

What Determines the Final Place of Care of Advanced Cancer Patients Receiving Integrated Home-based Palliative Care?: a Retrospective Cohort Study

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Abstract

Background

Meeting patients' preferences for place of care at the end-of-life is an indicator of quality palliative care. Understanding the elements required for terminal care within an integrated model may inform policy and practice to increase the likelihood of meeting preferences. Hence, this study aims to identify factors associated with the final place of care of advanced cancer patients receiving integrated home-based palliative care.

Methods

This retrospective cohort study included deceased adult advanced cancer patients enrolled into the home-based service from January 2016-December 2018. Patients with <2 weeks enrolment or ≤ 1 -week duration at the final place of care were excluded. Independent variables included patients' and families' characteristics, care preferences, healthcare utilization, functional status and symptom severity assessed using the Palliative Performance Scale (PPSv2) and the Edmonton Symptom Assessment System respectively. The dependent variable was the final place of care. Multivariate logistic regression identified independent determinants and Kappa value evaluated goal-concordance.

Results

Of the 359 eligible patients, home was the most common final place of care (58.2%), followed by inpatient hospice (23.7%) and hospital (16.7%). Single or divorced patients with older family caregivers had a 5.5 (95% CI:1.1-27.8) and 3.1 (95% CI:1.1-8.8) odds respectively of receiving terminal care in inpatient hospice. A PPSv2 $\geq 40\%$ and pain score ≥ 2 increased the odds by 9.1 (95% CI:3.3-24.8) and 3.6 (95% CI:1.3-9.8) times respectively, while non-home death preference increased it by 23.8 (95% CI:5.4-105.1) times. In predicting hospitalization, males had a 3.2 (95% CI:1.0-9.9) odds while a PPSv2 $\geq 40\%$ and pain score ≥ 2 increased the odds by 8.6 (95% CI:2.9-26.0) and 3.5 (95% CI:1.2-10.3) times respectively. Non-home death preference increased it by 9.8 (95% CI:2.1-46.3) times, all $p < 0.05$. Goal-concordance was fair (72.6%, kappa=0.39).

Conclusions

Higher functional status, greater pain intensity and non-home death preference predicted institutionalization as the final place of care. Additionally, single or divorced patients with older family caregivers were more likely to receive terminal care in inpatient hospice while males were more likely to be hospitalized. Despite an integrated care model, goal-concordance was suboptimal. More comprehensive community networks and resources, better pain control and personalized care planning discussions are recommended. Future research could examine factors in non-cancer patients.

Background

Providing quality palliative care is paramount for relieving the suffering and improving the quality of life of patients facing life-threatening illnesses.⁽¹⁾ Meeting patients' preferences for place of death is an indicator of quality palliative care⁽²⁾ which requires an awareness of patients and families' preferences through care planning discussions.⁽³⁾ Many individuals prefer to be cared for and die in the comfort and familiarity of their homes^(4, 5) but most do not do so.^(6, 7) A systematic review broadly categorized place of death determinants of advanced cancer patients into individual, illness-related and environmental factors. Home death preference, low functional status, staying with relatives, extended family support, availability and intensity of homecare services were strongly associated with home death.⁽⁸⁾ Besides providing support for patients' physical and psychosocial needs, home-based palliative care coordinates referrals to support services, reducing unnecessary care setting transitions at the end-of-life,⁽⁹⁾ thus increasing the likelihood of home death.^(10, 11) However, home death may not be suitable for everyone.⁽¹²⁻¹⁵⁾ Inadequately controlled symptoms and acute reversible events may require management in hospitals.^(4, 11, 14, 16-20) Some patients may also not wish to burden families with their care at home^(4, 5, 16, 21) due to the substantial opportunity and societal costs involved.^(20, 22, 23) The quality and sustainability of care at home may be affected⁽⁸⁾ when the dying trajectory is protracted and care demands increase beyond families' capacity to cope.^(13, 24) Additionally, there may be cultural and religious misgivings about dying at home and concerns about traumatizing children.⁽⁴⁾

An integrated palliative care model that coordinates all the services involved in patient's care can prevent care fragmentation amidst unavoidable care setting transitions.^(25, 26) In Singapore, such a model was established which consists of a home-based specialist palliative care team collaborating closely with a tertiary hospital and inpatient hospice. Direct admission to the hospital and inpatient hospice can be activated quickly to facilitate transitions when required. Patients can choose where they want to be cared for and die from the variety of care settings within the model.^(24, 26) Their medical records are accessible to all healthcare professionals involved in their care, ensuring care continuity even as they transit between settings. Additionally, the home-based team reviews patients regularly so that advance care arrangements can be made in anticipation of potential crises.⁽²⁶⁾

However, evidence on integrated care is scarce,^(27, 28) with studies commonly evaluating its effectiveness in facilitating home death instead of examining factors associated with the place of death.^(20, 29-31) Place of death outcomes are usually differentiated based on the setting's care focus⁽¹⁰⁾ or institutional nature^(13, 24, 32) even though home, inpatient hospice and hospital differ in purpose and should be examined separately. Additionally, exploring determinants associated with the final place of care where patients were cared for more than a week before dying may be more meaningful,⁽³³⁾ as healthcare setting transitions occurring in the last week of life affect the care quality of advanced cancer patients negatively.⁽³⁴⁾ However, existing studies focused on place of death and not the final place of care.^(8, 10, 11, 13, 24, 32) Understanding the elements and infrastructure required to care for patients at the different settings within the model at the end-of-life may inform practice and policy to improve the likelihood of meeting patients' preferences. Hence, this study aims to primarily determine factors associated with

home, inpatient hospice and hospital as the final place of care among advanced cancer patients receiving home-based palliative care within an integrated care model. Additionally, goal-concordance is an important outcome that has rarely been evaluated⁽³⁾ and families' support for patients' preferences is vital.⁽⁸⁾ Hence, the secondary aim is to determine goal-concordance and the congruence between patients and families' wishes.

Methods

This is a retrospective cohort study approved by the institutional review board. The need for informed consent was waived.

Patient population

Deceased adult advanced cancer patients (age ≥ 21 years) enrolled into the home-based palliative care service from January 2016 to December 2018 were included. Patients with less than two weeks enrolment duration or those who spent less than or a week at the final place of care were excluded.

Independent variables

Independent variables were selected based on literature review.^(8, 10, 11, 13, 24) These included patients' sociodemographic, clinical factors, family caregiver characteristics, place of care and death preferences, healthcare utilization, functional status and symptom severity assessed within two weeks before death or admission to the final place of care. The number and severity of comorbidities were captured using the Charlson comorbidity index which is a nineteen-category scale, weighted from one to six points. Higher scores indicate poorer survival.⁽³⁵⁾ Functional status was assessed by the home-based team during routine home visits using the validated Palliative Performance Scale v2 (PPSv2) which ranges from 0% (death) to 100% (normal function).^(36, 37) Symptom severity was measured using the Edmonton Symptom Assessment System (ESASr), a psychometrically tested tool ranging from 0 (no symptom) to 10 (worst). The overall symptom burden was obtained from the summation of individual scores.^(38, 39)

Dependent variable

The dependent variable was the final place of care which included the three care settings (home, inpatient hospice, hospital) within the integrated care model.⁽²⁶⁾

Other data

Documentation related to reasons for admission to inpatient hospice or hospital as the final place of care were extracted to augment the quantitative measures. However, their qualitative analysis will be undertaken and reported separately. Post-bereavement measures such as duration at the final place of care, families' acceptance of death and bereavement support required were also collected.

Data source

All the data were routine clinical documentation obtained from the electronic medical records of the home-based palliative care service.

Statistical analysis

Variables were summarized using descriptive statistics. Continuous variables were reported as median with interquartile range and mean with standard deviation while categorical variables were reported as frequencies with percentages.

Factors associated with the final place of care

Kruskal-Wallis test was used for the bivariate analysis of continuous variables with the final place of care due to the non-normality of data distribution while categorical variables were compared using chi-square test. Manual post-hoc analysis was performed to determine pairs of groups that were significantly different from each other. With three pair-wise comparisons, the p-value was adjusted to 0.017 with Bonferroni correction to control for Type 1 error.

Statistically significant variables from post-hoc analysis were then shortlisted for multivariate regression. Variables with high collinearity, categorical variables with low frequencies, symptom scores that were too low for meaningful interpretation and variables with overlapping concepts were excluded.

For ease of interpretation and applicability, continuous variables were transformed into categorical variables based on their median values while multi-categorical variables were collapsed into two based on conceptual similarities (Appendix Tables A1 and A2).

Multivariate binomial models were initially run separately to predict inpatient hospice and hospital as the final place of care with home as the reference category. Statistically significant variables were then entered into multinomial models to identify factors independently associated with the final place of care. The Hosmer-Lemeshow test assessed the goodness-of-fit of the models. Predictive accuracy, clinical relevance and Akaike and Bayesian Information Criteria further guided model selection.⁽⁴⁰⁾

Goal-concordance and congruence

Goal-concordance and congruence between patients and families' preferences were determined using the Kappa measure of agreement. A Kappa value < 0.2 indicates slight agreement while values ranging from 0.2–0.4, 0.4–0.6 and 0.6–0.8 indicate fair, moderate and substantial agreement respectively. Almost perfect agreement is reached with a value > 0.8.⁽⁴¹⁾

All statistical analyses were performed using SPSS, version 25 (IBM Corp, New York). Statistical significance was set at $p < 0.05$ except in cases with Bonferroni adjustment.

Results

Background characteristics

From January 2016 to December 2018, 540 advanced cancer patients were enrolled and deceased. Enrolment duration was < 2 weeks for 47 patients while 131 patients spent \leq 1 week at the final place of care. Three patients were excluded because of missing data. Among the included patients (N = 359), home was the most common final place of care (58.2%), followed by inpatient hospice (23.7%), hospital (16.7%) and nursing home (1.4%) (Fig. 1). The background characteristics of included and excluded patients (N = 181) are shown in Table 1.

Table 1
Comparison of background characteristics of included and excluded patients

Variables	Included patients (N = 359)	Excluded patients (N = 181)	P-value
Age (years)			
Median (IQR)	77 (67–84)	71 (63–80)	
Mean (SD)	75.3 (11.7)	71.2 (11.8)	< 0.0001
Gender			
Male	184 (51.3)	113 (62.4)	
Female	175 (48.7)	68 (37.6)	0.018
Ethnicity			
Chinese	312 (86.9)	169 (93.4)	
Malay	23 (6.4)	2 (1.1)	
Indian	17 (4.7)	6 (3.3)	
Eurasian	3 (0.8)	0	
Others	4 (1.1)	4 (2.2)	0.027
Marital status			
Single	32 (8.9)	24 (13.3)	
Married	178 (49.6)	102 (56.4)	
Divorced/separated	20 (5.6)	12 (6.6)	
Widowed	129 (35.9)	43 (23.8)	0.028
Cancer type			
Locally advanced/non-metastatic	77 (21.4)	22 (12.2)	

Variables	Included patients (N = 359)	Excluded patients (N = 181)	0.012 P-value
Metastatic	282 (78.6)	159 (87.8)	
Cancer site			
Brain	9 (2.5)	1 (0.6)	
Head and neck	13 (3.6)	6 (3.3)	
Gastrointestinal system	97 (27.0)	38 (21.0)	
Hepatobiliary pancreatic system	65 (18.1)	35 (19.3)	
Breast	25 (7.0)	11 (6.1)	
Gynecological	3 (0.8)	2 (1.1)	
Genitourinary	20 (5.6)	11 (6.1)	
Hematological	14 (3.9)	5 (2.8)	
Prostate	10 (2.8)	8 (4.4)	
Skin	3 (0.8)	2 (1.1)	
Lung	76 (21.2)	48 (26.5)	
Multiple sites	10 (2.8)	3 (1.7)	
Unknown	11 (3.1)	5 (2.8)	
Others	3 (0.8)	6 (3.3)	
			0.110
Duration of diagnosis (months)			
Median (IQR)	7 (2-18.5)	9 (2-27)	

Variables	Included patients (N = 359)	Excluded patients (N = 181)	P-value
Mean (SD)	17.4 (28.2)	19.7 (32.6)	0.357
Comorbidities			
Cardiovascular disease	99 (27.6)	49 (27.1)	0.982
Congestive heart failure	13 (3.6)	5 (2.8)	0.787
Connective tissue disease	7 (1.9)	6 (3.3)	0.497
Chronic obstructive pulmonary disease	27 (7.5)	14 (7.7)	1.000
Dementia	44 (12.3)	19 (10.5)	0.646
Diabetes mellitus	129 (36.0)	57 (31.4)	
Uncomplicated	86 (24.0)	39 (21.5)	
With end organ damage	43 (12.0)	18 (9.9)	0.576
Liver disease	27 (7.5)	16 (8.9)	
Mild	8 (2.2)	3 (1.7)	
Moderate-severe	19 (5.3)	13 (7.2)	0.625
Myocardial infarct	47 (13.1)	18 (9.9)	0.357
Peripheral vascular disease	10 (2.8)	1 (0.6)	0.158
Peptic ulcer disease	31 (8.6)	12 (6.6)	0.519
Hemiplegia	33 (9.2)	9 (5.0)	0.119
Moderate-severe chronic kidney disease	59 (16.4)	17 (9.4)	0.037
Leukemia	7 (1.9)	3 (1.7)	1.000
Lymphoma	6 (1.7)	2 (1.1)	0.891
Acquired immune deficiency syndrome	2 (0.6)	0	0.798
Charlson comorbidity index score			
Median (IQR)	11 (9–12)	10 (9–12)	

Variables	Included patients (N = 359)	Excluded patients (N = 181)	P-value
Mean (SD)	10.7 (2.4)	10.4 (2.2)	0.153
Results are reported as frequencies with percentages unless otherwise stated.			
IQR, interquartile range; SD, standard deviation.			

Bivariate analysis of factors associated with the final place of care

Among the three groups, patients whose final place of care was home were the oldest, with the highest proportion married or widowed and had a caregiver, mostly in the form of paid help. Home was the most frequently preferred place of care and death by patients and families in the home group. It also had the highest proportion of patients with a PPSv2 < 40%. Pain and depression scores were the lowest but drowsiness scores were the highest (all $p < 0.017$). Between the inpatient hospice and home group, family caregivers of patients whose final place of care was in the inpatient hospice were older. A higher proportion stayed in rented housing and received the highest level of government financial support. More acute healthcare resources were utilized and the median homecare enrolment duration was longer. Nausea and well-being scores were worse (all $p < 0.017$). Comparing the hospital and home groups, there were more males but fewer patients with lung cancer, cardiovascular disease and dementia in the hospital group. Appetite problems were also less severe (all $p < 0.017$) (Table 2).

Table 2
Significant factors associated with the final place of care in bivariate analysis

Variables	Final place of care			Adjusted P-value ^a	
	Home (N = 209)	Inpatient hospice (N = 85)	Hospital (N = 60)		
Age (years)					
Median (IQR)	79 (70–86)	71 (65–81)	71 (64–80)	< 0.0001 ^b	
Mean (SD)	77.7 (11.6)	71.6 (12.0)	72.3 (9.9)		< 0.0001 ^c
Gender					
Male	96 (45.9)	46 (54.1)	39 (65.0)	0.252 ^b	
Female	113 (54.1)	39 (45.9)	21 (35.0)		0.014 ^c
Marital status					
Single	8 (3.8)	18 (21.2)	6 (10.0)	< 0.0001 ^b	
Married	100 (47.8)	38 (44.7)	40 (66.7)		
Divorced	7 (3.3)	9 (10.6)	2 (3.3)		
Widowed	94 (45.0)	20 (23.5)	12 (20.0)		0.003 ^c
Housing type					
Rental	11 (5.3)	14 (16.5)	6 (10.0)	0.002 ^b	
Public	169 (80.9)	68 (80.0)	50 (83.3)		
Private condominium	15 (7.2)	2 (2.4)	2 (3.3)		
Private landed housing	14 (6.7)	1 (1.2)	2 (3.3)		0.300 ^c
Government financial support level					
High	117 (56.0)	67 (78.8)	33 (55.0)		

Variables	Final place of care			Adjusted P-value ^a
	Home (N = 209)	Inpatient hospice (N = 85)	Hospital (N = 60)	
				0.001 ^b
				0.605 ^c
Medium	20 (9.6)	7 (8.2)	9 (15.0)	
Low	23 (11.0)	5 (5.9)	7 (11.7)	
No support	49 (23.4)	6 (7.1)	11 (18.3)	
Cancer site				
Brain	6 (2.9)	1 (1.2)	2 (3.3)	
Head and neck	3 (1.4)	5 (5.9)	5 (8.3)	
Gastrointestinal system	54 (25.8)	27 (31.7)	14 (23.3)	
Hepatobiliary pancreatic system	36 (17.2)	15 (17.6)	14 (23.3)	
Breast	18 (8.6)	2 (2.4)	4 (6.7)	
Gynecological	3 (1.4)	0	0	
Genitourinary	12 (5.7)	5 (5.9)	3 (5.0)	
Hematological	10 (4.8)	2 (2.4)	1 (1.7)	
Prostate	5 (2.4)	2 (2.4)	3 (5.0)	
Skin	0	2 (2.4)	1 (1.7)	
Lung	50 (23.9)	17 (20.0)	8 (13.3)	
Multiple sites	4 (1.9)	4 (4.7)	2 (3.3)	
Unknown	8 (3.8)	1 (1.2)	2 (3.3)	

Variables	Final place of care			Adjusted P-value ^a
	Home (N = 209)	Inpatient hospice (N = 85)	Hospital (N = 60)	
Others	0	2 (2.4)	1 (1.7)	0.024 ^b 0.001 ^c
Cardiovascular disease	72 (34.4)	20 (23.5)	6 (10.0)	0.091 ^b < 0.0001 ^c
Dementia	35 (16.7)	5 (5.9)	1 (1.7)	0.023 ^b 0.005 ^c
Main caregiver availability	207 (99.0)	61 (71.8)	53 (88.3)	< 0.0001 ^b < 0.0001 ^c
Family	72 (34.8)	38 (62.3)	34 (64.2)	< 0.0001 ^b
Friend	0	2 (3.3)	2 (3.8)	< 0.0001 ^c
Foreign domestic helper	129 (62.3)	21 (34.4)	15 (28.3)	
Private/interim care nurse	6 (2.9)	0	2 (3.8)	
Family caregiver age (years)				0.007 ^b
Median (IQR)	54 (47–62)	61.5 (50.5–69)	51.5 (45–65)	0.932 ^c
Mean (SD)	53.6 (12.8)	58.5 (13.7)	54.2 (14.6)	
Patient's PPOC	138 (66.0)	70 (82.4)	41 (68.3)	
Home	135 (97.8)	31 (44.3)	21 (51.2)	
Inpatient hospice	1 (0.7)	38 (54.3)	3 (7.3)	
Hospital	1 (0.7)	0	16 (39.0)	
No preference	0	1 (1.4)	0	< 0.0001 ^b

Variables	Final place of care			Adjusted P-value ^a
	Home (N = 209)	Inpatient hospice (N = 85)	Hospital (N = 60)	
Any institution	1 (0.7)	0	1 (2.4)	
Patient's PPOD	136 (65.1)	70 (82.4)	35 (58.3)	
Home	130 (95.6)	33 (47.1)	25 (71.4)	
Inpatient hospice	1 (0.7)	34 (48.6)	5 (14.3)	
Hospital	1 (0.7)	0	2 (5.7)	
No preference	3 (2.2)	3 (4.3)	1 (2.9)	< 0.0001 ^b
Any institution	1 (0.7)	0	2 (5.7)	< 0.0001 ^c
Family's PPOC	207 (99.0)	72 (84.7)	47 (78.3)	
Home	202 (97.6)	7 (9.7)	7 (14.9)	
Inpatient hospice	3 (1.4)	65 (90.3)	14 (29.8)	
Hospital	2 (1.0)	0	23 (48.9)	
No preference	0	0	1 (2.1)	< 0.0001 ^b
Any institution	0	0	2 (4.3)	< 0.0001 ^c
Family's PPOD	206 (98.6)	72 (84.7)	42 (70.0)	
Home	196 (95.1)	8 (11.1)	16 (38.1)	
Inpatient hospice	4 (1.9)	63 (87.5)	14 (33.3)	
Hospital	2 (1.0)	0	8 (19.0)	
No preference	4 (1.9)	1 (1.4)	2 (4.8)	

Variables	Final place of care			Adjusted P-value ^a
	Home (N = 209)	Inpatient hospice (N = 85)	Hospital (N = 60)	
Any institution	0	0	2 (4.8)	< 0.0001 ^b < 0.0001 ^c
Duration of enrolment in the home-based care service (days)				
Median (IQR)	59 (32–124)	92 (57–168)	63 (42.5–160)	< 0.0001 ^b
Mean (SD)	93.7 (93.0)	130.1 (103.3)	107.6 (100.7)	0.080 ^c
Number of emergency department visits				
Median (IQR)	0	0 (0–1)	0 (0–1)	< 0.0001 ^b 0.054 ^c
Mean (SD)	0.3 (0.8)	0.7 (1.0)	0.7 (1.4)	
Number of hospital admissions				
Median (IQR)	0 (0–1)	1 (0–1)	0 (0–1)	< 0.0001 ^b 0.196 ^c
Mean (SD)	0.4 (0.8)	0.9 (1.0)	0.8 (1.7)	
Average length of hospitalization (days)				
Median (IQR)	0 (0–4)	5 (0–11)	0 (0–5.5)	< 0.0001 ^b 0.205 ^c
Mean (SD)	2.8 (6.2)	8.8 (11.0)	4.5 (9.4)	
PPSv2 2 weeks before death or admission to the final place of care				
10%	77 (36.8)	0	0	
20%	45 (21.5)	3 (3.5)	4 (6.7)	
30%	45 (21.5)	14 (16.5)	7 (11.7)	

Variables	Final place of care			Adjusted P-value ^a
	Home (N = 209)	Inpatient hospice (N = 85)	Hospital (N = 60)	
40%	21 (10.0)	25 (29.4)	11 (18.3)	
50%	8 (3.8)	19 (22.4)	22 (36.7)	
60%	4 (1.9)	4 (4.7)	8 (13.3)	
70%	1 (0.5)	2 (2.4)	1 (1.7)	< 0.0001 ^b
80%	0	0	1(1.7)	< 0.0001 ^c
Missing	8 (3.8)	18 (21.2)	6 (10.0)	
ESASr 2 weeks before death or admission to the final place of care				
Pain				
Median (IQR)	0 (0–2)	0 (0–3)	2.5 (0–3)	
Mean (SD)	0.9 (1.7)	2.2 (2.7)	2.1 (2.4)	< 0.0001 ^b < 0.0001 ^c
Nausea				
Median (IQR)	0	0	0	0.007 ^b 0.047 ^c
Mean (SD)	0.2 (0.9)	0.6 (1.5)	0.6 (1.7)	
Depression				
Median (IQR)	0	0	0	
Mean (SD)	0.2 (0.8)	1.1 (2.1)	0.9 (2.2)	< 0.0001 ^b 0.001 ^c
Drowsiness				
Median (IQR)	3 (0–8)	0 (0–5)	0 (0–3)	

Variables	Final place of care			Adjusted P-value ^a
	Home (N = 209)	Inpatient hospice (N = 85)	Hospital (N = 60)	
Mean (SD)	4.1 (3.8)	2.5 (3.1)	2.0 (2.8)	0.002 ^b < 0.0001 ^c
Appetite				
Median (IQR)	5 (0–9)	5 (3-6.5)	3 (0–5)	
Mean (SD)	4.6 (3.9)	4.3 (3.1)	3.1 (2.8)	0.608 ^b 0.015 ^c
Well-being				
Median (IQR)	0 (0–3)	3 (0–6)	3 (0–5)	
Mean (SD)	1.8 (2.5)	3.1 (2.9)	2.6 (2.7)	0.001 ^b 0.028 ^c
Results are reported as frequencies with percentages unless otherwise stated.				
IQR, interquartile range; SD, standard deviation; PPOC, preferred place of care; PPOD, preferred place of death; PPSv2, Palliative performance scale v2 is a valid and reliable tool ranging from 0% (death) to 100% (normal function) for assessing the functional status of palliative care patients; ^(36, 37) ESASr, Edmonton symptom assessment scale is a psychometrically tested tool that uses a numeric rating scale ranging from 0 (no symptom) to 10 (worst) for measuring the symptom severity of nine symptoms (pain, fatigue, nausea, depression, anxiety, drowsiness, appetite, well-being and dyspnea). Additional symptoms can be recorded if present. Individual symptom scores are summed with a higher total score indicating worse symptom burden. ^(38, 39)				
^a To control for type 1 error in multiple comparisons, Bonferroni adjustment was applied to the p-value. With three pairwise comparisons, the adjusted p-value for statistical significance was 0.017.				
^b Adjusted p-value when patients whose final place of care was in the inpatient hospice were compared to patients whose final place of care was at home.				
^c Adjusted p-value when patients whose final place of care was in the hospital were compared to patients whose final place of care was at home.				

Multivariate logistic regression of factors associated with the final place of care

Marital status, family caregiver age, PPSv2 and patients' place of death preference predicted inpatient hospice as the final place of care in the binomial model (Appendix Table A1). In the multinomial model,

pain score was additionally significant. Single or divorced patients with older family caregivers (≥ 55 years) had a 5.5 (95% CI:1.1–27.8) and 3.1 (95% CI:1.1–8.8) odds of receiving terminal care in inpatient hospice than married or widowed patients and those with younger family caregivers respectively. Patients with a PPSv2 $\geq 40\%$ had a 9.1 (95% CI:3.3–24.8) odds while patients with pain score ≥ 2 had a 3.6 (95% CI:1.3–9.8) odds. Non-home death preference increased the odds by 23.8 (95% CI:5.4-105.1) times, (all $p < 0.05$) (Table 3).

Gender, PPSv2, pain score and patients' place of death preference predicted hospital as the final place of care in both the binomial (Appendix Table A2) and multinomial models. Males had a 3.2 (95% CI:1.0-9.9) odds while patients with a PPSv2 $\geq 40\%$ had an 8.6 (95% CI:2.9–26.0) odds to be hospitalized for terminal care. Patients with pain score ≥ 2 were 3.5 (95% CI:1.2–10.3) times while patients with non-home death preference were 9.8 (95% CI:2.1–46.3) times more likely to be hospitalized (all $p < 0.05$) (Table 3).

Table 3

Multivariate analysis of factors associated with the final place of care using multinomial logistic regression

Variables	Inpatient hospice		Hospital	
	Adjusted odds ratio (95% CI)	P-value	Adjusted odds ratio (95% CI)	P-value
Gender				
Female	1.38 (0.52–3.63)		1	
Male	1	0.518	3.16 (1.01–9.90)	0.048
Marital status				
Married/widowed	1		1	
Single/divorced	5.52 (1.10-27.78)	0.038	5.00 (0.92–27.03)	0.063
Family caregiver age				
<55 years	1		1.30 (0.43–3.91)	
≥55 years	3.05 (1.06–8.78)	0.038	1	0.638
PPSv2				
<40%	1		1	
≥40%	9.10 (3.34–24.82)	< 0.0001	8.64 (2.87-26.00)	< 0.0001
Pain				
<2	1		1	
≥2	3.61 (1.33–9.79)	0.012	3.45 (1.16–10.27)	0.026
Patient's PPOD				
Home	1		1	
Non-home	23.76 (5.37-105.08)	< 0.0001	9.77 (2.07–46.25)	0.004
Reference category: Home.				
CI, confidence interval; PPSv2, Palliative performance scale v2 is a valid and reliable tool ranging from 0% (death) to 100% (normal function) for assessing the functional status of palliative care patients; (36, 37) PPOD, Preferred place of death.				

Goal-concordance and congruence

Despite substantial agreement in patients' preferences (90.4%, kappa = 0.75), goal-concordance with their place of care preference was moderate (76.7%, kappa = 0.54) while goal-concordance with their place of death preference was fair (72.6%, kappa = 0.39). In contrast, goal-concordance with families' preferences was substantial (89.9%, kappa = 0.79 and 86.3%, kappa = 0.67 for place of care and death preferences respectively). Congruence between patients and families' preferences was moderate (81.4%, kappa = 0.59 and 80.4%, kappa = 0.55 for place of care and death preferences respectively).

Post-bereavement measures

Patients whose final place of care was home stayed home the longest [median (IQR) = 40 (25–84) days] compared to inpatient hospice [median (IQR) = 20 (11–46) days] and hospital [median (IQR) = 16.5 (12–25.5) days], $p < 0.0001$. Professional bereavement support was more frequently needed for the inpatient hospice (30.6%) and hospital groups (26.7%) compared to the home group (21.5%), $p < 0.0001$, but there was no difference in the level of death acceptance, $p = 0.869$.

Discussion

Marital status and family caregiver age predicted inpatient hospice as the final place of care while gender determined end-of-life care in the hospital. Functional status, pain score and patient's place of death preference were associated with both inpatient hospice and hospital as the final place of care. Goal-concordance with patients' preferences was fair to moderate while patients and families' wishes were moderately congruent. However, unlike other studies, socioeconomic status^(10, 42) was not independently predictive of the final place of care. In Singapore's healthcare financing system, home-based palliative care and inpatient services are heavily subsidized. Hence, coupled with the national healthcare insurance and savings scheme, the amount of out-of-pocket payment⁽⁴³⁾ among the different settings might not vary substantially. Acute healthcare utilization^(13, 32, 44) was also not an independent predictor, possibly due to the home-based team's regular contact and prompt response to patients' needs throughout the illness trajectory.⁽²⁶⁾

In the Asian context, children and spouses are bound by values and societal norms to care for their immediate relatives when they are ill.⁽¹³⁾ Marital status predicted inpatient hospice as the final place of care likely because single or divorced patients lacked the social support accorded through marriage⁽⁸⁾ compared to married or widowed patients. Other studies found living arrangement to be predictive of the place of death^(8, 11, 13, 24) but not this study, possibly because marital status could be a more direct indicator of patients' level of social support instead. Additionally, many families depend on paid help to provide direct hands-on care,⁽¹³⁾ hence differences in place of residence may not be an issue in a small and well-connected nation like Singapore. Due to the vital role that family caregivers play, their age determined inpatient hospice as the final place of care. Family caregivers supplemented the professional care provided by the home-based team and informal care provided by paid help.⁽⁴⁵⁾ For older caregivers, caring for functionally dependent patients with cancer for a long duration can be particularly demanding physically and psychologically.⁽²²⁾ Their ability to sustain and provide care at home safely may be

compromised, necessitating inpatient hospice admission for terminal care.⁽⁴⁵⁾ Consistent with other studies' findings,^(13, 44) male patients were more likely to be hospitalized for terminal care due to their higher inclination for aggressive treatment in the hospital at the end-of-life.⁽⁴⁶⁾

Patients with higher functional status were more likely to be in inpatient hospice or hospital as the final place of care compared to bed-bound and fully assisted patients, echoing findings from systematic reviews.^(8, 11) Functionally better and more alert patients may hope to maintain their status through hospital interventions,⁽⁴⁾ while patients with PPSv2 scores between 40% and 60% and who are not as drowsy may require a level of supervision and physical assistance beyond caregivers' coping capacity, predisposing them to inpatient hospice for terminal care. Qualitative analysis of the reasons for admission may provide more insight into this finding. Given their better function, a hospice day care may be incorporated into the integrated model to supplement care for patients who prefer to remain at home. Pain severity also determined inpatient hospice and hospital as the final place of care. Complex pain and its associated psychological implications could overwhelm caregivers, affecting care quality.^(11, 14, 16-19) To ensure comfort at the end-of-life, patients and families may prefer an institutional setting where professional care and intervention are readily available.⁽⁴⁵⁾

Patients' preference for non-home death was the strongest determinant of inpatient hospice and hospital as the final place of care, consistent with findings from other studies.^(8, 10, 11, 24, 44) The home-based team initiated care planning discussions early with patients and families and revised them as circumstances changed along the illness trajectory. These discussions were documented in the electronic medical records so that all healthcare professionals involved were aware and could work collaboratively to support patients and families at their preferred location as much as possible.⁽²⁶⁾ This was reflected in the moderate congruence between patients and families' preferences and the substantial level of goal-concordance with families' preferences. However, it stood in contrast to the suboptimal level of goal-concordance with patients' preferences and has implications for policy and practice.

Implications of findings

Although close to 60% of our patients died at home which is above the national average of 28%,⁽⁴⁴⁾ the suboptimal level of concordance with patients' preferences revealed gaps within the integrated model that required addressing at the macro, meso and micro level.⁽²⁵⁾ More comprehensive social networks in the community could be established to support single or divorced patients who wish to remain at home.^(44, 47) The influence of family-related factors on patients' final place of care and the disparity in goal-concordance between patients and families' preferences highlighted the instrumental role families play in the end-of-life care of advanced cancer patients. Hence, more practical and emotional support could be provided to better equip families for the care and death of patients who prefer to be at home,^(4, 13, 21, 29) mitigating potential psychosocial sequelae. Patients whose final place of care were in institutions had lower mood and well-being while more of their families required professional bereavement support. As home was not the preferred place of care and death for a substantial minority of patients (~ 20%), the

integrated model could also be enhanced with more funding and capacity given the vital role it plays in catering to the diverse preferences and needs of patients and families.^(24, 26)

Although pain was not the most severe symptom, a score of 2 was sufficient to predict institutionalization. In order for patients to remain comfortably at home for terminal care according to their preference, analgesia can be pre-emptively prescribed to optimize pain control after due deliberation has been given regarding the propensity for misuse.⁽⁴⁸⁾ Caregivers should also be adequately trained regarding its complex administration. Additionally, being cognizant of the determinants of the final place of care allows care planning discussions to be personalized, improving communication and care satisfaction when preferences are met.^(11, 32, 49) Realistic goals can be set and transitions between care settings can be arranged in a timely manner to prevent traumatic changes at the end-of-life, minimizing the risk of complicated grief.^(4, 50) The high rates of care plans discussed with patients (~ 70%) and families (~ 90%) suggests that these important conversations were taking place in practice and efforts should continue to initiate them early.^(3, 4) When faced with non-modifiable factors, the wishes of functionally better male patients for hospital interventions should be respected, although the short hospitalization stay is sobering.

Strengths and limitations

This is one of the few studies examining factors associated with home, inpatient hospice and hospital as the final place of care among advanced cancer patients receiving home-based palliative care within an integrated model. As care planning is dynamic, the last discussion prior to death was obtained to capture the eventual wishes of patients. Symptoms and functional status assessed within two weeks before death or admission to the final place of care were also collected instead of on enrolment to reflect patients' condition at the end-of-life, overcoming the limitations of previous studies.^(10, 24)

However, this study has its own limitations. Causal links could not be established from associations identified and coding independent variables as binary indicators could result in a loss of power. Intensity of home-based palliative care service was associated with the place of death in some studies^(8, 13, 24) but it was not evaluated in this study. Not all patients discussed their care preferences, hence the goal-concordance and congruence outcomes should be interpreted with this in mind. Due to the retrospective study design, inferences made about preferences could not be confirmed but the documentation of all healthcare professionals involved were reviewed for corroboration. Even though the findings may be limited in its transferability to societies with vastly different cultural norms, values and healthcare systems, it may potentially still be generalizable to similar patient population and setting. Due to different care needs and disease trajectories,⁽⁵¹⁾ findings from advanced cancer patients in this study cannot be extrapolated to non-cancer. Hence, future research in non-cancer patients is required so that end-of-life care can be tailored to meet the needs and preferences of specific patient populations.

Conclusions

Higher functional status, greater pain intensity and non-home death preference predicted institutionalization as the final place of care. Additionally, single or divorced patients with older family caregivers were more likely to receive terminal care in inpatient hospice while males were more likely to be hospitalized. Despite the integrated care model, goal-concordance was suboptimal. Policies could consider establishing more comprehensive community networks for patients with poor social support while additional resources may be allocated to support families in caring for patients who wish to remain at home. Optimizing pain management and more personalized care planning discussions are also recommended in practice to improve the likelihood of meeting patients' preferences for the final place of care. Future research should similarly examine factors in non-cancer patients.

Abbreviations

PPSv2: Palliative Performance Scale v2; ESASr: Edmonton Symptom Assessment System.

Declarations

Ethics approval and consent to participate

All study procedures have been performed in accordance with the Declaration of Helsinki. Research ethics approval was obtained from the Singapore National Healthcare Group Domain Specific Review Board (Reference number: 2018/01392). The need for informed consent was waived by the Singapore National Healthcare Group Domain Specific Review Board given the retrospective nature of the study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and analyzed during this study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

RYT conceptualized and designed the study, acquired the data and drafted the manuscript. RC acquired the data and drafted the manuscript. WYO and AH conceptualized and designed the study and drafted the manuscript. All authors analyzed and interpreted the data, revised the manuscript critically for important intellectual content and approved the final manuscript.

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Figures

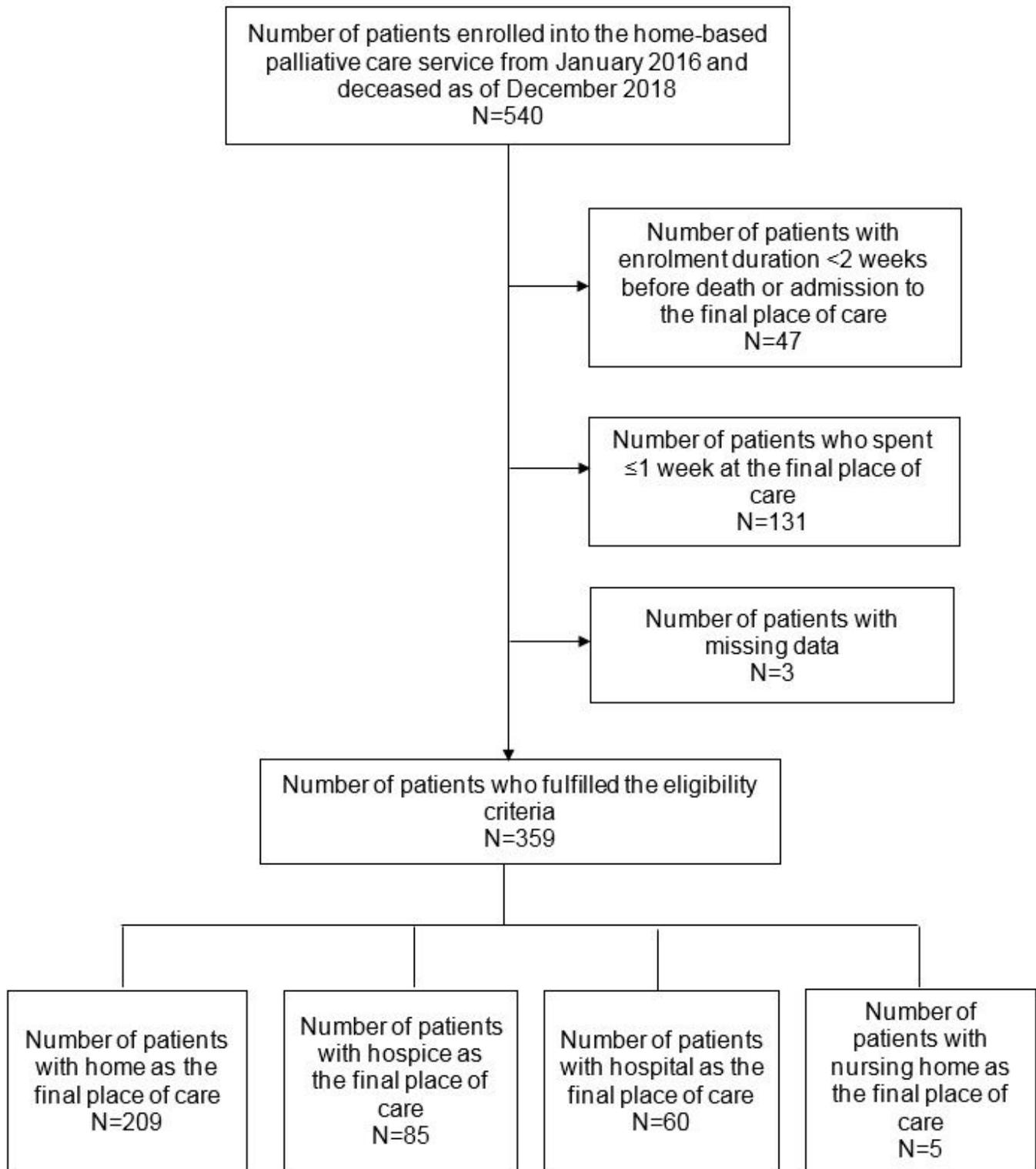


Figure 1

Flowchart of patients

Supplementary Files

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- [AppendixTablesA1andA2.docx](#)