Effects of hospice palliative care on medical service utilisation by patients on prolonged mechanical ventilation: A nationwide cohort study

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Research Article

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Abstract

Background: Several studies have shown that hospice palliative care interventions for cancer patients can reduce medical utilisation. In Taiwan, 20–25% of mechanical ventilation patients have been on prolonged mechanical ventilation (PMV), but only a few studies have discussed the effectiveness of hospice palliative care on these patients. This study aimed to explore the effectiveness of medical utilisation on patients undergoing PMV in hospice palliative care.

Methods: From the Health Insurance database of a nationwide population-based study, we identified patients who had been on mechanical ventilation for over 21 days, were 18 years or older between 2009 to 2017, and had undergone hospice palliative care. The control group was obtained by 1:1 matching using propensity scoring after excluding patients who had participated in palliative care for less than 15 or more than 181 days. Furthermore, we used conditional logistic regression analysis to explore intensive care unit readmission, emergency department presentation, and cardiopulmonary resuscitation incidents, 14 days prior to death.

Results: A total of 186,533 new PMV patients aged ≥ 18 years with terminal diseases were admitted between 2009 and 2017. Additionally, the number of patients receiving palliative care increased annually, from 0.6% in 2009 to 41.33% in 2017. The number of prolonged mechanical ventilation during emergency visits (odds ratio [OR]=0.68, 95%CI: 0.63-0.74), intensive care unit hospitalisation (OR=0.59, 95%CI: 0.53-0.46), cardiopulmonary resuscitation (OR=0.40, 95%CI: 0.35-0.46), and total hospitalisation cost (USD 1319.9.57 $\pm$ 1821.67 vs. 1544.37 $\pm$ 2309.27) was lower in the palliative care group.

Conclusion: Patients undergoing PMV whilst in hospice palliative care can significantly reduce total hospitalisation cost, intensive care unit admittance, cardiopulmonary resuscitation utilisation, and medical expenses at ≤ 14 days prior to death.

Background

The United States Federal Medical Insurance (Medicare) defines prolonged mechanical ventilation (PMV) as a continuous mechanical ventilation support requirement of ≥ 21 days, and ≥ 6 hours per day [1]. Taiwan's Ministry of Health and Welfare oversees its National Health Insurance Agency, which also uses the aforementioned definition [2]. Patients receiving PMV have been increasing in number consistently worldwide [3-6], and analysis from the National Inpatient Sample of the United States has predicted that patients on prolonged acute mechanical ventilation (mechanical ventilation ≥ 96 hours) will increase from 250,000 in 2000 to 605,898 in 2020 (approximately 2.4 times) [7].

The Taiwanese government reported that the number of beds in PMV care wards increased by four times between 2000 to 2010, and the number of PMV patients (ventilator use ≥ 21 days) increased by 2.4 times. These investments account for US\$ 246.67 million per person per year in health insurance expenditures [8], with the average age of beneficiaries being over 70 years [9, 10]. Over 60% of patients on PMV are not clear [2, 11, 12], and the five-year survival rate is approximately 16% [5, 13]. Therefore, the Taiwanese government has been actively involved in a number of hospice and palliative care (HPC) policies for patients on PMV and related medical interventions since 2011 [14-16].

The World Health Organization (WHO) believes that death is a normal occurrence in palliative care, which means that this type of care neither speeds nor delays the onset of death, but integrates psychological and spiritual care, provides support systems, and helps patients on PMV live as actively as possible [17]. The National Health Insurance (NHI) of Taiwan implemented the 'Shared Hospice Care Pilot Project' which, in addition to terminal cancer, also included end-stage of neuron disease, dementias, encephalopathy, heart failure, chronic obstructive pulmonary disease (COPD), other lung diseases, chronic liver disease and cirrhosis, acute kidney failure (unspecified), and chronic kidney diseases qualified by doctors' professional diagnosis. Terminally ill patients who are not admitted to the hospice ward have been included in the scope of service since 2011 [14]. While severely terminally ill patients who are hospitalised have a need for HPC services, they cannot be accommodated in a hospice ward. Hence, their medical teams can utilise "shared hospice care" teams to obtain the appropriate hospice and palliative care services [15, 16]. The NHI has encouraged HPC interventions for terminal patients on PMV from 2013. Patients on PMV requiring HPC services need to submit additional fees [18].

HPC interventions can reduce the utilisation of emergency departments, cardiopulmonary resuscitation (CPR), and intensive care unit (ICU) services [19-23], and medical costs for subjects with terminal cancer [24-26]. However, research has not explored the effectiveness of HPC on subjects undergoing PMV. Therefore, the purpose of this study was to explore the utilisation of medical services and related costs borne by patients undergoing PMV 14 days prior to their deaths, as a reference for the hospice and palliative care policy in Taiwan.

Methods

Study Design

Our hypothesis is that the utilisation of and costs borne from emergency, CPR, and ICU services, will be lower for patients on PMV who have received HPC, as opposed to those who have not, in the 14 days prior to their deaths. Many factors cause patients to require PMV. We do not have a definition for terminal patients on PMV. Therefore, this study included the subjects of the shared hospice care pilot project, afflicted with illnesses such as cancer, motor neuron disease, dementia, encephalopathy, heart failure, COPD not elsewhere classified, other lung diseases, chronic liver disease and cirrhosis, acute kidney failure (unspecified), and chronic kidney disease (unspecified). These were the 10 categories of patients on PMV who pay for HPC.

Research objects and data sources

We collected data from the NHI database maintained by the Health and Welfare Data Science Center of Taiwan's Ministry of Health and Welfare. We screened long-term ventilator-dependent patients (ventilator medical order) who were ≥ 18 years between 2009 to 2017. Codes 57001, 57002, and 57023 were used for more than 21 days and disabled for less than 5 days. Then, individual patients' basic characteristics, economic status, environment, and other factors were

analysed in series. First, 186,533 individuals were included from the entire population file of the NHI. Those without death records and incomplete data were excluded. Long-term ventilator patients who died within 15-180 days were included with the hospice care subjects. We then compared 131,939 patients on PMV who received HPC within 15-180 days before death, along with the status of HPC, and patient characteristics (Figure 1). In order to reduce the difference between the two groups, 10,675 individuals from each were subjected to 1:1 propensity score matching (PSM) to simulate randomisation in terms of gender, age, major end-stage disease category, comorbidity severity, etc. To reduce the sample deviation between the two groups (Table 1), we compared the differences in the utilisation of emergency department, CPR, and ICU services, and medical expenses, within 14 days prior to death.

Ethics

This study was approved by the Human Research Committee Review of the Research Ethics Committee of China Medical University and affiliated hospitals (number CMUH108-REC2-129).

Description of variables

Utilization of HPC

For the independent variable of HPC, patients on PMV who had not received palliative care for 15-180 days before death were categorised into the non-HPC group. The HPC group comprised those who had declared any HPC item medical order code (health insurance code 05601 K, 05602A, 05603B, P4401B, P4402B, P4403B, 05312C, 05313C, 05314C, 05336C, 05338C, 05340C, 05323C, 05324C, 05325C, 05337C, 05368C, 05341C, 05362C, 05366C, 05370C, 05364C, 05339C, 05372C, 05363C, 05367C, 05371C, 05365C, 05369C, 05373C, 05326C, 05327C, 05315C, 05374C, 02020B).

Main disease categories:

The main disease categories referred to in this research were based on the 'Shared Hospice Care Pilot Project'. The 10 included categories from ICD9 are 140-208, 335.2, 290, 348.39, 428.9, 496, 518.89, 571, 584.9, A350, and 585 [27].

Utilisation of ICU:

The use of the ICU was indicated by the code (03010E, 03011F, 03012G), or the inpatient examination fee of the ICU (02011 K, 02012A, 0013 B) which was a basis for deciding whether to use ICU services.

Emergency service use:

Emergency room utilisation was indicated by whether a patient had visited the emergency room 14 days prior to death. Specific indicators include the codes for emergency observation bed care fee for the first day (03073A, 03074 B, 03075A, 03076 B), emergency medical examination fee codes (01015C, 01016C, 01017C) 00201A, 00202A, 00203A, 00204A, 00201 B, 00202 B, 00203 B, 00204 B, 00225 B), emergency observation bed codes (03018A, 03019 B, 03042A, 03073A, 07075A, 03043 B, 03074 B, 07076 B), and other emergency declaration codes: P4603B, P4604B, P4605B, P4606B, P4607B, P4608B.

Statistics analysis

In this study, retrospective generation studies were used to analyse health insurance data, using SAS 9.4 (SAS Institute Inc., Cary, NC, USA) as the analysis tool. First, we counted the patients on PMV ≥ 18 years of age who had used mechanical ventilator support for ≥ 21 days, and screened 10,675 subjects receiving HPC. The types of diseases were studied according to gender, age, comorbidity severity, and main comfort benefits. PSM was used to pair patients 1:1 based on similar backgrounds, with the difference being whether or not they obtained HPC services. The frequency of patients' requirements of emergency visits, first aid assistance, and ICU services, was measured to describe medical utilisation by patients on PMV in the 14 days prior to death. The total costs for HPC and medical utilisation were compared using a t-test and ANOVA to determine whether there was a significant difference in medical expenditure and outcomes between the HPC and non-HPC groups ($P < .05$).

Results

A total of 186,533 new patients on PMV aged ≥ 18 years with terminal and related diseases were admitted between 2009 and 2017. In the same time, the number of patients receiving HPC increased from 0.6% in 2009 to 41.33% in 2017 (Figure 2).

Ten ventilator-dependent patients with end-stage illnesses benefited from HPC. A total of 131,939 patients on PMV died with death records. A 1:1 PSM was created for patients on PMV, with 10,675 patients who had used HPC and an equal number who had not, resulting in a total of 21,350 patients who were compared. As shown in Table 1, in the 1:1 PSM, the two groups were not significantly different from each other ($P > .05$) in gender, age, comorbidity, severity, and major disease categories.

As shown in Table 2, the rates for emergency room utilisation, ICU utilisation, CPR implementation, and the total medical expenses borne, were lower for patients on PMV who had used HPC, as compared to those who had not. For the HPC and non-HPC groups, the emergency utilisation rates for 14 days prior to death were 11.63% vs. 15.99% ($P < .001$, OR=0.68, 95%CI: 0.63-0.74), ICU utilisation rates were 4.90% vs. 8.12%, ($P < .05$; OR=0.59, 95%CI: 0.53- 0.66), and CPR utilisation rates were 2.53% vs. 6.01% ($P < .05$, OR=0.40, 95%CI: 0.35-0.46), respectively. Total medical expenses were US\$ 1319.91 $\pm$ 1821.67 for the HPC group, vs. 1544.37 $\pm$ 2309.27, for the non-HPC group ($P < .05$, OR=0.88, 95%CI: 0.81-0.96).

Discussion

Patients on PMV's willingness to use HPC services increased between 2009 to 2017 in Taiwan. The HPC acceptance rate in palliative care increased from 0.6% in 2009 to 41.33% in 2017. It is speculated that this could be related to the government's active promotion of hospice and palliative care policies in recent years [16, 28-30]. These include the promotion of HPC-related policies, including expanded benefits for the end-stage of 10 categories of disease [27, 28] since 2009; advocacy for peaceful deaths; the implementation of HPC and relaxation regulations, so that patients can assuredly make decisions on life-saving treatments; and the implementation of the health insurance card effect [29]. In addition, patients and their family members have the opportunity to confer with hospice care teams by paying a consultation fee, so that they are aware of their choices regarding hospice care services [31].

By excluding common, family consultation, and palliative care fees from the fixed PMV payments, the promotion of palliative education can allow the public to receive palliative care, increase medical staff support for patients and their families, and provide patients with an additional medical choice [18]. Studies have shown that family members or the main caregivers for patients with ventilator dependence are 66.7–64.4% willing to adopt HPC [9, 10]. Approximately 17.3% of patients on PMV's family members with long term care facility had agreed to remove the ventilator immediately, and 56.7% had regretted choosing long-term mechanical ventilation [9]. About 80% of family members are willing to sign do not resuscitation, but only 10% decide to withdraw artificial airway and ventilator support [32, 33].

The burdensome nature of hospice care is alleviated by HPC services. The rates of emergency department utilisation, ICU utilisation, CPR implementation, and total medical expenses of patients with interventional HPC were significantly lower than those without HPC. It is speculated that this could be due to the expansion of the recipients of HPC benefits [28], implementation of the HPC payments programme [14], provision of payments for palliative medical family consultation fees [31], and promotion and implementation of the second revision of HPC regulations which allow patients to make decisions about life-saving treatments [29]. The care teams of terminal patients with acute and severe diseases have the ability to hold family meetings, so that patients are provided an additional hospice care choice.

End-of-life refers to the fact that death becomes unavoidable when the disease reaches its maximum potential. It is called end-of-life, but there is no information about how long death will take [34]. According to the generally accepted definition in medicine, the prognosis of death within 6 months is termed the end-of-life state [34, 35]. This study concerns the current situation of patients on PMV receiving HPC at the end stages of their diseases, but there is no definition or categorisation for end-of-life ventilator-dependent patients. Therefore, this study only included patients on PMV suffering from 10 major diseases [27].

In this study, we first observed the current situation and impact of medical utilisation on patients who had been receiving palliative care for 15–180 days before death. Because there are many reasons for long-term ventilator dependence, the NHI does not categorise patients on PMV as terminal. However, the payments for patients on PMV to the NHI have also included additional fees for HPC interventions since 25 May 2015 [36]. Further, the integrated care database for long-term ventilator-dependent patients from 2000 to 2010 showed that the 180-day (6 months) survival rate of patients on PMV is 47.6% [5]. Moreover, another study found that the mortality rate of ventilator-dependent patients in Taiwan from 2005 to 2011 increased from 32.93% to 34.01%. Therefore, 30–50% of patients on PMV may experience end-of-life conflicts [37].

This study shows that rates of utilising emergency department services, ICUs, and CPR in the 14 days prior to death were significantly lower among patients using HPC, as compared to non-HPC patients. Availing of HPC services by cancer patients can reduce their requirements of emergency services, CPR, and endotracheal intubation chance [19]. There was a study said only 15% CPR rate and lower life-sustaining treatment in HPC group between 2009-2013 in Taiwan [38]. One Taiwanese study reviewing the cancer care volume in the month before death showed that between 2000-2006, the utilisation of CPR, intubation, and mechanical ventilation services was lower in those using HPC than those without HPC [20]; another study had similar benefits, showing that an HPC intervention for terminal patients in a Taiwanese hospital caused the DNR rate to increase from 10.8% to 34.6% in four months [21].

The purpose of HPC is mainly to provide dying patients with relief from their symptoms and to provide physical, emotional, and mental support. In the past, the main recipients of HPC have been terminal cancer patients in hospice units. Currently, end-stage critical patients can also obtain HPC through medical consultation [14]. Studies and analyses of end-stage patients who cannot be admitted to hospice units consult for HPC mainly for the management of clinical symptoms, as more than 60% of patients and their families have psychosocial care needs, and more than 75% of them have a higher need for near-death-adjusted care. Medications, religious support, and invasive treatments can relieve the symptoms of pain and dyspnoea in dying patients [39]. A European study showed that most patients using home ventilators in the last three months of life are aware of the severity and prognosis of their illnesses and are mainly troubled by ventilatory symptoms, but their economic burden is heavier than health concerns; and when these patients were re-hospitalised, 74.4% of them were admitted to the ICU, and 27% received resuscitation [23]. One study analysed the electronic medical records of a tertiary hospital in Singapore in 2014, finding that 255 end-stage patients visited the emergency department, 32.7% had a cancer diagnosis, and their common symptoms were drowsiness (66.3%), dyspnoea (61.5%), and fever (29.7%) [22].

A study similar to ours is the United States Elderly Health Insurance (MediCare) database, which found that cancer patients who have enrolled in HPC for one year prior to death can save an average of US\$ 2,309 as compared to others, and the most savings are from the day of death [24]. Further studies in the United States have analysed the increase in end-of-life care, active treatment, and costs for veterans at the end of lung cancer between 2006-2012. They found that without limiting the treatment of end-of-life veterans with lung cancer, the increase in end-of-life care and the availability of care services are related to fewer medication use and significantly reduced costs, with an approximate reduction of \$266 per day over 6 months [25]. However, there are also studies in Taiwan that analyse cancer patients' medical expenditure in the 5 days prior to their deaths, which was not found to be reduced by having used HPC for the year prior to their deaths [26].

The database of health insurance does not have DNR information; therefore, we used service codes to analyse HPC utilisation by patients on PMV, which may have caused our numbers to be underestimated. Patients on PMV are not necessarily terminally ill, so we have use information on HPC payments to determine terminal diseases, which may have caused our numbers to be underestimated.

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Conclusion

HPC can reduce patients on PMV's utilisation of emergency and ICU services, decrease the frequency of CPR, and reduce medical costs. Therefore, we highly recommend that patients on PMV are enabled to obtain more information and awareness about HPC services, so that they can avail hospice services that will benefit their health conditions.

Declarations

Ethics approval and consent to participate

Data are available from the National Health Insurance Research Database published and managed by the Ministry of Health and Welfare, Taiwan. Due to legal restrictions imposed by the Taiwan government related to the Personal Information Protection Act, these databases cannot be made publicly available. This study was approved by the Clinical Trial/Human Research Committee Review (IRB) of the Research Ethics Committee of China Medical University and affiliated hospitals (number CMUH108-REC2-129).

Consent for publication

Not applicable.

Availability of data and materials

This study used databases including the National Health Insurance Research Database and the Cause of Death File. All researchers can apply for using the databases for conducting their studies. Requests for using data can be sent as a formal proposal to the Science Center of the Ministry of Health and Welfare (<https://www.mohw.gov.tw/mp-2.html>). Any raw data are not allowed to be brought out from the Science Center. Only the analytic outputs in format of table or figure can be printed out. The restrictions prohibited the authors from making the minimal data set publicly available.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1

Distributions of demographics and patient characteristics in study cohort with and without Propensity score matching.

Variable items	All subjects (N=131939)							1:1 propensity score matching (N=21350)						
	Total		HPC		Non-HPC		P	Total		HPC		Non-HPC		P
	N	%	N	%	N	%		N	%	N	%	N	%	
Total	131939	100.00	10675	8.09	121264	91.91	0.197	21350	100.00	10675	50.00	10675	50.00	
Gender														
Male	81015	61.40	6617	61.99	74398	61.35	0.197	13214	61.89	6617	61.99	6597	61.80	0.77
Female	50924	38.60	4058	38.01	46866	38.65		8136	38.11	4058	38.01	4078	38.20	
Age (years)														
≤44	4176	3.17	340	3.19	3836	3.16	<.001	672	3.15	340	3.19	332	3.11	0.99
45-54	7663	5.81	814	7.63	6849	5.65		1607	7.53	814	7.63	793	7.43	
55-64	14976	11.35	1569	14.70	13407	11.06		3145	14.73	1569	14.70	1576	14.76	
65-74	24488	18.56	2104	19.71	22384	18.46		4197	19.66	2104	19.71	2093	19.61	
75-84	47040	35.65	3313	31.04	43727	36.06		6657	31.18	3313	31.04	3344	31.33	
≥85	33596	25.46	2535	23.75	31061	25.61		5072	23.76	2535	23.75	2537	23.77	
(mean ± SD)			73.99	13.81	75.67	13.34				73.99	13.81	74.06	13.73	
CCI score														
≤3	95072	72.06	7003	65.60	88069	72.63	<.001	14045	65.78	7003	65.60	7042	65.97	0.83
4~6	30005	22.74	2704	25.33	27301	22.51		5407	25.33	2704	25.33	2703	25.32	
7~9	5967	4.52	801	7.50	5166	4.26		1572	7.36	801	7.50	771	7.22	
≥10	895	0.68	167	1.56	728	0.60		326	1.53	167	1.56	159	1.49	
Main disease														
Neoplasm	30917	23.43	4648	15.03	26269	84.97	<.001	9295	43.54	4648	43.54	4647	43.53	0.98
MND	120	0.09	27	22.50	93	77.50	<.001	54	0.25	27	0.25	27	0.25	1.00
Dementias	31775	24.08	2460	7.74	29315	92.26	<.001	4918	23.04	2460	23.04	2458	23.03	1.00
encephalopathy	4932	3.74	759	15.39	4173	84.61	<.001	1482	6.94	759	7.11	723	6.77	0.33
Hear failure	22660	17.17	2469	10.90	20191	89.10	<.001	4928	23.08	2469	23.13	2459	23.04	0.87
COPD not elsewhere classified	26547	20.12	2229	8.40	24318	91.60	<.001	4427	20.74	2229	20.88	2198	20.59	0.60
Other lung disease	4341	3.29	439	10.11	3902	89.89	<.001	828	3.88	439	4.11	389	3.64	0.07
Chronic liver disease and cirrhosis	40505	30.70	6868	16.96	33637	83.04	<.001	13760	64.45	6868	64.34	6892	64.56	0.73
AKI unspecified	35944	27.24	2934	8.16	33010	91.84	0.558	5874	27.51	2934	27.48	2940	27.54	0.92
CKD unspecified	31456	23.84	2866	9.11	28590	90.89	<.001	5756	26.96	2886	27.04	2870	26.89	0.95

MND= Motor neuron disease

COPD= chronic obstructive pulmonary disease

AKF=acute kidney failure

CKD= acute kidney disease

Table 2

Medical utilization before 14 death for PMV subjects with and without HPC

Variables	All subjects		HPC		Non-HPC		P	odds ratio	95%CI
	N	%	N	%	N	%			
Total	21350	100%	10675	50.00%	10675	50.00%			
ED Visiting							<.0001		
Yes	2949	13.81%	1242	11.63%	1707	15.99%		0.68	(0.63-0.74)
No	18401	86.19%	9433	88.37%	8968	84.01%			
ICU Admission							<.001		
Yes	1390	186.19%	523	4.90%	867	8.12%		0.59	(0.53-0.66)
No	19960	93.49%	10152	95.10%	9808	91.88%			
CPR Implantation							<.001		
Yes	912	4.27%	270	2.53%	642	6.01%		0.41	(0.35-0.46)
No	20439	386.19%	10405	97.47%	10033	93.99%			
	N		mean	STD	mean	STD		odds ratio	
Medical Cost	21350						<.001	0.88	(0.96-0.003)
USD			1319.91	1821.66	1544.37	2309.27			

ED= emergency department

ICU= intensive care unit

CPR= cardiopulmonary resuscitation

One US dollar was 30 New Taiwan dollars on 2017/12/01

Figures

Figure 1

Figure 2

PMV= prolonged mechanical ventilation HPC= hospice palliative care Fig 2 the new PMV receiving HPC care from 2009-2017 by year