

# Medical care utilization and costs on end-of-life cancer patients

## The role of hospice care

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### Abstract

Although there are 3 hospice care programs for terminal cancer patients in Taiwan, the medical utilization and expenses for these patients by programs have not been well-explored. The aim of this study was to examine the medical utilization and expenses of terminal cancer patients under different programs of hospice care in the last 90, 30, and 14 days of life.

This was a retrospective observational study by secondary data analysis. By using the National Health Insurance claim database and Hospice Shared Care Databases. We identified cancer descents from these databases and classified them into nonhospice care and hospice care groups based on different combination of hospice care received. We then analyzed medical utilization including inpatient care, outpatient care, emergency room visits, and medical expenses by patient groups in the last 90, 30, and 14 days of life.

Among 118,376 cancer descents, 46.9% ever received hospice care. Patients had ever received hospice care had significantly lower average medical utilization and expenses in their last 90, 30, and 14 days of life (all  $P < 0.001$ ) compared to nonhospice care group. Each hospice care group had significantly less medical utilization and expenses in the last 90, 30, and 14 days of life (all  $P < 0.01$ ).

Different kinds of hospice care program have different effects on medical care utilization reduction and cost-saving at different stage of the end of life of terminal cancer patients.

**Abbreviations:** ER = emergency room, HHC = hospice home care, HIC = hospice inpatient care, HSC = hospice shared care, NHC = nonhospice care, NHI = National Health Insurance, NHIRD = National Health Insurance Research Database.

**Keywords:** end-of-life care, hospice home care, hospice inpatient care, hospice shared care, medical expenses, medical utilization

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## 1. Introduction

Hospice care is a type of care and philosophy of care that focuses on the palliation of a chronically ill, terminally ill or seriously ill patient's pain and symptoms, and attending to their emotional and spiritual needs.

In Taiwan, hospice cares are reimbursed by the National Health Insurance (NHI) programs. Currently, 3 kinds of hospice care programs are provided to terminal cancer patients in Taiwan. The 1st program is hospice home care (HHC), which began in 1996, providing hospice care to terminal patients living in the community or in long-term care facilities. The 2nd program is hospice inpatient care (HIC), which began in 2000, providing inpatient care to terminal patients who need to be hospitalized and who are willing to be admitted to a hospice ward. The 3rd program, hospice shared care (HSC), which is a kind of inpatient palliative consultation began in 2005, providing care to patients who are admitted to acute hospital wards and who are in need of palliative care for physical, psychosocial, or spiritual issues.<sup>[1]</sup>

Previous studies conducted in Taiwan and Southern Korea reported cost-saving impacts on inpatient hospice care for hepatocellular carcinoma<sup>[2]</sup> and lung cancer patients,<sup>[3,4]</sup> and another study conducted in the United States reported cost reduction in inpatient hospice care for terminal cancer and noncancer patients.<sup>[5]</sup> Several studies revealed that inpatient palliative consultation or HSC reduced costs and provided better care to seriously ill or terminal cancer patients.<sup>[6,7]</sup> Recent studies on HHC were focused on caregiver support needs assessments,<sup>[8]</sup>

after-hours symptoms management,<sup>[9]</sup> and caregivers' experiences and needs of families under HHC.<sup>[10]</sup> In Taiwan, the NHI provided comprehensive hospice care programs for patients with different needs, however, at present no study has focus on medical utilization and medical expenses on patients received different kinds of end-of-life hospice care. Therefore, the aims of this study were to analyze hospital admissions, outpatient clinic visits, emergency room (ER) visits, and medical costs in the last 90, 30, and 14 days of life for terminal cancer patients to understanding the medical utilization pattern and medical expenses by patients under different hospice care groups for further policy discussions.

## 2. Methods

### 2.1. Data sources

This study was a secondary data analysis. First, we used the National Health Insurance Research Database, which contains deidentified secondary data derived from patient registries and claims data from the Taiwan NHI program, to identify subjects who died of cancer (ICD-9-CM coding 140-208) between January 1, 2010 and December 31, 2012. The Taiwan NHI program, which began in 1995, covers more than 99% of the national population with good representativeness. Then we linked the data to the Hospice Shared Care Database (HDB) for further analysis. The National Health Insurance Research Database provides information of outpatient care (including HHC), inpatient care (including HIC and HSC), ER visits, medical examinations, and managements. The HSC database provides information of HSC. There were a total of 118,376 patients died of cancer during the study period. We further classified patients into 8 groups as nonhospice care (NHC), HSC, HIC, HHC, HSC and HIP, HSC and HHC, HSC, HIC, and HHC, and HIP and HHC. This study was approved by the institutional review board of Taipei Veterans General Hospital.

### 2.2. Statistical analysis

Data linkage and statistical analyses were performed by SAS 9.2. For descriptive statistical analysis, continuous variables were presented by mean and standard deviation while categorical variables were presented by number and percentage. For inference statistics, NHC and different hospice care groups were

compared. Continuous variables were compared by using *t* tests or ANOVA while categorical variables were compared by Chi-square tests. Medical utilization and expenses between groups were presented at 3 different periods: last 90, 30, and 14 days of life. A 2-tailed *P* value <0.05 was considered as statistical significant.

## 3. Results

Among all cancer descents, 62,884 (53.1%) never received hospice care (NHC group) while 55,492 (46.9%) cancer descents ever received hospice care. Among them, 25,907 (21.9%) received HSC, 10,925 (9.2%) received HSC and HIC, 7783 (6.6%) received HIC, 3630 (3.1%) received HSC, HIC, and HHC, 2818 (2.4%) received HIC and HHC, 2531 (2.1%) received HSC and HHC, and 1898 (1.6%) received HHC. For age distributions in different care groups, majority patients in the NHC group (37.6%), HSC group (35.0%), HSC and HIC (32.9%), HIC (35.8%), HSC, HIC, and HHC group (37.1%), HSC and HHC (38.2%), and HHC (42.5%) died between 65 and 79 years old, while majority of the patients only received HSC (35.0%) died between 50 and 64 years. The score of Charlson comorbidity index of patients received either kind of hospice cares were significantly higher than who never received hospice care (all *P* < 0.001). Among patients ever received hospice care, patients received HSC, HIC, and HHC had longer duration ( $128.2 \pm 167.8$  days) of hospice care, followed by HSC and HHC ( $101.1 \pm 149.4$  days), HIC and HHC ( $89.6 \pm 123.0$  days), HHC ( $61.8 \pm 112.7$  days), and HSC and HIC ( $59.8 \pm 113.3$  days) (Table 1). Cancer diagnoses for these patients were described in Table 2, and the top 2 diagnoses were lung cancer and liver cancer both for NHC and hospice care patients.

We then compared NHC patients with patients received hospice care and found that patients ever received hospice care had significantly lower average frequency of hospital admission, length of stay, admission expenses, average number of outpatient visits, average outpatient care medical expenses, ER visits, average ER medical expenses, and average total medical expenses in the last 90, 30, and 14 days of their life (all *P* < 0.001) (Table 3).

We further compared medical utilization and expenses between patients received different kinds of hospice care and NHC patients. In the last 90 days of patients' life, compared with

**Table 1**  
Demographic characteristics of terminal cancer patients under different kind of care (total n=118,376).

Characteristics	NHC	HSC	HSC and HIC	HIC	HSC, HIC, and HHC	HSC and HHC	HIC and HHC	HHC
Total number (n, %)	62,884 (53.1)	25,907 (21.9)	10,925 (9.2)	7783 (6.6)	3630 (3.1)	2531 (2.1)	2818 (2.4)	1898 (1.6)
Sex								
Male (n, %)	41,605 (66.2)	16,240 (62.7)	6515 (59.6)	4660 (59.9)	1951 (53.7)	1348 (53.3)	1495 (53.1)	1011 (53.3)
Female (n, %)	21,279 (33.8)	9667 (37.3)	4410 (40.4)	3123 (40.1)	1679 (46.3)	1183 (46.7)	1323 (46.9)	887 (46.7)
Age at mortality (year, mean $\pm$ SD)	67.7 $\pm$ 14.5	63.6 $\pm$ 14.6	64.9 $\pm$ 14.6	67.7 $\pm$ 14.3	67.7 $\pm$ 14.3	68.0 $\pm$ 14.0	70.5 $\pm$ 13.5	71.4 $\pm$ 13.0
<35 (n, %)	1133 (1.8)	647 (2.5)	213 (1.9)	89 (1.1)	52 (1.4)	38 (1.5)	20 (0.7)	15 (0.8)
35–49 (n, %)	5947 (9.5)	3786 (14.6)	1508 (13.8)	840 (10.8)	382 (10.5)	229 (9)	202 (7.2)	113 (6)
50–64 (n, %)	17,421 (27.7)	9066 (35)	3588 (32.8)	2205 (28.3)	977 (26.9)	707 (27.9)	658 (23.3)	388 (20.4)
65–79 (n, %)	23,639 (37.6)	8380 (32.3)	3590 (32.9)	2786 (35.8)	1346 (37.1)	966 (38.2)	1089 (38.6)	807 (42.5)
$\geq$ 80 (n, %)	14,744 (23.4)	4028 (15.5)	2026 (18.5)	1863 (23.9)	873 (24)	591 (23.4)	849 (30.1)	575 (30.3)
Charlson comorbidity index score (mean $\pm$ SD)	6.9 $\pm$ 2.6	7.3 $\pm$ 2.3	7.5 $\pm$ 2.2	7.4 $\pm$ 2.2	7.6 $\pm$ 2.2	7.5 $\pm$ 2.2	7.5 $\pm$ 2.2	7.3 $\pm$ 2.3
Days on hospice care (mean $\pm$ SD)	0	49.0 $\pm$ 120.7	59.8 $\pm$ 113.3	28.3 $\pm$ 59.3	128.2 $\pm$ 167.8	101.1 $\pm$ 149.4	89.6 $\pm$ 123.0	61.8 $\pm$ 112.7

HHC=hospice home care, HIC=hospice inpatient care, HSC=hospice shared care, NHC=nonhospice care, SD=standard deviation.

**Table 2**  
**Cancer diagnosis of patients by different kind of care (total n = 118,376).**

	NHC	HSC	HSC and HIC	HIC	HSC, HIC, and HHC	HSC and HHC	HIC and HHC	HHC <sup>a</sup>
Total number (n, %)	62,884 (53.1)	25,907 (21.9)	10,925 (9.2)	7783 (6.6)	3630 (3.1)	2818 (2.4)	2531 (2.1)	1898 (1.6)
Hepatocellular carcinoma	11,985 (19.1)	4818 (18.6)	1955 (17.9)	1439 (18.5)	471 (13)	379 (15)	391 (13.9)	260 (13.7)
Lung cancer	11,516 (18.3)	5026 (19.4)	1831 (16.8)	1435 (18.4)	694 (19.1)	501 (19.8)	543 (19.3)	409 (21.5)
Hematological malignancy	4275 (6.8)	1073 (4.1)	253 (2.3)	157 (2)	66 (1.8)	55 (2.2)	43 (1.5)	39 (2.1)
Oral cancer	4030 (6.4)	1837 (7.1)	905 (8.3)	515 (6.6)	315 (8.7)	127 (5)	162 (5.7)	98 (5.2)
Gastric cancer	3402 (5.4)	1510 (5.8)	679 (6.2)	434 (5.6)	216 (6)	155 (6.1)	167 (5.9)	119 (6.3)
Colorectal cancer	2879 (4.6)	1113 (4.3)	472 (4.3)	365 (4.7)	198 (5.5)	141 (5.6)	186 (6.6)	118 (6.2)
Esophageal cancer	2557 (4.1)	1059 (4.1)	389 (3.6)	233 (3)	103 (2.8)	66 (2.6)	66 (2.3)	51 (2.7)
Breast cancer	2435 (3.9)	1367 (5.3)	544 (5)	410 (5.3)	179 (4.9)	157 (6.2)	145 (5.1)	101 (5.3)
Prostate cancer	1935 (3.1)	487 (1.9)	217 (2)	218 (2.8)	110 (3)	87 (3.4)	118 (4.2)	66 (3.5)
Urinary bladder cancer	1764 (2.8)	394 (1.5)	193 (1.8)	144 (1.9)	86 (2.4)	69 (2.7)	54 (1.9)	35 (1.8)
Pancreas cancer	1623 (2.6)	1033 (4)	562 (5.1)	371 (4.8)	140 (3.9)	98 (3.9)	102 (3.6)	65 (3.4)
Nasopharyngeal cancer	919 (1.5)	311 (1.2)	149 (1.4)	110 (1.4)	56 (1.5)	39 (1.5)	45 (1.6)	30 (1.6)
Cervical cancer	740 (1.2)	430 (1.7)	205 (1.9)	141 (1.8)	91 (2.5)	36 (1.4)	56 (2)	33 (1.7)
Ovarian cancer	525 (0.8)	424 (1.6)	179 (1.6)	90 (1.2)	54 (1.5)	43 (1.7)	46 (1.6)	24 (1.3)
Pharyngeal cancer	351 (0.6)	123 (0.5)	49 (0.4)	47 (0.6)	27 (0.7)	12 (0.5)	18 (0.6)	12 (0.6)
Uterine cancer	334 (0.6)	234 (0.9)	93 (0.9)	49 (0.7)	31 (0.9)	17 (0.7)	17 (0.6)	11 (0.6)
Others	11,526 (18.3)	4615 (17.8)	2233 (20.4)	1609 (20.7)	783 (21.6)	548 (21.7)	653 (23.2)	423 (22.3)

HHC=hospice home care, HIC=hospice inpatient care, HSC=hospice shared care, NHC=nonhospice care.

NHC group, the average frequency of hospital admission, length of stay, admission expenses, and outpatient visits were significantly less in each hospice care group than in the NHC group (all  $P < 0.001$ ), while the average outpatient care medical expenses were significantly less in HSC, HIC, HSC, HIC, HSC and HHC, HSC and HHC, HIC and HHC, and HHC groups than in NHC group (all  $P < 0.01$ ); the frequency of ER visits and ER medical expenses were significantly less in HSC and HIC, HIC, HIC, HSC, and HHC, HSC, and HHC groups (all  $P < 0.01$ ) (Table 4).

In the last 30 days of patients' life, when compared with NHC group, the average frequency of hospital admission, total admission expenses, outpatient visit frequency, total outpatient care expenses, ER visits, and ER care expense were significantly less in each hospice care group than in the NHC group (all  $P < 0.01$ ); the average length of stay was significantly shorter in each hospice care group except in the HSC and HHC group (Table 5).

In the last 14 days of patients' life, as compared with NHC group, the average frequency of hospital admission, length of stay, total admission expenses, outpatient visit frequency, outpatient care expenses, ER visit frequency, and ER care expenses were significantly less in each hospice care group than in NHC group (all  $P < 0.01$ ) (Table 6).

#### 4. Discussion

This study has 2 major significant findings. First, patients had ever received hospice care had significantly less medical utilization and expenses in their last 90, 30, and 14 days of life than patients never received hospice care. Second, each hospice care group had less medical utilization and expenses in the last 90, 30, and 14 days of life than patients never received hospice care.

Our findings are comparable to previous studies: 2 studies on EOL care for geriatric hepatocellular carcinoma and lung cancer patients found cost-reduction effects in their last hospital admission in Taiwan.<sup>[2,3]</sup> Another longitudinal study reported a cost-saving effect on lung cancer patients received inpatient hospice care in Taiwan.<sup>[11]</sup> Still another study in Korea found a

less hospital inpatient charges on terminal lung cancer patients admitted to hospitals with hospice care beds for end-of-life care.<sup>[4]</sup> A recent review article reported that inpatient palliative care consultation had a cost-saving effect on terminal care.<sup>[6]</sup> Another study in Taiwan reported that HSC saved medical costs and reduced intensive medical care utilization.<sup>[7]</sup>

Our study further compared medical utilization and expenses of patients received different kinds of hospice care. We found that patients under care of hospice cares involving inpatient cares including HSC, HSC and HIC, HIC, HSC had significantly less medical utilization and expenses in outpatient care and ER care in EOL care. This might due to that these patients spend a considerable time been taken care in the hospital. Several studies reported that HIC<sup>[2-5,12-14]</sup> and inpatient hospice consultation care<sup>[6,7,15]</sup> could save medical care costs. We also found that patients who received hospice care involving HHC had significantly less medical utilization of inpatient care and expenses in the end of life. Another significant finding in this study is the different cost-saving effects in medical utilization and expenses in the different stage of end-of-life, the cost-saving effects became more extensive near patients' death. A previous study in Canada found that community-based palliative care could reduce healthcare cost by reducing the use of acute care beds.<sup>[16]</sup> Another study in the United States reported that patients under in-home palliative care were less likely to visit the emergency department or admitted to the hospital than patients receiving usual care which resulting in significantly cost-reduction in in-home palliative care patients.<sup>[17]</sup> It seems that HHC provides palliative care for patients at their homes could help patient stay in their own home and also is cost-saving.

Several previous studies have reported that overtreatment or aggressive end-of-life care could be harmful to terminal patients and their families. Patients received aggressive end-of-life care in institutions had poorer symptoms control, less physician communication, less emotional support, and less being treated with respect. But, family members of deceased patients who received hospice care at home were more likely to report a favorable dying experience.<sup>[18]</sup> Aggressive end-of-life care was also associated with worse quality of life of patients and worse

**Table 3** Medical utilization and expenses in non-hospice care and hospice care patients in the last 90, 30 and 14 days of patients' life.

Medical utilization and expenses (MTD)*	90 days			30 days			14 days		
	Nonhospice care	Hospice care	P	Nonhospice care	Hospice care	P	Nonhospice care	Hospice care	P
	n = 62,884	n = 55,492		n = 62,884	n = 55,492		n = 62,884	n = 55,492	
Length of stay, day	26.4	23.0	<0.001	9.3	10.7	<0.001	9.3	3.8	<0.001
Hospital admission frequency	1.9	1.2	<0.001	0.9	0.7	<0.001	0.7	0.6	<0.001
Average total hospital admission expenses	213,904.0	252,124.0	<0.001	83,634.4	120,367.0	<0.001	66,185.3	21,770.3	<0.001
Average examination expenses	922.6	1112.3	<0.001	867.1	1321.7	<0.001	432.0	299.3	<0.001
Average radiological examination expenses	688.5	1528.4	<0.001	446.1	1395.7	<0.001	265.8	122.5	<0.001
Average blood transfusion expenses	525.8	1431.0	<0.001	570.6	1773.5	<0.001	224.3	152.0	<0.001
Average hemodialysis expenses	76.7	339.2	<0.001	69.9	361.4	<0.001	21.9	13.6	<0.001
Average medication expenses	1899.8	2885.5	<0.001	1678.0	3314.7	<0.001	1026.5	657.1	<0.001
Outpatient visit frequency	9.5	6.8	<0.001	2.4	2.6	<0.001	1.9	1.4	<0.001
Average total outpatient care expenses	36,159.7	59,257.3	<0.001	7827.4	18,371.0	<0.001	5203.9	1382.2	<0.001
Average total outpatient care expenses	3477.1	5483.0	0.02	2362.2	5745.1	<0.001	1806.2	813.8	<0.001
ER visit frequency	1.6	1.7	<0.001	0.8	1.0	<0.001	0.7	0.4	<0.001
Average total ER care expenses	10,226.8	14,759.7	0.02	5922.6	10,751.5	<0.001	4702.7	5939.5	<0.001
Average ER care expenses per visit	5292.4	7839.6	<0.001	4287.3	8027.3	<0.001	3429.6	5175.4	<0.001

ER=emergency room, SD=standard deviation.  
\*1USD=30NTD.

**Table 4** Medical utilization and expenses in the last 90 days of terminal cancer patients' life (total n=118,376).

Medical utilization and expenses (MTD)*	NHC (n=62,448)		HSC (n=25,907)		HSC and HIC (n=10,925)		HSC, HIC, and HHC (n=3630)		HSC and HHC (n=2818)		HIC and HHC (n=2531)		HHC (n=1898)	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
	Hospital admission frequency	1.9	1.2	2.1	1.2	2.4	1.2	2.4	1.2	2.0	1.2	2.1	1.1	1.5
Length of stay, day	26.4	23.0	33.7	21.4	37.2	21.0	28.7	20.8	19.1	18.7	24.9	18.1	17.7	27.7
Average total hospital admission expenses	213,904.0	252,124.0	215,463.0	194,875.0	207,332.0	138,959.0	157,558.0	107,616.0	131,964.0	127,070.0	127,098.0	97,278.0	89,584.7	111,789.0
Average examination expenses	922.6	1112.3	648.5	547.6	463.0	377.3	443.1	492.5	306.7	624.4	308.9	366.0	536.7	1097.7
Average radiological examination expenses	688.5	1528.4	647.8	967.9	507.5	816.6	465.9	885.1	643.8	1387.9	270.0	669.7	459.1	1021.4
Average blood transfusion expenses	525.8	1431.0	336.0	734.8	183.2	436.4	134.0	356.6	468.1	468.1	83.2	226.1	122.0	360.6
Average hemodialysis expenses	76.7	339.2	33.7	217.1	24.8	191.5	23.4	191.5	121.9	169.4	8.8	112.6	9.0	111.0
Average medication expenses	1899.8	2885.5	1663.9	1728.5	1220.9	1398.8	1011.8	892.1	1205.3	1399.4	767.0	1220.9	1025.7	1912.4
Outpatient visit frequency	9.5	6.8	8.8	6.4	8.0	6.1	9.1	6.4	9.1	5.7	9.1	5.7	10.4	6.3
Average total outpatient care expenses	36,159.7	59,257.3	34,699.4	53,595.3	29,084.6	47,720.7	31,783.0	51,625.2	28,940.8	43,562.6	24,167.1	37,108.8	30,116.5	44,960.9
ER visit frequency	1.6	1.8	1.7	1.8	1.7	1.8	1.8	2.1	1.7	1.8	1.7	1.8	1.5	1.7
Average total ER care expenses	10,226.8	14,759.7	10,692.3	16,362.8	9875.4	13,783.6	10,089.2	12,839.1	8966.1	11,391.9	8015.7	11,280.5	7670.3	11,622.8

ER=emergency room, HHC=hospice inpatient care, HSC=hospice shared care, NHC=nonhospice care, SD=standard deviation.  
\*1USD=30NTD.

**Table 5**

**Medical utilization and expenses in the last 30 days of terminal cancer patients' life (total n = 118,376).**

Medical utilization and expenses (NTD)*	NHC (n = 62,448)		HSC (n = 25,907)		HSC and HIC (n = 10,925)		HIC (n = 7783)		HSC, HIC, and HHC (n = 3630)		HSC and HHC (n = 2818)		HIC and HHC (n = 2531)		HHC (n = 1898)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Hospital admission frequency	0.9	0.7	1.0	0.7	1.2	0.6	1.2	0.6	1.1	0.7	0.8	0.7	1.0	0.7	0.6	0.7
Length of stay, day	9.3	10.7	11.5	9.5	14.3	8.8	12.0	8.7	10.2	8.4	6.9	8.0	9.5	8.4	5.0	7.3
Average total admission expenses	83,634.4	120,367.0	73,183.3	82,490.0	76,110.0	55,042.0	62,742.7	50,682.0	50,902.5	43,144.6	35,877.3	53,021.2	47,251.0	42,008.5	25,411.6	42,554.2
Average examination expenses	867.1	1321.7	558.7	711.5	343.3	426.8	328.1	489.1	244.2	403.1	390.4	741.8	225.8	391.2	359.3	698.7
Average radiological examination expenses	446.1	1395.7	353.9	852.7	235.2	666.3	212.1	707.0	96.2	429.7	187.9	1225.4	82.5	362.1	160.7	664.2
Average blood transfusion expenses	570.6	1773.5	332.2	936.7	163.8	495.5	119.5	421.8	86.6	297.0	161.3	584.3	68.4	249.7	107.0	407.3
Average hemodialysis expenses	69.9	361.4	28.5	208.3	21.2	181.3	19.2	180.3	6.8	101.3	15.1	157.1	6.9	125.3	8.0	105.7
Average medication expenses	1678.0	3314.7	1291.1	2001.4	942.9	1249.2	778.2	1098.4	636.7	793.6	809.1	1337.5	558.2	777.5	644.7	1158.4
Outpatient visit frequency	2.4	2.6	1.8	2.3	1.4	2.0	2.0	2.3	1.9	1.8	2.5	2.2	2.3	2.1	3.1	2.4
Average total outpatient care expenses	7827.4	18,371.0	5758.7	14,881.3	3720.1	11,422.7	5467.2	15,115.0	4052.7	7858.6	5983.6	11,832.0	4712.2	10,458.3	6985.3	12,482.9
ER visit frequency	0.8	1.0	0.8	1.0	0.7	1.0	0.9	1.0	0.7	0.8	0.7	0.9	0.7	0.9	0.7	0.9
Average total ER care expenses	5922.6	10,751.5	5199.4	9379.6	4218.7	8102.4	5195.9	8372.2	3655.5	6049.2	4068.9	7733.2	3340.3	5475.9	3557.5	7019.1

ER = emergency room, HHC = hospice home care, HIC = hospice inpatient care, HSC = hospice shared care, NHC = nonhospice care, SD = standard deviation.  
\* 1USD = 30NTD.

**Table 6**

**Medical utilization and expenses in the last 14 days of terminal cancer patients' life (total n = 118,376).**

Medical utilization and expenses (NTD)*	NHC (n = 62,448)		HSC (n = 25,907)		HSC and HIC (n = 10,925)		HIC (n = 7783)		HSC, HIC, and HHC (n = 3630)		HSC and HHC (n = 2818)		HIC and HHC (n = 2531)		HHC (n = 1898)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Hospital admission frequency	0.5	0.6	0.5	0.6	0.8	0.5	0.8	0.6	0.6	0.6	0.4	0.5	0.6	0.6	0.3	0.5
Length of stay, day	3.0	5.6	3.3	4.6	5.2	4.7	4.7	4.5	3.4	4.2	2.1	3.6	3.3	4.2	1.7	3.2
Average total admission expenses	29,361.3	57,956.7	21,628.1	36,984.5	27,323.4	26,451.1	24,807.7	24,981.0	17,239.6	21,732.9	11,730.2	23,363.2	16,503.1	20,851.4	9166.7	19,579.7
Average examination expenses	675.3	1416.7	376.8	774.7	229.8	426.3	240.5	486.5	197.9	449.9	281.4	791.9	181.1	411.5	274.3	716.2
Average radiological examination expenses	278.1	1363.0	162.4	684.2	101.5	508.3	107.7	599.7	37.2	215.7	97.5	1158.5	40.0	207.3	80.2	457.1
Average blood transfusion expenses	441.3	1810.1	214.2	852.9	124.4	514.4	87.9	414.8	66.3	322.5	124.2	614.1	47.3	236.2	80.2	403.7
Average hemodialysis expenses	47.8	333.0	16.6	172.1	16.0	175.4	13.1	158.4	5.1	95.7	4.5	85.8	4.6	109.3	2.5	57.0
Average medication expenses	1133.6	3050.0	757.5	1874.8	687.6	1063.7	586.6	1036.1	436.6	828.3	529.0	1342.0	363.0	730.0	429.8	1093.6
Outpatient visit frequency	0.9	1.4	0.5	1.0	0.4	0.9	0.6	1.1	0.8	1.1	1.1	1.3	0.9	1.1	1.5	1.4
Average total outpatient care expenses	2529.2	8880.3	1345.3	5975.8	771.0	4201.0	1539.9	8714.1	1517.0	3287.5	2372.1	6442.3	1593.0	3527.3	2865.4	5428.4
ER visit frequency	0.5	0.7	0.4	0.7	0.3	0.6	0.5	0.7	0.4	0.6	0.4	0.6	0.4	0.6	0.4	0.6
Average ER care expenses	3881.0	8872.5	2617.3	6411.6	1881.8	5517.8	3006.6	6351.8	2086.3	4306.7	2367.9	5490.7	1927.6	4053.7	2251.1	5041.0

ER = emergency room, HHC = hospice home care, HIC = hospice inpatient care, HSC = hospice shared care, NHC = nonhospice care, SD = standard deviation.  
\* 1USD = 30NTD.

caregiver bereavement adjustment.<sup>[19]</sup> But, patients' quality of life and mood could be improved by early palliative care, and even longer survival.<sup>[20]</sup>

This study has several strengths. First, this is a study to examine different kinds of care, including hospice cares and NHC, on medical utilization and expenses at different stages of end-of-life care. Second, we used a nationwide data, including all terminal cancer patients, with good representativeness. However, the current study also has several limitations. First, because this is a secondary data analysis, some information including education and income of patients are not available. Second, due to the cross-sectional study design, the causal relationship could not be identified.

In conclusion, for terminal cancer patients, end-of-life hospice care could not only reduce medical care utilization but also is cost-saving. Different kinds of hospice care program have different effects on medical care utilization reduction and cost-saving at different stage of the end of life of terminal cancer patients.

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