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Hospice delivery models and survival differences in the terminally ill: a large cohort study

Wei-Shu Lai ¹, I-Ting Liu,² Jui-Hung Tsai,² Pei-Fang Su,^{3,4} Pin-Hsuan Chiu,^{3,4} Ying-Tzu Huang,² Ge-Lin Chiu,⁵ Yu-Yeh Chen,⁵ Peng-Chan Lin ²

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For numbered affiliations see end of article.

Correspondence to

Dr Peng-Chan Lin, Department of Oncology, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, Tainan, Taiwan; pengchan@mail.ncku.edu.tw

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ABSTRACT

Objective A common difficulty at the end of life (EOL) is to determine an appropriate service model, such as hospice share care (HSC), hospice inpatient care (HIC) and hospice home care (HHC). This study aimed to recommend the appropriate hospice delivery model based on the physical, psychosocial and spiritual needs of patients referred for hospice care.

Methods This cohort study included patients who received only one kind of hospice delivery model between 2006 and 2020. Data were analysed with descriptive statistics, Fisher's exact test, non-parametric analysis of variance, Kaplan-Meier curves and Cox proportional hazards model that determined the patients' clinical characteristics for a hospice delivery model and overall survival.

Results A total of 8874 hospice patients were recruited, of which 7076 (79.7%) were HSC patients, 918 (10.4%) were HIC patients and 880 (9.9%) were HHC patients. There were significant differences in the physical symptoms and demographic, psychosocial and spiritual factors among the three groups ($p < 0.001$). The patients who received the HHC were less to have dyspnoea (18.5%) and dysphagia (28.7%). The HIC patients showed higher severity of symptoms and experienced greater psychosocial distress (73.2%). The HSC is appropriate for noncancer patients. Patients with cancer were associated with less dyspnoea (32.4%) and dysphagia (46.5%). Patients with lung cancer who received the HHC had better survival than those who received other types of hospice care (HR=0.75, 95% CI: 0.66 to 0.86, $p < 0.001$).

Conclusions This study provides guidance regarding the appropriate hospice service model, based on individualised palliative needs, targeting improvement in EOL care.

Key messages

What was already known?

- ⇒ The appropriate service model that addresses different hospice care needs.
- ⇒ Few studies have examined the association of the hospice model with patient characteristics and cancer survival.

What are the new findings?

- ⇒ Recommending the appropriate hospice care depending on the physical, psychosocial and spiritual needs of patients.
- ⇒ Patients receiving the hospice inpatient care presented higher symptom clusters and psychosocial and spiritual issues than patients receiving the other types of hospice care.
- ⇒ Patients receiving the hospice home care depicted poor performance and low-to-moderate symptom burden compared with the other two models.
- ⇒ Non-cancer patients were highly suitable for the hospice share care.

What is their significance?

- ⇒ Clinical: This study provides guidance regarding the appropriate service model for hospice care. It is based on individualised hospice assessment and symptom.
- ⇒ Research: Future research should establish the effectiveness of these hospice delivery models and promote their acceptance once they are proven useful or integrated in clinical practice.

INTRODUCTION

Hospices offer a patient-centred care model that delivers services and focuses on relieving suffering at the end of life (EOL). Several hospice services can be used at the EOL,^{1,2} such as outpatient and day palliative care clinics, acute palliative care units, community-based palliative

care, hospice share (combined) care (HSC), hospice inpatient care (HIC) and hospice home care (HHC). We provided three hospital-based hospice delivery models, HSC, HIC and HHC, in Taiwan. The HSC provides specialist consultation regarding hospice care in the acute medical ward. They work with the primary medical specialist team to provide hospice care for terminally ill patients admitted to their original ward.^{3,4} The hospice care team faces several challenges in selection of an appropriate service model to alleviate the symptoms and provide holistic care with respect to the physical, emotional and spiritual needs of terminally ill patients, while supporting them through the EOL period.^{5,6} Understanding the patients' characteristics and palliative care needs should help clinicians improve their choice of the hospice model.

All hospice models are intended to deliver goal-directed care to patients with cancer and other serious diseases.⁷ The choice of the model should be based on the patient's characteristics, symptoms and sociocultural and spiritual beliefs about sickness and death.⁸ Healthcare delivery is changing rapidly, trending toward individualised hospice care. The evidence regarding benefits of early effective palliative care in patients with cancer and non-cancer patients is irrefutable.^{9,10} However, few studies have examined the association of the hospice model with patient characteristics and cancer survival. Ideally, palliative care models vary in patients depending on their disease symptoms. However, most patients eligible for hospice services do not receive timely and accurate care, facing death at home.^{11,12} Therefore, the role of hospice service delivery should be studied.¹³

In Taiwan, hospice and palliative care are well established. The 2015 Quality of Death Index, as rated by the Economist Intelligence Unit, ranked Taiwan first among the Asian countries and sixth in the world.¹⁴ The National Health Insurance (NHI) in Taiwan offers universal coverage, but the database lacks information regarding the different hospice cares provided to patients. A better understanding of the different models could help clinicians improve their care and design appropriate training programmes. There are three primary models for specialist palliative care, namely, the HIC, HSC and HHC, through which comprehensive hospital-based palliative care is provided at the National Cheng Kung University Hospital. This study determined the differences in main characteristics and survival of patients who received the different care models. Based on the difference in patients' characteristics and palliative care needs, the appropriate hospice service model was administered in this study.

MATERIAL AND METHODS

Study design and setting

This cohort study included patients who experienced only one type of hospice care at a single tertiary metropolitan medical centre between 2006 and 2020. The

study setting was a 1193-bed medical centre located in an urban area, with 1.8 million people. This institute had a palliative care programme during the study period. Online questionnaires were developed in the Hospice Databank, an electronic quality monitoring system, and the hospice care referral registry. The Hospice Databank is a web-based, provider-centred, point-of-care assessment and reporting tool, designed to collect data of clinical encounters in palliative care.

Population

Terminally ill patients referred to the hospice care unit were analysed. The inclusion criteria were: (1) patients with diseases not responsive to curative treatment, (2) limited disease prognosis, including those with cancer and other terminal illnesses and (3) patients who willingly accepted hospice care initially. Exclusion criteria were: (1) patient's rejection of on-going palliative care, (2) patient's refusal to sign a do not resuscitate (DNR) legal document, in accordance with the Taiwan Hospice Palliative Care Act and NHI reimbursement regulation (the DNR code is not the part of an advance care planning in Taiwan)³ and (3) patients receiving more than two modes of hospice care.

Data collection

Clinical information was obtained from the Hospice Databank. Data collectors were well-trained nursing professionals of palliative care. The physical, psychosocial and spiritual needs of the patients were measured on hospice care referring. A 41-item standardised questionnaire was administered by the specialised hospice nurses to compare the different service models. The variables included basic demographics, type of hospice care, cancer or non-cancer diagnosis, Eastern Cooperative Oncology Group (ECOG) performance status, time when the DNR was signed, symptoms and psychosocial and spiritual issues. Pain was assessed on a scale from 0 to 10 (0: none; 10: worst possible pain). These scores were grouped into low (0–3), moderate (4–6) and high (7–10) categories. Other symptoms, such as dyspnoea, nausea, constipation and dysphagia, were also evaluated (0: none; 4: worst possible symptoms). These scores were grouped into none (0), moderate (1–2) and high (3–4) categories. Ascites¹⁵ was assessed using the following category scale: grade 0='No', grade 1='asymptomatic', grade 2='symptomatic, medical intervention indicated', grade 3='symptomatic, invasive procedure indicated' and grade 4='life threatening consequences'. Psychosocial and spiritual issues were classified as yes or no or unknown, partially known or well known.

Statistical analysis

The data analysis was performed by the Center for Quantitative Sciences. Descriptive statistics, including the means and standard errors for continuous variables, and the percentages and frequencies

for categorical variables were tabulated. To analyse the hospice patients' baseline characteristics across hospice delivery models, cancer or non-cancer diagnoses and different cancer diagnoses, the Kruskal-Wallis rank-sum test and Wilcoxon rank-sum test were used for continuous variables (eg, age). Fisher's exact test was used for categorical variables (eg, gender, pain, etc). Moreover, for time-to-event endpoints, the Kaplan-Meier method and log-rank tests were used. Cox proportional hazards model that included all the baseline variables were employed for the analysis of overall survival (OS), defined as the time between the cancer diagnosis and death. The HRs and 95% CIs were estimated with this model. All statistical tests were two sided and $p < 0.05$ indicated statistical significance. All analyses were performed using R statistical software (V.4.0.2) for Windows.

RESULTS

Characteristics of patients treated with different hospice delivery models

A total of 15 259 patients were analysed. Of these, 8874 patients received only one type of hospice care model in entirely hospice care, 4594 patients received two types of hospice care models and 1431 patients received three types of hospice care models. The palliative care needs in 8874 patients were assessed. The patients did not change the service models, justifying the contribution of the delivery model.

We identified the palliative care needs and characterised the symptoms among the three approaches to palliative care in [table 1](#). During the study period, 8874 hospice patients ($M_{age} = 65$, $SD = 16$, $n = 5368$ (60.5%) males) were recruited, of whom 7076 (79.7%) patients received the HSC, 918 (10.4%) the HIC and 880 (9.9%) the HHC. Of these, 7669 (86.4%) were primarily diagnosed for cancer and 1205 (13.6%) were non-cancer patients. Most patients (95.3%) had an ECOG performance status of three or four. Almost 30% of the patients were unaware or only partially aware of their diagnosis, while half of the patients (51.5%) were unaware or only partially aware of their prognosis. There were significant differences in demographics, physical symptoms and psychosocial and spiritual demands among the HHC, HIC and HSC groups ($p < 0.001$).

Patients receiving the HHC who had a poor performance status (ECOG 3–4, 99%) were unlikely to experience severe symptoms, except for severe constipation (26.0%). Compared with the patients receiving the other two cares, a higher proportion of the HHC patients experienced spiritual distress (43.2%). The HIC patients showed higher severity of symptoms, such as dyspnoea (56.2%), nausea (9.5%), dysphagia (50.8%), ascites (12.5%) and lymphedema (12.2%) and plausibly experienced greater psychosocial distress (73.2%). Compared with the patients receiving the other two models, a higher proportion of HSC

patients were unaware of their diagnosis (22.6%) and prognosis (26.7%). Nearly half of the HSC patients (46.7%) signed a DNR after starting palliative care.

Comparing the palliative care needs of patients with cancer and non-cancer patients

Prediction of disease trajectory in non-cancer patients is challenging. Most of the non-cancer patients received the HSC. The difference of palliative needs in patients with cancer and non-cancer patients was compared. In our study ([table 2](#)), the mean age was 69 years. Most non-cancer patients (80.7%) signed a DNR before starting palliative care and 90.3% received the HSC. The mean duration of the HSC was 149 days ($SD = 211$) and 64 days ($SD = 103$ days) in non-cancer patients and patients with cancer, respectively. Non-cancer patients were more likely to have poorer ECOG performance status scores of 3–4 (99.2%) and severe dyspnoea (54.9%), dysphagia (77.5%) and incontinence (72%) symptoms. Nearly half of the non-cancer patients were unaware of their disease diagnosis (54.5%) and prognosis (59.5%). A greater number of family members of non-cancer patients experienced psychosocial and spiritual issues (88% and 70.8%, respectively) than the non-cancer patients themselves (43% and 12.6%, respectively). Approximately 12.3% of the patients with cancer were unaware of their diagnosis, while 15.5% of the patients were unaware of their prognosis. A total of 55.1% and 24.3% of the patients with cancer had psychosocial and spiritual issues, respectively. Overall, 66.2% of family members (of patients with cancer) had psychosocial issues and 45% had spiritual issues. Here as well, a greater number of family members than patients with cancer experienced psychosocial and spiritual issues. These results imply that the non-cancer HSC patients had relatively higher complex physical, psychosocial and spiritual issues. The HSC provides specialist consultation regarding hospice care in the acute medical ward. They provide consultation and cooperate with the medical specialists of various expertise, such as the oncologist, cardiologist and pulmonologist. They aim to control the symptoms and help patients and family members understand the disease trajectory as well as medical and ethical decisions.

Survival of advanced cancers in the hospice delivery model

To further investigate whether the selection of hospice care model affects the survival of advanced cancer, four major cancer types were analysed. Hospice care did not compromise the survival of patients with an advanced lung cancer diagnosis. There was a significant difference in the survival rate among patients stratified by the hospice delivery models. The survival curves are shown in [figure 1](#). The impact of the hospice service delivery model on the survival probability was evaluated. The median survival probability was 0.48 (95% CI: 0.447 to 0.518) among those with

Table 1 Characteristics of hospice delivery model

Hospice services no. (%)					
Characteristic	Overall (N=8874)	HSC (n=7076)	HIC (n=918)	HHC (n=880)	P value*
Basic demographics					
Age, mean (SD), years	65 (16)	64 (16)	67 (14)	72 (14)	<0.001
Gender					
Male	5368 (60.5)	4358 (61.6)	525 (57.2)	485 (55.1)	<0.001
Female	3506 (39.5)	2718 (38.4)	393 (42.8)	395 (44.9)	
Religious					
Folk beliefs	4455 (68.9)	3344 (69.8)	506 (59.8)	605 (73.3)	<0.001
Buddhism	685 (10.6)	415 (8.7)	147 (17.4)	123 (14.9)	
Christian/Catholicism	374 (5.8)	262 (5.5)	65 (7.7)	47 (5.7)	
Taoism	760 (11.8)	629 (13.1)	98 (11.6)	33 (4.0)	
Other	188 (2.9)	141 (2.9)	30 (3.5)	17 (2.1)	
Patients with cancer					
No	1205 (13.6)	1088 (15.4)	47 (5.1)	70 (8.0)	<0.001
Yes	7669 (86.4)	5988 (84.6)	871 (94.9)	810 (92.0)	
DNR document signing					
Before care	4476 (62.3)	2913 (53.3)	786 (92.0)	777 (89.6)	<0.001
After care	2710 (37.7)	2552 (46.7)	68 (8.0)	90 (10.4)	
ECOG performance					
0–2	285 (4.7)	248 (5.7)	28 (3.2)	9 (1.0)	<0.001
3–4	5779 (95.3)	4080 (94.3)	845 (96.8)	854 (99.0)	
Symptoms/signs score					
Pain					
0–3	5478 (88.3)	3958 (89.3)	746 (83.1)	774 (88.5)	<0.001
4–6	558 (9.0)	345 (7.8)	123 (13.7)	90 (10.3)	
7–10	167 (2.7)	127 (2.9)	29 (3.2)	11 (1.3)	
Dyspnoea					
0	1427 (22.5)	819 (17.9)	252 (28.0)	356 (40.7)	<0.001
1–2	2619 (41.2)	2121 (46.3)	142 (15.8)	356 (40.7)	
3–4	2304 (36.3)	1637 (35.8)	505 (56.2)	162 (18.5)	
Nausea					
0	5011 (82.6)	3698 (86.0)	685 (77.1)	628 (71.7)	<0.001
1–2	765 (12.6)	431 (10.0)	119 (13.4)	215 (24.5)	
3–4	290 (4.8)	173 (4.0)	84 (9.5)	33 (3.8)	
Constipation					
0	2376 (39.1)	1943 (45.2)	261 (29.0)	172 (19.6)	<0.001
1–2	2572 (42.4)	1621 (37.7)	475 (52.8)	476 (54.3)	
3–4	1124 (18.5)	733 (17.1)	163 (18.1)	228 (26.0)	
Dysphagia					
0	1265 (20.7)	950 (21.8)	167 (18.6)	148 (16.9)	<0.001
1–2	1680 (27.4)	928 (21.3)	276 (30.7)	476 (54.4)	
3–4	3178 (51.9)	2470 (56.8)	457 (50.8)	251 (28.7)	
Fungating wound					
0	5586 (93.4)	3952 (93.6)	818 (92.7)	816 (93.2)	0.510
1–2	286 (4.8)	191 (4.5)	47 (5.3)	48 (5.5)	
3–4	107 (1.8)	78 (1.8)	17 (1.9)	12 (1.4)	
Ascitest					
0	4167 (69.0)	2941 (68.8)	534 (60.1)	692 (79.0)	<0.001
1–2	1330 (22.0)	957 (22.4)	244 (27.4)	129 (14.7)	
3–4	545 (9.0)	379 (8.9)	111 (12.5)	55 (6.3)	
Lymphedema					
0	4598 (77.0)	3414 (81.2)	513 (57.4)	671 (76.6)	<0.001
1–2	990 (16.6)	585 (13.9)	271 (30.3)	134 (15.3)	

Continued

Table 1 Continued

Hospice services no. (%)					
Characteristic	Overall (N=8874)	HSC (n=7076)	HIC (n=918)	HHC (n=880)	P value*
3–4	387 (6.5)	207 (4.9)	109 (12.2)	71 (8.1)	
General oedema					<0.001
0	2191 (37.0)	1385 (32.6)	271 (33.6)	535 (61.8)	
1–2	3131 (52.9)	2446 (57.5)	434 (53.8)	251 (29.0)	
3–4	601 (10.1)	421 (9.9)	101 (12.5)	79 (9.1)	
Fatigue					<0.001
0	138 (2.1)	123 (2.6)	8 (0.9)	7 (0.8)	
1–2	885 (13.8)	689 (14.8)	132 (14.6)	64 (7.3)	
3–4	5402 (84.1)	3832 (82.5)	765 (84.5)	805 (91.9)	
Insomnia					<0.001
0	3603 (59.6)	2942 (68.9)	363 (40.6)	298 (34.0)	
1–2	1913 (31.7)	1012 (23.7)	428 (47.9)	473 (54.0)	
3–4	525 (8.7)	317 (7.4)	103 (11.5)	105 (12.0)	
Incontinence					<0.001
0	2128 (35.5)	1616 (38.2)	244 (27.2)	268 (30.6)	
1–2	948 (15.8)	525 (12.4)	153 (17.0)	270 (30.8)	
3–4	2926 (48.8)	2087 (49.4)	501 (55.8)	338 (38.6)	
Psychosocial/spiritual issues					
Awareness of diagnosis (patient)					<0.001
Well known	4907 (71.6)	3663 (71.9)	626 (71.0)	618 (70.8)	
Partial	630 (9.2)	281 (5.5)	214 (24.3)	135 (15.5)	
Unknown	1315 (19.2)	1153 (22.6)	42 (4.8)	120 (13.7)	
Awareness of prognosis (patient)					<0.001
Well known	3312 (48.5)	2300 (45.3)	616 (69.8)	396 (45.4)	
Partial	1971 (28.9)	1418 (27.9)	226 (25.6)	327 (37.5)	
Unknown	1546 (22.6)	1356 (26.7)	40 (4.5)	150 (17.2)	
Awareness of prognosis (family)					<0.001
Well known	6279 (91.5)	4548 (89.2)	872 (98.4)	859 (98.4)	
Partial	528 (7.7)	507 (9.9)	10 (1.1)	11 (1.3)	
Unknown	53 (0.8)	46 (0.9)	4 (0.5)	3 (0.3)	
Psychosocial issues (patient)					<0.001
Yes	4745 (53.5)	3580 (50.6)	672 (73.2)	493 (56.0)	
No	4129 (46.5)	3496 (49.4)	246 (26.8)	387 (44.0)	
Psychosocial issues (family)					<0.001
Yes	6138 (69.2)	4800 (67.8)	791 (86.2)	547 (62.2)	
No	2736 (30.8)	2276 (32.2)	127 (13.8)	333 (37.8)	
Spiritual issues (patient)					<0.001
Yes	2017 (22.7)	1554 (22.0)	83 (9.0)	380 (43.2)	
No	6857 (77.3)	5522 (78.0)	835 (91.0)	500 (56.8)	
Spiritual issues (family)					<0.001
Yes	4302 (48.5)	3731 (52.7)	85 (9.3)	486 (55.2)	
No	4572 (51.5)	3345 (47.3)	833 (90.7)	394 (44.8)	
Psychosocial spiritual care‡					<0.001
Yes	1319 (14.9)	625 (8.8)	547 (59.6)	147 (16.7)	
No	7555 (85.1)	6451 (91.2)	371 (40.4)	733 (83.3)	

*Statistical tests performed: Kruskal-Wallis test; Fisher's exact test for count data with simulated p value (based on 2000 replicates).

†Grade of ascites: 0=No; 1=asymptomatic; 2=symptomatic, medical intervention indicated; 3=symptomatic, invasive procedure indicated; 4=life threatening consequences.

‡Psychosocial spiritual care: There are multiprofessional team members involved in the care, such as, music therapists and spiritual care worker.

DNR, do not resuscitation; ECOG, Eastern Cooperative Oncology Group; HHC, hospice home care; HIC, hospice inpatient care; HSC, hospice share care.

Table 2 Characteristics of patients with cancer and non-cancer patients

Characteristic	Patients no. (%)		P value*
	Non-cancer (n=1205)	Cancer (n=7669)	
Basic demographics			
Age, mean (SD), years	69 (21)	64 (15)	<0.001
Gender			<0.001
Male	673 (55.9)	4695 (61.2)	
Female	532 (44.1)	2974 (38.8)	
DNR document signing			<0.001
Before care	900 (80.7)	3576 (58.9)	
After care	215 (19.3)	2495 (41.1)	
ECOG performance			<0.001
0–2	7 (0.8)	278 (5.4)	
3–4	920 (99.2)	4859 (94.6)	
Group			<0.001
HSC	1088 (90.3)	5988 (78.1)	
HIC	47 (3.9)	871 (11.4)	
HHC	70 (5.8)	810 (10.6)	
Length of HSC (days), mean (SD)	10 (11)	12 (14)	<0.001
Length of HIC (days), mean (SD)	10 (11)	11 (11)	0.154
Length of HHC (days), mean (SD)	149 (211)	64 (103)	<0.001
Symptoms score			
Pain			<0.001
0–3	996 (96.0)	4482 (86.8)	
4–6	29 (2.8)	529 (10.2)	
7–10	12 (1.2)	155 (3.0)	
Dyspnoea			<0.001
0	168 (15.3)	1259 (24.0)	
1–2	328 (29.8)	2291 (43.6)	
3–4	603 (54.9)	1701 (32.4)	
Dysphagia			<0.001
0	122 (11.4)	1143 (22.6)	
1–2	119 (11.1)	1561 (30.9)	
3–4	828 (77.5)	2350 (46.5)	
Incontinence			<0.001
0	228 (21.6)	1900 (38.4)	
1–2	68 (6.4)	880 (17.8)	
3–4	761 (72.0)	2165 (43.8)	
Psychosocial/spiritual issues			
Awareness of diagnosis (patient)			<0.001
Well known	406 (36.4)	4501 (78.4)	
Partial	101 (9.1)	529 (9.2)	
Unknown	607 (54.5)	708 (12.3)	
Awareness of prognosis (patient)			<0.001
Well known	260 (23.4)	3052 (53.4)	
Partial	189 (17.0)	1782 (31.2)	
Unknown	661 (59.5)	885 (15.5)	
Psychosocial issues (patient)			<0.001

Continued

Table 2 Continued

Characteristic	Patients no. (%)		P value*
	Non-cancer (n=1205)	Cancer (n=7669)	
Yes	518 (43.0)	4227 (55.1)	
No	687 (57.0)	3442 (44.9)	
Psychosocial issues (family)			<0.001
Yes	1061 (88.0)	5077 (66.2)	
No	144 (12.0)	2592 (33.8)	
Spiritual issues (patient)			<0.001
Yes	152 (12.6)	1865 (24.3)	
No	1053 (87.4)	5804 (75.7)	
Spiritual issues (family)			<0.001
Yes	853 (70.8)	3449 (45.0)	
No	352 (29.2)	4220 (55.0)	

*Statistical tests performed: Kruskal-Wallis test; Fisher's exact test for count data with simulated p value (based on 2000 replicates).
HSC, hospice share care; HIC, hospice inpatient care; HHC, hospice home care; DNR, do not resuscitation; ECOG, Eastern Cooperative Oncology Group.

advanced lung cancer receiving the HHC (figure 1). Patients with lung cancer who received the HHC had better survival than those who received other types of hospice care. In the adjusted Cox regression analysis, patients receiving the HHC had a better outcome (HR: 0.75, 95% CI: 0.66 to 0.86, $p < 0.001$). The HRs of the OS are as follows: age (1.01, 95% CI: 1.00 to 1.01, $p = 0.005$), female (0.85, 95% CI: 0.75 to 0.97, $p = 0.014$), target therapy (0.83, 95% CI: 0.72 to 0.96, $p = 0.013$) and systemic therapy (0.76, 95% CI: 0.64 to 0.90, $p = 0.002$), indicating the significance of these variables to predict the OS (online supplemental

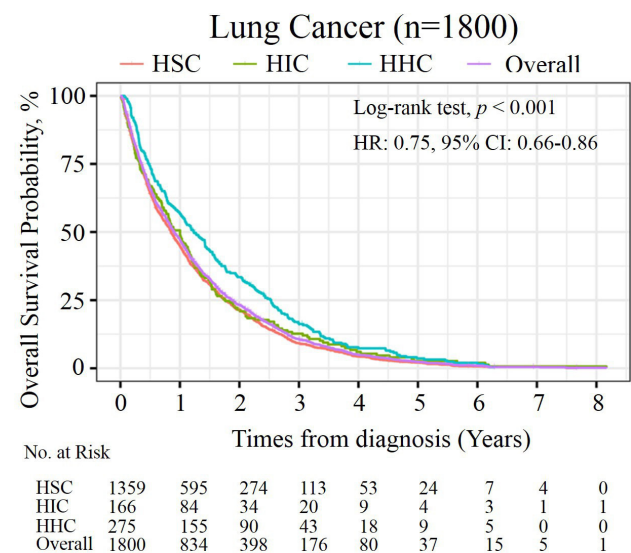


Figure 1 Kaplan-Meier plot of patients with lung cancer receiving different hospice delivery models. Patients with lung cancer receiving hospice home care had a significantly better survival outcome, with a log-rank $p < 0.001$. HHC, hospice home care; HIC, hospice inpatient care; HSC, hospice share care.

table 1). The median survival probabilities were 0.50 (95% CI: 0.442 to 0.568), 0.50 (95% CI: 0.414 to 0.586) and 0.52 (95% CI: 0.456 to 0.585) in HHC patients who were affected with advanced head and neck cancers, hepatocellular carcinomas and colorectal cancers (CRCs), respectively. Therefore, there was no significant difference according to the hospice delivery model ($p=0.20, 0.46, 0.69$). This study did not identify any difference in survival among patients with cancer based on the hospice care. These results indicated that the selection of hospice model did not

impact cancer survival significantly, except for patients with lung cancer.

Creating an individualised hospice care plan in patients with cancer

Based on the four major cancer types, the palliative care needs for individualised hospice care plans in patients with cancer were investigated. The characteristics of 3479 patients with advanced cancer with four major types of cancer who received hospice care are shown in table 3. Of the four cancer types assessed, higher

Table 3 Hospice care in different cancer types

Characteristic	Cancer types no. (%)					P value*
	Overall (N=3479)	Lung (n=1800)	HNSC (n=769)	HCC (n=515)	CRC (n=395)	
Basic demographics						
Hospice delivery model						<0.001
HSC	2695 (77.5)	1359 (75.5)	640 (83.2)	414 (80.4)	282 (71.4)	
HIC	287 (8.2)	166 (9.2)	46 (6.0)	46 (8.9)	29 (7.3)	
HHC	497 (14.3)	275 (15.3)	83 (10.8)	55 (10.7)	84 (21.3)	
Length of HSC (days), mean (SD)	9 (11)	9 (10)	12 (14)	8 (10)	9 (10)	<0.001
Length of HIC (days), mean (SD)	5 (10)	5 (10)	6 (11)	4 (8)	6 (10)	0.122
Length of HHC (days), mean (SD)	20 (55)	23 (64)	19 (51)	11 (32)	20 (43)	<0.001
Diagnosis to hospice (months), mean (SD)	14 (16)	14 (15)	17 (19)	6 (9)	22 (19)	<0.001
Symptoms/signs score						
Pain						
0–3	2178 (88.1)	1114 (90.1)	463 (84.6)	330 (88.0)	271 (86.3)	
4–6	234 (9.5)	94 (7.6)	67 (12.2)	36 (9.6)	37 (11.8)	
7–10	61 (2.5)	29 (2.3)	17 (3.1)	9 (2.4)	6 (1.9)	
Dyspnoea						
0	628 (24.9)	263 (20.2)	134 (24.9)	115 (31.2)	116 (37.4)	<0.001
1–2	1156 (45.8)	569 (43.6)	254 (47.1)	193 (52.4)	140 (45.2)	
3–4	738 (29.3)	473 (36.2)	151 (28.0)	60 (16.3)	54 (17.4)	
Nausea						
0	2054 (85.4)	1068 (87.9)	468 (90.9)	289 (79.8)	229 (73.4)	<0.001
1–2	285 (11.9)	120 (9.9)	42 (8.2)	64 (17.7)	59 (18.9)	
3–4	65 (2.7)	27 (2.2)	5 (1.0)	9 (2.5)	24 (7.7)	
Dysphagia						
0	582 (23.9)	287 (23.3)	80 (14.9)	123 (33.7)	92 (30.3)	<0.001
1–2	813 (33.3)	430 (34.9)	112 (20.9)	144 (39.5)	127 (41.8)	
3–4	1044 (42.8)	516 (41.8)	345 (64.2)	98 (26.8)	85 (28.0)	
Fungating wound						
0	2145 (90.1)	1184 (98.7)	312 (59.5)	355 (99.4)	294 (97.7)	<0.001
1–2	180 (7.6%)	10 (0.8)	162 (30.9)	2 (0.6)	6 (2.0)	
3–4	57 (2.4)	6 (0.5)	50 (9.5)	0 (0.0)	1 (0.3)	
Ascites†						
0	1845 (77.3)	1074 (89.1)	463 (91.3)	123 (33.2)	185 (60.7)	<0.001
1–2	409 (17.1)	116 (9.6)	39 (7.7)	166 (44.7)	88 (28.9)	
3–4	134 (5.6)	15 (1.2)	5 (1.0)	82 (22.1)	32 (10.5)	

*Statistical tests performed: Fisher's exact test for count data with simulated p value (based on 2000 replicates); Kruskal-Wallis test.

†Grade of ascites: 0=No; 1=asymptomatic, medical intervention indicated; 2=symptomatic, invasive procedure indicated; 3=symptomatic, life threatening consequences.

CRC, colorectal cancer; DNR, do not resuscitation; ECOG, Eastern Cooperative Oncology Group; HCC, hepatocellular carcinoma; HHC, hospice home care; HIC, hospice inpatient care; HNSC, head and neck cancer; HSC, hospice share care; Lung, lung cancer.

proportions of patients with lung cancer (15.3%) and patients with CRC (21.3%) received the HHC. The mean lengths of the delivery of the HSC, HIC and HHC were 9, 5 and 20 days, respectively. Compared with hepatocellular carcinoma patients ($M_{\text{days}}=11$, $SD=32$ days), the mean duration of the HHC was longer, with 23 days, 19 days and 20 days for patients with lung cancer, patients with head and neck cancer and patients with CRC, respectively. The mean time from the cancer diagnosis to hospice care delivery was 14 months; the duration was 6 months for patients with hepatocellular carcinoma and 22 months for patients with CRC. Most of the patients had poor ECOG performance status scores of 3–4 (more than 95%).

A total of 36.2% and 41.8% of the patients with lung cancer had severe dyspnoea and dysphagia symptoms, respectively. A total of 64.2% and 9.5% of patients with the head and neck cancer had dysphagia and fungating wounds, respectively. In total, 22.1% of the patients with hepatocellular carcinoma had severe ascites. A high percentage of the patients with CRC receiving the HHC had a lower symptom burden. Most of the severe symptoms experienced by the patients with CRC were nausea and vomiting (7.7%). The proportions of patients who experienced psychosocial and spiritual distress were similar in the four cancer type groups. The models chosen by the patients receiving hospice care are shown in online supplemental table 2. Based on the results of this study, we can create an individualised hospice care plan for patients.

DISCUSSION

With advances in specialised hospice care, selection of an appropriate service model for hospital-based palliative care is critical. Several characteristics were identified to be associated with the palliative care needs in different approaches. There are four main results: (1) We identified palliative care needs and characterised symptoms among three approaches to palliative care in table 1. Patients who received the HHC were less likely to have dyspnoea, dysphagia and ascites, (2) compared with patients with cancer, a greater number of non-cancer patients had dyspnoea and dysphagia. Most of the non-cancer patients received the HSC, (3) better survival was observed in patients with lung cancer receiving the HHC. The selection of hospice model has no significant impact on survival in other types of cancer and (4) depending on the four major cancer types, individualised hospice care plans were created for patients with cancer. Through this comprehensive approach, new insights into the identification of palliative care needs and characteristic symptoms for these three palliative cares were provided, in Taiwan. Using these four themes, an individualised hospice service delivery model was constructed. Focused education plans for specialised hospice care were also provided.

We encountered difficulties when discharging hospice patients to care homes.¹⁶ There was no standardisation

of hospice services. The heterogeneity of the patients meant that the care needed to be adaptive.¹⁷ We used four key themes to discuss care models, patients with cancer and non-cancer patients, cancer characteristics and survival. Using these four themes, we constructed an individualised hospice service delivery model. Consistent with previous the research,⁵ the HIC provides expert symptom management for acutely symptomatic hospitalised patients. Patients with the highest level of distress and complexity benefit from admission to the HIC units. In contrast, the HHC is more appropriate for patients with a poor performance status and low-to-moderate symptom burden. The study results show that the HIC provides greater symptom control and ability to address complex psychosocial and spiritual issues, similar to hospice intensive care. This also indicates that another point of focus for the HHC patients is to reduce the frequency of hospital admission by implementing home care plans for disease exacerbations. These could be individual interventions or can be integrated into hospital discharge plans.

For non-cancer patients, the unpredictable disease trajectories make hospice planning more complex, including symptom control, prognosis, and the psychosocial and spiritual needs of their caregivers.¹⁸ It imposes significant burdens on both the patients and the family members. Integrating palliative care into chronic disease management is difficult.^{19 20} The HSC is suitable for non-cancer patients, as it facilitates cooperation with their primary care team to achieve symptom control. It helps professionals communicate with the patients about the natural course of their disease and the prognosis. Cross-team cooperation provides comprehensive supportive care for patients with advanced disease throughout its course. This study found that non-cancer patients had higher dyspnoea and dysphagia scores, whereas patients with cancer struggled with greater pain. These results were consistent with previous findings, demonstrating that a trigger for palliative care may be identified by assessing the patient symptoms.²¹ In this study, non-cancer patients were more likely to receive the HSC than the other two models. The non-cancer patients were elderly, with poor performance status scores and higher symptoms of dyspnoea and dysphagia. An adequate amount of time should be spent while communicating the diagnosis and prognosis to the patients and their families.

Initiating palliative care early in oncology is essential and can improve patient outcomes.^{22 23} In case of patients with lung cancer, there was no difference in survival between those who received aggressive therapy at the EOL and those who did not.²⁴ However, there have only been a few studies on survival in patients receiving different hospice models. The national death registry databank and official mortality data were used to investigate the survival in patients with cancer

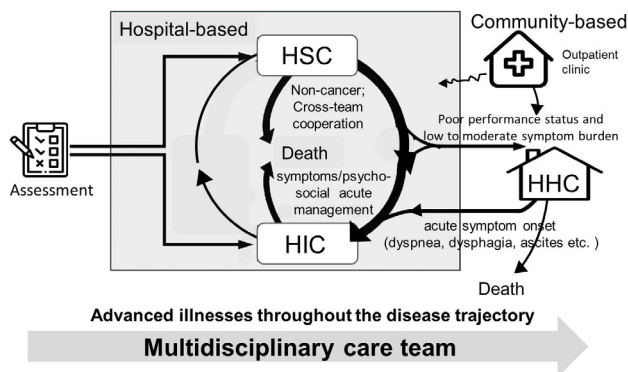


Figure 2 Incorporating different models of palliative care. These three models of palliative care can be applied to subsets of the hospice patient population with different characteristics, providing comprehensive care along the disease spectrum.

receiving hospice care. Patients with lung cancer receiving the HHC showed survival benefit.

Although majority of people want to spend their last moments in their home, including patients with cancer and older adults, most face death in a hospital.²⁵ In a previous study, the mean duration of home care was 10.8 days.²⁶ In this study, 21.3% of the patients with advanced CRC received the HHC. The mean duration of the HHC was 20 days for the patients with CRC, which was twice as long compared with the hepatocellular carcinoma patients. They had a lower symptom burden, with the exception of nausea and vomiting. Most patients with CRC were aware of their diagnosis. The HHC is an appropriate option for the patients with CRC. In contrast, if the HCC patients have severe ascites, the HIC is a suitable option.

Integrating hospice care for suitable patients was proposed in this study. Figure 2 illustrates the different models of palliative care. Each of these models is best suited for a hospice patient population with specific characteristics along the course of their disease. Palliative care interventions can be individualised to further improve the quality of care. Future research should establish the effectiveness of these models, disseminating or promoting their acceptance once they are proven to be useful or are integrated in clinical practice.

Following limitations should be considered when interpreting the findings: (1) Our data were limited to referred patients and clinicians limit referrals for patients with serious illness to those with poor performance status scores. The OS of cancer could be influenced by many factors. The hospice care is not reimbursed by NHI if patients refuse to sign a DNR. Owing to the late referral of hospice care in Taiwan, the difference of OS in patients with lung cancer might not be relevant to the effect of hospice care in our study, (2) the symptom assessment may have evaluated symptoms of the other comorbidities, (3) the data were collected from a single institute, limiting the

generalisation and (4) because this is an observational research, baseline imbalances (unbalanced group size) might affect estimates. Therefore, multivariable analyses were used to allow adjustment for all available confounders. The strength of these analyses is that researchers attain a greater idea of the palliative care by including a large number of patients. The weakness of the research is that with missing data, exposure estimates may be biased, which can decrease confidence in the result. Further research is needed to develop standardised screening processes. They should not only be based on assessing patients' clinical characteristics but also on anticipating their palliative care needs and predicting the course of their functional decline. A comprehensive assessment could identify their potential needs, which could be promptly fulfilled.

CONCLUSIONS

Our data support the use of a comprehensive hospice care assessment to guide the selection of an appropriate hospice care model for terminally ill patients. Based on the comprehensive hospice assessments and symptom characteristics, individualised care targeting improvement in EOL care was formulated. In the future, focus shall be on the patients' need and characteristics with a change in hospice services.

Author affiliations

¹Department of Nursing, College of Medicine, National Cheng Kung University, Tainan, Taiwan

²Department of Oncology, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, Tainan, Taiwan

³Department of Statistics, National Cheng Kung University, Tainan, Taiwan

⁴Center for Quantitative Sciences, Clinical Medicine Research Center, National Cheng Kung University Hospital, Tainan, Taiwan

⁵Department of Nursing, National Cheng Kung University Hospital, College of Medicine, National Cheng Kung University, Tainan, Taiwan

X Peng-Chan Lin @pengchanlin

Contributors All authors confirm public responsibility for the conduct of the study, had access to the data, and controlled the decision to publish. The order of authors listed in the manuscript has been approved by all the authors. P-CL had full access to all data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis. Concept and design, acquisition, analysis or interpretation of data and critical revision of the manuscript for important intellectual content: All authors. Drafting of the manuscript: W-SL, I-TL, J-HT and P-CL. Statistical analysis: P-FS and P-HC. Supervision: P-FS and P-CL. All authors have read and approved the manuscript and agree with its publication.

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ORCID iDs

Wei-Shu Lai <http://orcid.org/0000-0002-8308-9228>

Peng-Chan Lin <http://orcid.org/0000-0002-9424-1985>

REFERENCES

- 1 Teno JM, Gozalo PL, Bynum JPW, *et al.* Change in end-of-life care for Medicare beneficiaries: site of death, place of care, and health care transitions in 2000, 2005, and 2009. *JAMA* 2013;309:470–7.
- 2 Wright AA, Keating NL, Ayanian JZ, *et al.* Family perspectives on aggressive cancer care near the end of life. *JAMA* 2016;315:284–92.
- 3 He Y-J, Lin M-H, Hsu J-L, *et al.* Overview of the motivation of advance care planning: a study from a medical center in Taiwan. *Int J Environ Res Public Health* 2021;18:417.
- 4 Lin W-Y, Chiu T-Y, Ho C-T, *et al.* Hospice shared-care saved medical expenditure and reduced the likelihood of intensive medical utilization among advanced cancer patients in Taiwan—a nationwide survey. *Support Care Cancer* 2014;22:1907–14.
- 5 Ko E, Fuentes D, Singh-Carlson S, *et al.* Challenges and facilitators of hospice decision-making: a retrospective review of family caregivers of home hospice patients in a rural US-Mexico border region—a qualitative study. *BMJ Open* 2020;10:e035634.
- 6 Danielsen BV, Sand AM, Rosland JH, *et al.* Experiences and challenges of home care nurses and general practitioners in home-based palliative care - a qualitative study. *BMC Palliat Care* 2018;17:95.
- 7 Wiencek C, Coyne P. Palliative care delivery models. *Semin Oncol Nurs* 2014;30:227–33.
- 8 Hui D, Bruera E. Models of palliative care delivery for patients with cancer. *J Clin Oncol* 2020;38:852–65.
- 9 Bakitas MA, Dionne-Odom JN, Ejem DB, *et al.* Effect of an early palliative care telehealth intervention vs usual care on patients with heart failure: the enable CHF-PC randomized clinical trial. *JAMA Intern Med* 2020;180:1203–13.
- 10 Parikh RB, Kirch RA, Smith TJ, *et al.* Early specialty palliative care—translating data in oncology into practice. *N Engl J Med* 2013;369:2347–51.
- 11 Koffman J, Higginson IJ. Dying to be home? preferred location of death of first-generation black Caribbean and native-born white patients in the United Kingdom. *J Palliat Med* 2004;7:628–36.
- 12 Higginson IJ, Finlay IG, Goodwin DM, *et al.* Is there evidence that palliative care teams alter end-of-life experiences of patients and their caregivers? *J Pain Symptom Manage* 2003;25:150–68.
- 13 Jeurkar N, Farrington S, Craig TR, *et al.* Which hospice patients with cancer are able to die in the setting of their choice? results of a retrospective cohort study. *J Clin Oncol* 2012;30:2783–7.
- 14 The Economist Intelligence Unit. 2015 quality of death index, 2015. Available: <https://www.eiuperspectives.economist.com/healthcare/2015-quality-death-index>
- 15 Trotti A, Colevas AD, Setser A, *et al.* CTCAE v3.0: development of a comprehensive grading system for the adverse effects of cancer treatment. *Semin Radiat Oncol* 2003;13:176–81.
- 16 Thomas T, Clarke G, Barclay S. The difficulties of discharging hospice patients to care homes at the end of life: a focus group study. *Palliat Med* 2018;32:1267–74.
- 17 Hasson F, Jordan J, McKibben L, *et al.* Challenges for palliative care day services: a focus group study. *BMC Palliat Care* 2021;20:11.
- 18 Wenedy A, Lim YQ, Lin Ronggui CK, *et al.* A study of medication use of cancer and non-cancer patients in home hospice care in Singapore: a retrospective study from 2011 to 2015. *J Palliat Med* 2019;22:1243–51.
- 19 Hess S, Stiel S, Hofmann S, *et al.* Trends in specialized palliative care for non-cancer patients in Germany—data from the national hospice and palliative care evaluation (HOPE). *Eur J Intern Med* 2014;25:187–92.
- 20 Boland J, Johnson MJ. End-Of-Life care for non-cancer patients. *BMJ Support Palliat Care* 2013;3:2–3.
- 21 Bostwick D, Wolf S, Samsa G, *et al.* Comparing the palliative care needs of those with cancer to those with common non-cancer serious illness. *J Pain Symptom Manage* 2017;53:1079–84.
- 22 Finlay E, Newport K, Sivendran S, *et al.* Models of outpatient palliative care clinics for patients with cancer. *J Oncol Pract* 2019;15:187–93.
- 23 Temel JS, Greer JA, Muzikansky A, *et al.* Early palliative care for patients with metastatic non-small-cell lung cancer. *N Engl J Med* 2010;363:733–42.
- 24 Yoo SH, Keam B, Kim M, *et al.* The effect of hospice consultation on aggressive treatment of lung cancer. *Cancer Res Treat* 2018;50:720–8.
- 25 Korean Statistical Information System. Annual report on the causes of death statistics, 2017. Available: <http://kosis.nso.go.kr>
- 26 Tyrer F, Exley C. Receiving care at home at end of life: characteristics of patients receiving hospice at home care. *Fam Pract* 2005;22:644–6.

Supplementary Table 1. Univariate and Multivariate Analysis of Lung Cancer Survival

Explanatory	Total N	levels	HR (univariable)	HR (multivariable)
Hospice delivery model	1145	HSC	-	-
		HIC	0.89 (0.73-1.10, $p=0.278$)	1.11 (0.90-1.36, $p=0.336$)
		HHC	0.71 (0.60-0.84, $p<0.001$)	0.39 (0.32-0.48, $p<0.001$)
Diagnosis to hospice (Months)	1145	Mean (SD)	0.90 (0.89-0.90, $p<0.001$)	0.89 (0.88-0.90, $p<0.001$)
Age	1145	Mean (SD)	1.02 (1.01-1.03, $p<0.001$)	1.01 (1.00-1.01, $p=0.005$)
Gender	1145	Male	-	-
		Female	0.67 (0.59-0.75, $p<0.001$)	0.85 (0.75-0.97, $p=0.014$)
Targeted Therapy	1145	No	-	-
		Yes	0.51 (0.45-0.58, $p<0.001$)	0.83 (0.72-0.96, $p=0.013$)
Radiotherapy	1145	No	-	-
		Yes	1.28 (1.13-1.46, $p<0.001$)	0.94 (0.82-1.08, $p=0.383$)
Systemic Therapy	1145	No	-	-
		Yes	0.28 (0.24-0.33, $p<0.001$)	0.76 (0.64-0.90, $p=0.002$)

Abbreviations: N, Numbers; HR, Hazard ratio; HSC, hospice share care; HIC, hospice inpatient care; HHC, hospice home care

Supplementary Table 2. Individualized Hospice Care Plan by Patient Characteristics

Hospice delivery model	Patient characteristics
Hospice share care	Noncancer patients, cross-team symptom management, Do-not-resuscitate or hospice care communication
Hospice inpatient care	Dyspnea in noncancer or lung cancer patients. Patients with nausea and dysphagia. Ascites, especially in hepatocellular carcinoma patients
Hospice home care	Low to moderate symptom burdens such as colorectal and lung cancer patients. Head and neck cancer patients with fungating wounds