score is correlated with inpatient mortality [7]. However, it has also been shown both in an outpatient setting [10] and on an APCU [11] that fatigue, drowsiness, lack of appetite, and dyspnea increase in severity closer to death, while other symptoms tend to remain stable. Although the overall ESAS distress score was also associated with death on the APCU in our sample, the FDSA score demonstrated a stronger association. Further prospective studies are warranted to confirm the role of FDSA symptom cluster in the setting of an APCU.

Limitations of this study include that it was based on data from a single center, which may limit generalizability to other APCUs. The study's retrospective design precluded prospective assessment of changes in symptoms and performance status over time, which may predict outcomes more reliably than a single score at admission [31]. Only 10% of patients screened positive for delirium, despite the death rate of 56%. This incidence of delirium is lower compared to other APCU studies that reported lower death rate [4, 32], and calls into question the sensitivity of the CAM delirium screening tool. Lastly, there were missing ESAS data for 26% of patients on admission. Missing data are common in studies of patients on APCUs: in one prospective study, 21% of patients had missing ESAS scores on admission [7] and in another, the ESAS was partially completed by 20% of patients and not completed by a further 29% during the first week of admission [33]. In our study, patients with missing ESAS had a shorter length of stay and a higher death rate, indicating that most of them were likely too ill to complete patient-reported measures. To avoid bias from excluding those with missing data, we included "missing" as a category in the univariable and multivariable analyses. Future studies in the setting of an APCU should continue to take into consideration missing data of patients' self-reported symptoms.

In conclusion, age, reason for admission, and symptom burden on admission are variables that can inform clinicians about probable discharge disposition. Fatigue, drowsiness, shortness of breath, and appetite comprise a unique symptom cluster that predicts greater likelihood of inpatient death and will need further validation. This information may be used as a guide to minimize futile treatments, make discharge plans, and inform conversations with patients and families. Further prospective studies are needed in order to address predictive variables over time and to establish prognostic models in the APCU setting.

Funding information This research was funded by the Canadian Institutes of Health Research (CIHR grant no. 152996; CZ) and the Ontario Ministry of Health and Long Term Care. Dr. Zimmermann is supported by the Rose Family Chair in Palliative Medicine and Supportive Care, Faculty of Medicine, University of Toronto.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Von Gunten CF (2002) Secondary and tertiary palliative care in US hospitals. JAMA 287(7):875–881
2. Glare PA, Sinclair CT (2008) Palliative medicine review: prognostication. J Palliat Med 11(1):84–103. https://doi.org/10.1089/jpm.2008.9992
3. Elsayem A, Mori M, Parsons HA et al (2010) Predictors of inpatient mortality in an acute palliative care unit at a comprehensive cancer center. Support Care Cancer 18(1):67–76. https://doi.org/10.1007/s00520-009-0631-5
4. Mori M, Parsons HA, la Cruz M et al (2011) Changes in symptoms and inpatient mortality: a study in advanced cancer patients admitted to an acute palliative care unit in a comprehensive cancer center. J Palliat Med 14(9):1034–1041. https://doi.org/10.1089/jpm.2010.0544
5. Fainsinger RL, Demoissac D, Cole J, Mead-Wood K, Lee E (2000) Home versus hospice inpatient care: discharge characteristics of palliative care patients in an acute care hospital. J Palliat Care 16(1):29–34
6. Hui D, Elsayem A, Palla S, De La Cruz M et al (2010) Discharge outcomes and survival of patients with advanced cancer admitted to an acute palliative care unit at a comprehensive cancer center. J Palliat Med 13(1):49–57. https://doi.org/10.1089/jpm.2009.0166
7. Hui D, Kilgore K, Fellman B et al (2012) Development and cross-validation of the in-hospital mortality prediction in advanced cancer patients score: a preliminary study. J Palliat Med 15(8):902–909. https://doi.org/10.1089/jpm.2011.0437
8. Masel EK, Huber P, Schur S, Kierner KA, Nemecek R, Watzke HH (2015) Coming and going: predicting the discharge of cancer patients admitted to a palliative care unit: easier than thought? Support Care Cancer 23(8):2335–2339. https://doi.org/10.1007/s00520-015-2601-4
9. Ohde S, Hayashi A, Takahasi O et al (2011) A 2-week prognostic prediction model for terminal cancer patients in a palliative care unit at a Japanese general hospital. Palliat Med 25(2):170–176. https://doi.org/10.1177/0269216310383741
10. Cheung WY, Barmala N, Zarinehbaf S, Rodin G, Le LW, Zimmermann C (2009) The association of physical and psychological symptom burden with time to death among palliative cancer outpatients. J Pain Symptom Manage 37(3):297–304. https://doi.org/10.1016/j.jpainsymman.2008.03.008
11. Hui D, dos Santos R, Chisholm GB, Bruera E (2015) Symptom expression in the last seven days of life among cancer patients admitted to acute palliative care units. J Pain Symptom Manage 50(4):488–494. https://doi.org/10.1016/j.jpainsymman.2014.09.003
12. Seow H, Barbera L, Sutradhar R et al (2011) Trajectory of performance status and symptom scores for patients with cancer during the last six months of life. J Clin Oncol 29(9):1151–1158. https://doi.org/10.1200/JCO.2010.30.7173

13. Bryson J, Coe G, Swami N et al (2010) Administrative outcomes five years after opening an acute palliative care unit at a comprehensive cancer center. J Palliat Med 13(5):559–565. https://doi.org/10.1089/jpm.2009.0373
14. Bruera E, Kuehn N, Miller MJ, Selmser P, Macmillan K (1991) The Edmonton Symptom Assessment System (ESAS): a simple method for the assessment of palliative care patients. J Palliat Care 7(2):6–9
15. Watanabe SM, Nekolaichuk CL, Beaumont C (2012) The Edmonton Symptom Assessment System, a proposed tool for distress screening in cancer patients: development and refinement. Psychooncology 21(9):977–985. https://doi.org/10.1002/pon.1996
16. Hannon B, Dyck M, Pope A et al (2015) Modified Edmonton Symptom Assessment System including constipation and sleep: validation in outpatients with cancer. J Pain Symptom Manag 49(5):945–952. https://doi.org/10.1016/j.jpainsymman.2014.10.013
17. Inouye SK, van Dyck CH, Alessi CA, Balkin S, Siegal AP, Horwitz RI (1990) Clarifying confusion: the confusion assessment method. A new method for detection of delirium. Ann Intern Med 113(12):941–948
18. Wong CL, Holroyd-Leduc J, Simel DL, Straus SE (2010) Does this patient have delirium? Value of bedside instruments. JAMA 304(7):779–786. https://doi.org/10.1001/jama.2010.1182
19. Ryan K, Leonard M, Guerin S, Donnelly S, Conroy M, Meagher D (2009) Validation of the confusion assessment method in the palliative care setting. Palliat Med 23(1):40–45. https://doi.org/10.1177/0269216308099210
20. Follwell M, Burman D, Le LW et al (2009) Phase II study of an outpatient palliative care intervention in patients with metastatic cancer. J Clin Oncol 27(2):206–213. https://doi.org/10.1200/JCO.2008.17.7568
21. Zimmermann C, Burman D, Follwell M et al (2010) Predictors of symptom severity and response in patients with metastatic cancer. Am J Hosp Palliat Med 27(3):175–181. https://doi.org/10.1200/JCO.2008.17.7568
22. Palmer JL (2004) Analysis of missing data in palliative care studies. J Pain Symptom Manag 28(6):612–618. https://doi.org/10.1016/j.jpainsymman.2004.02.026
23. Grendarova P, Sinnarajah A, Trotter T, Card C, Wu JSY (2015) Variations in intensity of end-of-life cancer therapy by cancer type at a Canadian tertiary cancer centre between 2003 and 2010. Support Care Cancer 23(10):3059–3067. https://doi.org/10.1007/s00520-015-2676-y
24. Pritchard S, Cuvelier G, Harlos M, Barr R (2011) Palliative care in adolescents and young adults with cancer. Cancer 117(SUPPL. 10):2323–2328. https://doi.org/10.1002/cncr.26044
25. Wein S, Pery S, Zer A (2010) Role of palliative care in adolescent and young adult oncology. J Clin Oncol 28(32):4819–4824. https://doi.org/10.1200/JCO.2009.22.4543
26. Hashimoto K, Yonemori K, Katsumata N et al (2009) Factors that affect the duration of the interval between the completion of palliative chemotherapy and death. Oncologist 14(7):752–759. https://doi.org/10.1634/theoncologist.2008-0257
27. Randén M, Helde-Frankling M, Runesdotter S, Strang P (2013) Treatment decisions and discontinuation of palliative chemotherapy near the end-of-life, in relation to socioeconomic variables. Acta Oncol (Madr) 52(6):1062–1066. https://doi.org/10.3109/0284186X.2012.758872
28. Wentlandt K, Krzyzanowska MK, Swami N et al (2014) Referral practices of pediatric oncologists to specialized palliative care. Support Care Cancer 22(9):2315–2322. https://doi.org/10.1007/s00520-014-2203-6
29. Bruera S, Chisholm G, Dos Santos R, Bruera E, Hui D (2015) Frequency and factors associated with unexpected death in an acute palliative care unit: expect the unexpected. J Pain Symptom Manag 49(5):822–827. https://doi.org/10.1016/j.jpainsymman.2014.10.011
30. Towns K, Dougherty E, Kevork N et al (2012) Availability of services in Ontario hospices and hospitals providing inpatient palliative care. J Palliat Med 15(5):527–534. https://doi.org/10.1089/jpm.2011.0453
31. Hung CY, Wang HM, Kao CY et al (2014) Magnitude of score change for the palliative prognostic index for survival prediction in patients with poor prognostic terminal cancer. Support Care Cancer 22(10):2725–2731. https://doi.org/10.1007/s00520-014-2274-4
32. De la Cruz M, Ransing V, Yennu S et al (2015) The frequency, characteristics, and outcomes among cancer patients with delirium admitted to an acute palliative care unit. Oncologist 20(12):1425–1431. https://doi.org/10.1634/theoncologist.2015-0115
33. Modonesi C, Scarpi E, Maltoni M et al (2005) Impact of palliative care unit admission on symptom control evaluated by the Edmonton symptom assessment system. J Pain Symptom Manag 30(4):367–373