

ORIGINAL RESEARCH

Death trajectories and treatment decisions in emergency departments: evaluating the effects of the life-sustaining treatment decision act

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Abstract

Background: The emergency department (ED) is not ideal for end-of-life care; however, unavoidable deaths arising from sudden death, severe chronic illness, and advanced frailty do occur. Treatment approaches, ranging from full life-support treatment to comfort-focused care, vary according to these causes. This study aimed to analyze the death trajectories (DTs) and treatment decisions in patients who died in the ED after the implementation of the Life-Sustaining Treatment (LST) Decision Act. **Methods:** This retrospective study included patients aged ≥ 18 years who died in the ED of two tertiary care hospitals from 2018 to 2022. By reviewing electronic medical records, the DT was categorized based on specific criteria. We analyzed the treatment direction, decisions on LST withdrawal, and care received in the ED. **Results:** During the study, 2996 patients died in the EDs of the two hospitals. Of these, 1432 patients did not experience cardiac arrest upon ED admission, while 1564 patients did. In patients with out-of-hospital cardiac arrest, between 78.8% and 97.1% received full life-support treatment, depending on the specific DT. Approximately 50% of patients with chronic serious illness or advanced frailty received comfort-focused treatment. Of the 292 patients who completed LST plans, only 12.7% opted for self-determination. **Conclusions:** This study highlights a lack of advanced care planning for end-of-life patients. For patients with severe chronic illness or advanced frailty, proactive preparations for comfort-focused treatment options, such as LST plans, are recommended based on patient autonomy. Appropriate ED workflow systems are crucial to providing high-quality end-of-life care to patients with irreversible conditions and imminent death, particularly to those in the last hours or days of life.

Keywords

Emergency service hospital; Life support care; Chronic disease; Personal autonomy; Advance care planning; Resuscitation order

1. Introduction

In East Asian countries, approximately 70% to 90% of deaths occur at medical institutions annually, with 0.7% occurring in the emergency department (ED) in South Korea [1–5]. The leading cause of death remains cancer, with a sharp and notable increase in deaths among adult patients with dementia aged ≥ 80 years in recent years in South Korea [6]. While the ED is not the preferred location for end-of-life (EOL) care, unavoidable deaths have been reported in this setting [7, 8].

The vast range of treatment approaches in the ED, from intensive life-support to comfort-focused treatments, highlights critical issues regarding the suitability and effectiveness of EOL care in acute ED settings. Emergency physicians (EPs) face the challenge of balancing emergent life-support treatment with the ethical considerations of providing a dignified death

while ensuring their best interest and autonomy in decisions, often making these decisions under significant time constraints without prior relationships with the patients [9–11]. This situation reveals a significant gap in our understanding of how EOL care is provided in the chaotic ED environment and emphasizes the potential discord between treatment actions and patient wishes for comfort at life's end [12].

The complexity is further heightened by the legal and ethical implications surrounding Life-Sustaining Treatments (LST), where decisions to withhold or withdraw LST rely on accurate clinical judgments regarding the irreversibility of disease and imminence of death. With the implementation of the Act on Decisions on LST for Patients in Hospice and Palliative Care or at the End of Life in Korea in February 2018 [13], aimed at respecting the dignity and autonomy of dying patients, there arises a need to assess its impact on emergency EOL care

practices.

Clinicians observe various patterns of functional decline at the EOL categorized into death trajectories (DTs), such as sudden death, cancer, organ failure and frailty [14, 15]. Enhancing our understanding of these trajectories can significantly improve prognostication, ethical decision-making and the quality of EOL care [16]. Despite existing legal frameworks like LST plans or physician orders for LST (POLST), which provide more specific guidance than advance directives, or a do-not-resuscitate (DNR) order [17, 18], the actual practice in EDs often reverts to full life-support treatment, even when it may not correspond with the patient's or family's preferences.

Therefore, this study aims to analyze DTs and treatment decisions in patients who died in the ED after the LST Decision Act was implemented. By examining how treatment decisions are influenced by legislative frameworks and DTs, this research seeks to identify potential areas for policy enhancement and improved clinical practices in emergency EOL care.

2. Materials and methods

2.1 Study design, setting and population

In this retrospective study, we examined patients aged ≥ 18 years who died in the EDs of two tertiary care hospitals between January 2018 and December 2022. Patients who were confirmed deceased upon arrival at these EDs were excluded. The annual ED patient volume for the two hospitals was approximately 45,000 and 35,000. Of the 375,666 patient admissions to the EDs of these hospitals, 3139 deaths were recorded between January 2018 and December 2022. Forty-seven cases of patients aged < 18 years and 96 patients who were confirmed deceased upon arrival at the EDs were excluded. Consequently, 2996 patients who died in the EDs of the two tertiary hospitals were eligible for analysis (Fig. 1).

2.2 Study questions and objectives

This study primarily aims to evaluate the influences of the LST Decision Act on the treatment decisions and DTs of patients who died in the ED. To understand the impact of the LST Decision Act in EDs, this study will address the following questions: Since the implementation of the LST Decision Act, what types of treatments have been administered to patients who die in EDs, specifically those who present with or without cardiac arrest upon arrival? Have there been variations in the treatment decisions in EDs based on the different DTs of these patients, or have there been changes over subsequent years? How has the LST Decision Act influenced the decision-making process for EOL treatments in EDs, particularly with regard to patient self-determination?

2.3 Data collection and definitions

We systematically collected data from electronic medical records, including patient age, sex, insurance status, date and time of ED visit, initial vital signs, and mental state upon ED presentation. Additional information included the initial triage level, route of ED visits (direct visit or transfer), mode of arrival at the ED, and

primary symptoms. Treatments administered in the EDs included cardiopulmonary resuscitation (CPR), endotracheal intubation, artificial ventilation, hemodialysis, extracorporeal membrane oxygenation, blood transfusions and inotropic drug administration. We also examined the duration of each patient's stay in the ED, any registered decisions regarding the withdrawal of LSTs or DNR forms and documentation on the patient's death.

To categorize DTs, the compiled data and electronic medical records were meticulously and independently reviewed by two EPs. DTs were classified into the following four types based on functional decline patterns: (i) sudden death in otherwise healthy or stable patients and chronic illness trajectories resulting in death from (ii) cancer, (iii) organ failure and (iv) frailty, as defined in the relevant literature [14, 15]. Patients were classified as receiving full life-support treatment, limited treatment, or comfort-focused treatment according to the treatments they received, documentation of decisions to withdraw LSTs or DNR orders, and a comprehensive review of medical records. Full life-support treatments included intensive interventions, including CPR, artificial ventilation, invasive procedures and aggressive drug administration. In contrast, comfort-focused treatment was characterized by treatments directed at pain management, symptom alleviation, and patient comfort without aggressive interventions [17, 18].

2.4 Statistical analysis

Descriptive statistics are presented as medians with interquartile ranges (25th and 75th percentiles), whereas categorical variables are presented as counts and percentages. To assess the significant differences among the DT groups, the Kruskal-Wallis test was applied to continuous variables, and the chi-square test was used for categorical variables. Furthermore, the patients were divided into two groups based on their registration status for withdrawal of LST, and their demographic and clinical characteristics were then compared.

Using multiple regression stepwise analysis, the variables associated with the registration of withdrawal of LST were analyzed. The results are represented as odds ratios (ORs) along with their 95% confidence intervals (CIs). All statistical analyses were performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). For all two-sided tests, a p -value of < 0.05 indicated statistical significance.

3. Results

During the study period from January 2018 to December 2022, 2996 patients died in the EDs of two tertiary hospitals. Of these, 1432 patients did not experience cardiac arrest upon ED admission, while 1564 patients did (Fig. 1). Among patients without cardiac arrest upon ED admission, 542 (37.8%) were women, and the median age was 75 years (Table 1). The median age varied across different DTs as follows: sudden death, 70 years; death from cancer, 71 years; death from organ failure, 77 years; and death from chronic frailty, 83 years. Upon admission, 55.2% of patients were alert, with circulatory (25.6%) and respiratory (31.3%) symptoms being the most prevalent. The median ED stay ranged from 8.1

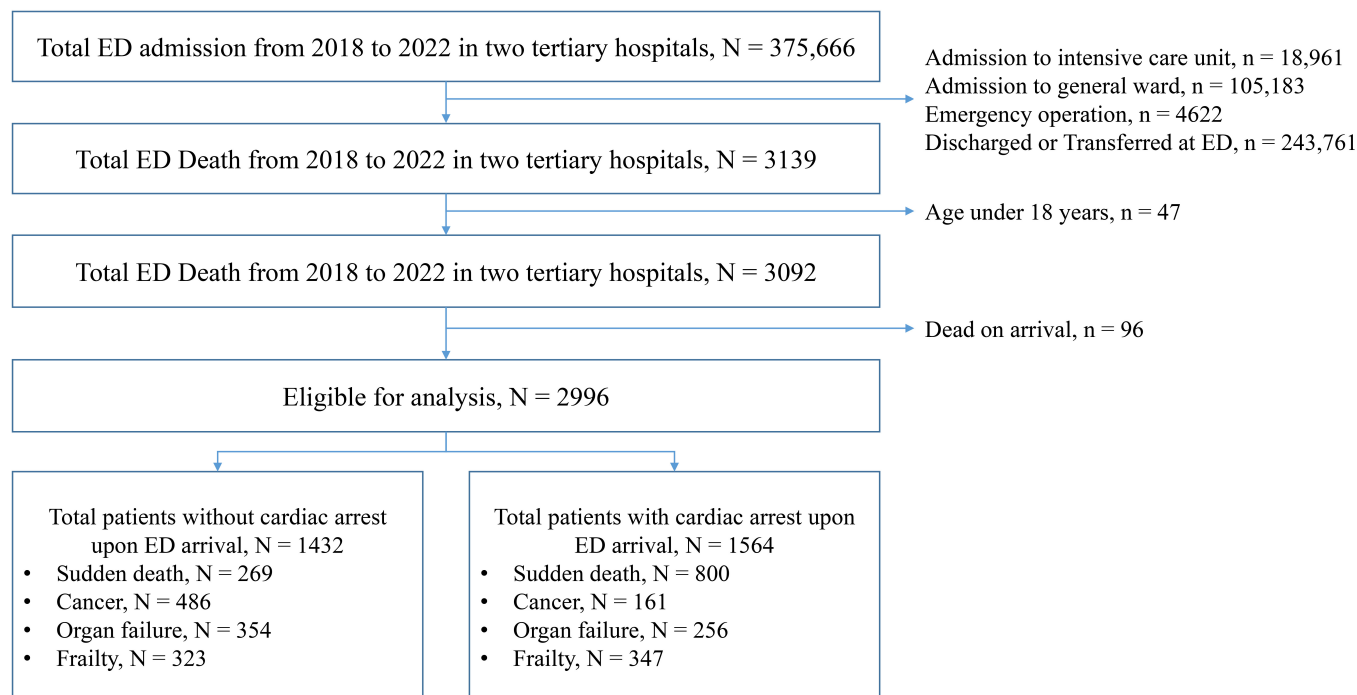


FIGURE 1. Flowchart of study patients. ED, emergency department.

to 10.9 hours. Overall, 38.8% of patients received full life-support treatment, 56.0% received comfort-focused treatment and 5.2% received limited treatment. Specifically, among patients without cardiac arrest and categorized by DT, the percentages of those who received full life-support treatment were as follows: 72.5% of 195 patients with sudden death, 32.3% of 157 patients with cancer, 34.2% of 121 patients with organ failure and 25.7% of 83 patients with frailty.

For patients with cardiac arrest upon arrival at the ED, 555 (35.5%) were women, and the median age was 72 years (Table 2). The median ages varied across DTs as follows: 61.5 years for sudden death and 73, 77 and 83 years for deaths from cancer, organ failure and chronic frailty, respectively. Of these patients, 91.1% visited the ED directly and 88.9% used public emergency medical services. Upon admission, 96.9% of these patients had circulatory symptoms. Among those with cardiac arrest upon ED arrival, the proportion receiving full life-support treatment was approximately 90%, varying depending on their specific DT: 97.1% for patients with sudden death, 81.4% for patients with cancer, 78.5% for those with organ failure and 85.9% for patients with frailty. The number of patients receiving comfort-focused treatment increased from 123 patients (26.0%) in 2018 to 238 (32.5%) in 2022 (Fig. 2).

The number of patients for whom LST was withdrawn increased from 27 in 2018 to 94 in 2022 (Fig. 3). Regarding LST decisions in the ED, 40.4% of patients with a registered LST plan were women, with a median age of 75 years, compared with the 36.2% of women among those without a registered LST plan, with a median age of 79 years (Table 3). Initial assessments revealed that 49.7% of the registered group were alert, compared with 22.2% in the unregistered group. Among patients with a registered LST plan, eight (2.7%) had possessed pre-existing advanced directives, and 37 (12.7%) had made the decision autonomously. The median ED stay was

significantly longer for the registered group (14.8 hours) than for the unregistered group (0.5 hours). Treatment modalities varied, with 9.6% of the registered group undergoing CPR, 36.6% undergoing intubation and 24.0% receiving transfusion, compared with 57.1%, 63.6% and 16.2%, respectively, in the unregistered group.

Assessment of factors associated with decisions to withdraw LST in the ED revealed that patients diagnosed with cancer (adjusted OR (AOR), 3.90; 95% CI: 2.22–6.87), organ failure (AOR, 3.45; 95% CI: 1.94–6.14) and frailty (AOR, 3.97; 95% CI: 2.25–7.03) were more inclined to opt for withdrawal than were patients with sudden death (Table 4). Clinically, patients who did not undergo CPR in the ED (AOR, 3.81; 95% CI: 2.44–5.95), those who did not experience cardiac arrest upon ED arrival (AOR, 2.28; 95% CI: 1.45–3.60), and those with an ED stay exceeding 8 hours (AOR, 2.85; 95% CI: 2.09–3.88) were more likely to have their LST withdrawn.

4. Discussion

To the best of our knowledge, this is the first study to investigate DTs and treatment decisions in patients who die in EDs in South Korea. Our findings highlight several aspects of EOL care in the ED setting, reflecting on both the current practices and the implications of the LST Decision Act implemented in 2018. The key findings of the study are as follows. First, in patients with cardiac arrest upon ED arrival, between 78.8% and 97.1% received full life-support treatment, depending on the specific DT. Second, approximately 50% of patients with chronic serious illness or advanced frailty received comfort-focused treatment following completion of DNR orders or LST plans, with an increasing trend of patients opting for comfort-focused treatment each year. Third, the rate of self-determination of LST plans was notably low at 12.7%.

TABLE 1. Characteristics of patients without cardiac arrest upon emergency department admission, categorized by death trajectory.

Variable	Total N = 1432 (%)	Sudden death N = 269 (%)	Cancer N = 486 (%)	Organ failure N = 354 (%)	Frailty N = 323 (%)	p-value
Female sex	542 (37.8)	93 (34.6)	148 (30.5)	132 (37.3)	169 (52.3)	<0.001***
Age, yr, median, [IQR]	75 [65–83]	70.0 [59–79]	71 [62–79]	77 [66–83]	83 [77–88]	<0.001***
Age group						
19–29 yr	17 (1.2)	7 (2.6)	3 (0.6)	3 (0.8)	4 (1.2)	
30–39 yr	22 (1.5)	13 (4.8)	6 (1.2)	3 (0.8)	0 (0.0)	
40–49 yr	57 (4.0)	17 (6.3)	21 (4.3)	15 (4.2)	4 (1.2)	
50–59 yr	149 (10.4)	34 (12.6)	70 (14.4)	39 (11.0)	6 (1.9)	
60–69 yr	236 (16.5)	58 (21.6)	111 (22.8)	50 (14.1)	17 (5.3)	<0.001***
70–79 yr	428 (29.9)	80 (29.7)	165 (34.0)	109 (30.8)	74 (22.9)	
80–89 yr	424 (29.6)	54 (20.1)	99 (20.4)	113 (31.9)	158 (48.9)	
≥90 yr	99 (6.9)	6 (2.2)	11 (2.3)	22 (6.2)	60 (18.6)	
Insurance status						
National health insurance	1232 (86.0)	200 (74.3)	445 (91.6)	299 (84.5)	288 (89.2)	
Medical aid	163 (11.4)	32 (11.9)	41 (8.4)	55 (15.5)	35 (10.8)	<0.001***
Liability insurance	35 (2.4)	35 (13.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Other	2 (0.1)	2 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	
Route of ED visit (Direct)	921 (64.3)	182 (67.7)	346 (71.2)	200 (56.5)	193 (59.8)	<0.001***
Public EMS use	791 (55.2)	171 (63.6)	261 (53.7)	177 (50.0)	182 (56.3)	0.007**
Initial mental status on ED admission (Alert)	744 (52.0)	93 (34.6)	307 (63.2)	209 (59.0)	135 (41.8)	<0.001***
Symptoms upon ED admission						
Circulatory	366 (25.6)	104 (38.7)	90 (18.5)	93 (26.3)	79 (24.5)	<0.001***
Respiratory	448 (31.3)	27 (10.0)	180 (37.0)	110 (31.1)	131 (40.6)	<0.001***
Neurological	229 (16.0)	48 (17.8)	74 (15.2)	53 (15.0)	54 (16.7)	0.729
Gastrointestinal	180 (12.6)	19 (7.1)	87 (17.9)	54 (15.3)	20 (6.2)	<0.001***
General or infectious	132 (9.2)	9 (3.3)	48 (9.9)	39 (11.0)	36 (11.1)	0.003**
Trauma	45 (3.1)	40 (14.9)	1 (0.2)	2 (0.6)	2 (0.6)	<0.001***
Intoxication	20 (1.4)	19 (7.1)	1 (0.2)	0 (0.0)	0 (0.0)	<0.001***
Other	11 (0.8)	3 (1.1)	5 (1.0)	2 (0.6)	1 (0.3)	0.585
Length of stay (ED), in h, median [IQR]	8.1 [2.7–18.9]	2.5 [1.0–8.6]	9.3 [4.0–20.1]	10.9 [4.1–21.9]	9.5 [3.2–23.5]	<0.001***
Treatment decisions at ED						
Full life-support treatment	556 (38.8)	195 (72.5)	157 (32.3)	121 (34.2)	83 (25.7)	
Limited treatment	74 (5.2)	15 (5.6)	22 (4.5)	16 (4.5)	21 (6.5)	<0.001***
Comfort-focused treatment	802 (56.0)	59 (21.9)	307 (63.2)	217 (61.3)	219 (67.8)	
Registration of legal LST plan	260 (18.2)	13 (4.8)	104 (21.4)	71 (20.1)	72 (22.3)	<0.001***
Treatment at ED						
Cardiopulmonary resuscitation	359 (25.1)	151 (56.1)	71 (14.6)	72 (20.3)	65 (20.1)	<0.001***
Endotracheal intubation	651 (45.5)	194 (72.1)	149 (30.7)	165 (46.6)	143 (44.3)	<0.001***
Artificial ventilation	635 (44.3)	199 (74.0)	125 (25.7)	172 (48.6)	139 (43.0)	<0.001***
Hemodialysis	52 (3.6)	5 (1.9)	14 (2.9)	24 (6.8)	9 (2.8)	0.003**
Transfusion	360 (25.1)	90 (33.5)	142 (29.2)	98 (27.7)	30 (9.3)	<0.001***
Inotropic drugs	728 (50.8)	132 (49.1)	211 (43.4)	230 (65.0)	155 (48.0)	<0.001***

Statistical significance: ** $p < 0.01$, *** $p < 0.001$. All values are expressed as either numbers (percentages) or medians [interquartile ranges]. IQR, interquartile range; ED, emergency department; EMS, emergency medical services; LST, life-sustaining treatment.

TABLE 2. Characteristics of patients with cardiac arrest upon emergency department admission, categorized by death trajectory.

Variable	Total N = 1564 (%)	Sudden death N = 800 (%)	Cancer N = 161 (%)	Organ failure N = 256 (%)	Frailty N = 347 (%)	p-value
Female sex	555 (35.5)	223 (27.9)	51 (31.7)	99 (38.7)	182 (52.4)	<0.001***
Age, yr, median, [IQR]	72 [59–81]	61.5 [48–72]	73 [65–80]	77 [71–82]	83 [79–87]	<0.001***
Age group						
19–29 yr	51 (3.3)	48 (6.0)	0 (0.0)	0 (0.0)	3 (0.9)	
30–39 yr	67 (4.3)	59 (7.4)	1 (0.6)	4 (1.6)	3 (0.9)	
40–49 yr	121 (7.7)	107 (13.4)	4 (2.5)	9 (3.5)	1 (0.3)	
50–59 yr	183 (11.7)	149 (18.6)	18 (11.2)	14 (5.5)	2 (0.6)	
60–69 yr	260 (16.6)	184 (23.0)	33 (20.5)	32 (12.5)	11 (3.2)	<0.001***
70–79 yr	423 (27.0)	186 (23.3)	61 (37.9)	102 (39.8)	74 (21.3)	
80–89 yr	406 (26.0)	65 (8.1)	41 (25.5)	89 (34.8)	211 (60.8)	
≥90 yr	53 (3.4)	2 (0.3)	3 (1.9)	6 (2.3)	42 (12.1)	
Insurance status						
National health insurance	1280 (81.8)	594 (74.3)	148 (91.9)	231 (90.2)	307 (88.5)	
Medical aid	168 (0.7)	90 (11.3)	13 (8.1)	25 (9.8)	40 (11.5)	<0.001***
Liability insurance	111 (7.1)	111 (13.9)	0 (0.0)	0 (0.0)	0 (0.0)	
Other	5 (0.3)	5 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	
Route of ED visit (Direct)	1425 (91.1)	724 (90.5)	149 (92.5)	236 (92.2)	316 (91.1)	0.766
Public EMS use	1390 (88.9)	719 (89.9)	133 (82.6)	228 (89.1)	310 (89.3)	0.063
Presenting symptoms in ED						
Circulatory	1516 (96.9)	779 (97.4)	147 (91.3)	248 (96.9)	342 (98.6)	<0.001***
Respiratory	18 (1.2)	7 (0.9)	4 (2.5)	4 (1.6)	3 (0.9)	0.298
Neurological	16 (1.0)	9 (1.1)	3 (1.9)	2 (0.8)	2 (0.6)	0.565
Gastrointestinal	8 (0.5)	2 (0.3)	6 (3.7)	0 (0.0)	0 (0.0)	<0.001***
General or infectious	3 (0.2)	0 (0.0)	1 (0.6)	2 (0.8)	0 (0.0)	0.038*
Trauma	2 (0.1)	2 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0.591
Intoxication	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0.812
Length of stay (ED), in hours, median [IQR]	0.5 [0.3–0.9]	0.5 [0.3–0.8]	0.4 [0.3–1.2]	0.7 [0.4–1.5]	0.4 [0.3–0.8]	<0.001***
Treatment decisions at ED						
Full life-support treatment	1407 (90.0)	777 (97.1)	131 (81.4)	201 (78.5)	298 (85.9)	<0.001***
Limited treatment	86 (5.5)	18 (2.3)	15 (9.3)	32 (12.5)	21 (6.1)	
Comfort-focused treatment	71 (4.5)	5 (0.6)	15 (9.3)	23 (9.0)	28 (8.1)	
Registration of legal form LST plan	32 (2.0)	3 (0.4)	9 (5.6)	10 (3.9)	10 (2.9)	<0.001***
Treatment at the ED						
Cardiopulmonary resuscitation	1214 (77.6)	672 (84.0)	116 (72.0)	189 (73.8)	237 (68.3)	<0.001***
Endotracheal intubation	1175 (75.1)	612 (76.5)	126 (78.3)	185 (72.3)	252 (72.6)	0.268
Artificial ventilation	1414 (90.4)	738 (92.3)	133 (82.6)	221 (86.3)	322 (92.8)	<0.001***
Hemodialysis	2 (0.1)	0 (0.0)	0 (0.0)	2 (0.8)	0 (0.0)	0.017*
Extracorporeal Membrane Oxygenation	5 (0.3)	5 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0.188
Transfusion	149 (9.5)	125 (15.6)	10 (6.2)	10 (3.9)	4 (1.2)	<0.001***
Inotropic drugs	236 (15.1)	105 (13.1)	30 (18.6)	58 (22.7)	43 (12.4)	<0.001***

Statistical significance: * $p < 0.05$, *** $p < 0.001$. All values are expressed as either numbers (percentages) or medians [interquartile ranges]. IQR, interquartile range; ED, emergency department; EMS, emergency medical services; LST, life-sustaining treatment.

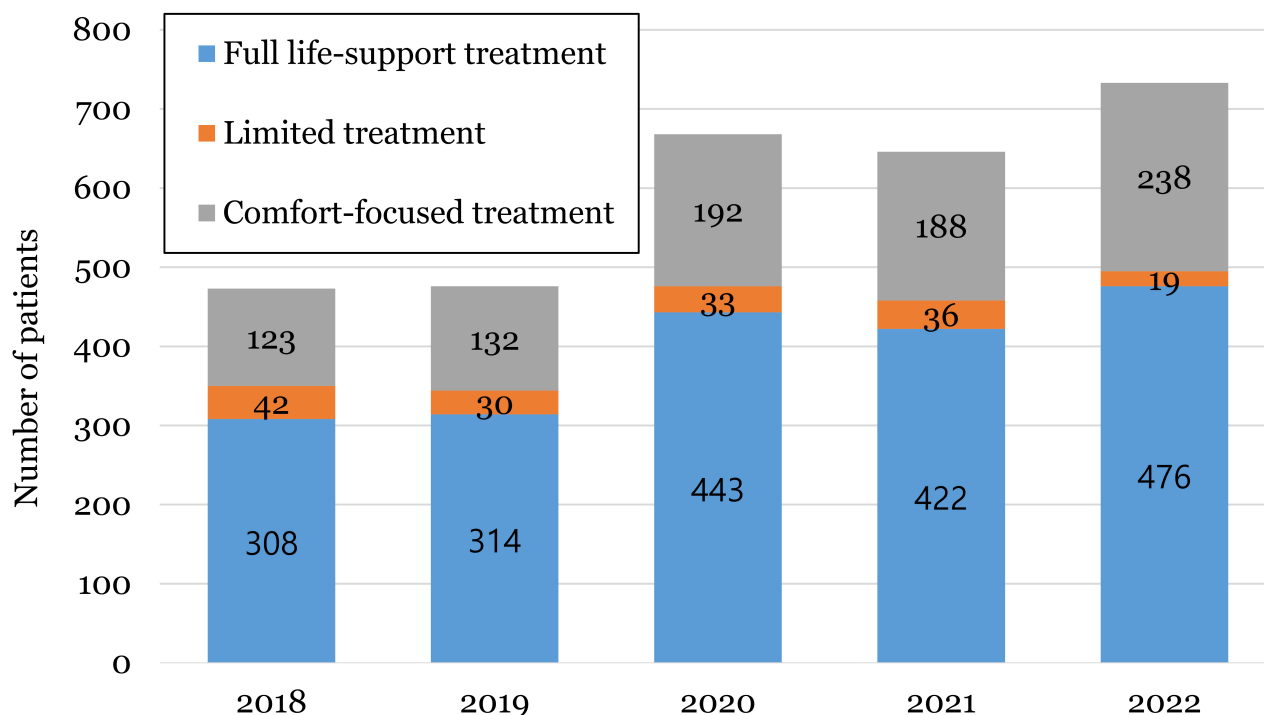


FIGURE 2. Annual trends of treatment decisions for patients who died in emergency departments.

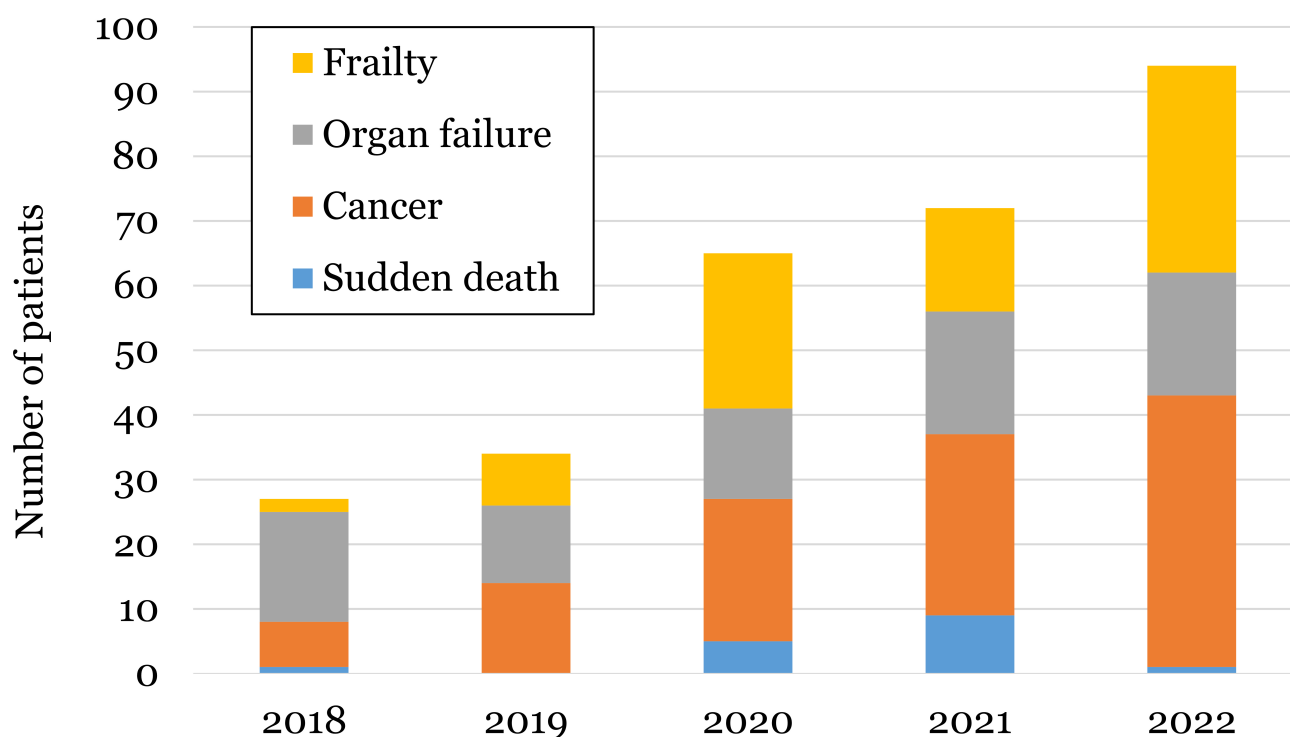


FIGURE 3. Annual number of patients opting for withdrawal of LST, categorized by death trajectories.

For most patients with cardiac arrest upon ED arrival, approximately 90% received full life-support treatment until death. Specifically, cases categorized under sudden death of DTs with or without cardiac arrest upon ED arrival are mainly provided full life-support treatments. This practice reflects a potentially reflexive approach to emergency care, where rapid and intensive interventions are often necessitated by the life-threatening conditions presented by out-of-hospital

cardiac arrest (OHCA). Despite the existence of LST plans, emergency protocols may still prioritize resuscitative efforts, influenced by the acute nature of conditions and the legal protections for EPs in ED settings, along with concerns about medical professional liability claims involving adult patients in ED [19]. Among patients with serious illness or advanced frailty who experienced OHCA, 20% chose comfort-focused treatment, opting not to receive CPR. In Korea, approximately

TABLE 3. Characteristics and interventions for patients categorized based on decisions regarding life-sustaining treatment in the emergency department.

Variable	Registration of legal form LST plan N = 292 (%)	No registration of legal form LST plan N = 2704 (%)	p-value
Female sex	118 (40.4)	979 (36.2)	0.157
Age, yr, median, [IQR]	75 [66–82]	74 [61–81]	0.005**
Age group			
19–29 yr	2 (0.7)	66 (2.4)	
30–39 yr	1 (0.3)	88 (3.3)	
40–49 yr	14 (4.8)	164 (6.1)	
50–59 yr	30 (10.3)	302 (11.2)	0.017**
60–69 yr	43 (14.7)	453 (16.8)	
70–79 yr	91 (31.2)	760 (28.1)	
80–89 yr	97 (33.2)	733 (27.1)	
≥90 yr	14 (4.8)	138 (5.1)	
Advanced directives	8 (2.7)	N/A	
Patient determination	37 (12.7)	N/A	
Insurance status			
National health insurance	265 (90.8)	2247 (83.1)	
Medical aid	27 (9.2)	304 (11.2)	
Liability insurance	0 (0.0)	146 (5.4)	<0.001***
Other	0 (0.0)	7 (0.3)	
Initial mental status on ED admission (Alert)	145 (49.7)	600 (22.2)	<0.001***
Presenting symptoms in ED			
Circulatory	80 (27.4)	1802 (66.6)	<0.001***
Respiratory	102 (34.9)	364 (13.5)	<0.001***
Neurological	41 (14.0)	204 (7.5)	<0.001***
Gastrointestinal	28 (9.6)	160 (5.9)	0.014**
General or infectious	34 (11.6)	101 (3.7)	<0.001***
Trauma	3 (1.0)	44 (1.6)	0.433
Intoxication	2 (0.7)	19 (0.7)	0.973
Other	2 (0.7)	9 (0.3)	
length of stay (ED), h median, [IQR]	14.8 [7.0–29.4]	1 [0.4–5.8]	<0.001***
Death trajectories			
Sudden death	16 (5.5)	1053 (38.9)	
Cancer	113 (38.7)	534 (19.7)	
Organ failure	81 (27.7)	529 (19.6)	<0.001***
Chronic frailty	82 (28.1)	588 (21.7)	
Treatment at the ED			
Cardiopulmonary resuscitation	28 (9.6)	1545 (57.1)	<0.001***
Endotracheal intubation	107 (36.6)	1719 (63.6)	<0.001***
Artificial ventilation	106 (36.3)	1943 (71.9)	<0.001***
Hemodialysis	13 (4.5)	41 (1.5)	<0.001***
Transfusion	70 (24.0)	439 (16.2)	<0.001***
Inotropic drug	157 (53.8)	807 (29.8)	<0.001***

Statistical significance: ** $p < 0.01$, *** $p < 0.001$. All values are expressed as either numbers (percentages) or medians [interquartile ranges]. IQR, interquartile range; ED, emergency department; EMS, emergency medical services; LST, life-sustaining treatment; N/A, Not Applicable.

TABLE 4. Factors associated with decisions to withdraw life-sustaining treatment in the emergency department.

Factors influencing decisions	Adjusted OR	95% CI
Death trajectories		
Sudden death	1.00	
Cancer	3.90	2.22–6.87
Organ failure	3.45	1.94–6.14
Frailty	3.97	2.25–7.03
Clinical circumstances in ED		
Absence of CPR in ED	3.81	2.44–5.95
No cardiac arrest upon ED arrival	2.28	1.45–3.60
ED stay exceeding 8 hours	2.85	2.09–3.88

OR, odds ratio; CI, confidence interval; ED, emergency department; CPR, cardiopulmonary resuscitation.

67% of cardiac arrest cases in the ED are OHCA cases, and approximately 50% are individuals aged ≥ 70 years [1, 5]. In the United States, for patients who have no pulse and are not breathing, paramedics can refer to the DNR consent on the POLST forms to initiate or discontinue CPR or allow for natural death at home instead of transporting the patient to the hospital. Moreover, patients who do not require CPR can receive oxygen and pain management at home, with the primary goal of maximizing comfort upon consenting to the POLST [20, 21]. In Korea, paramedics currently perform CPR under the medical guidance of EPs in the pre-hospital setting while transporting the patient [22, 23], allowing for the possibility of withdrawing CPR if the LST plan or advanced directive has been completed. Adequate societal discourse and consensus are required in South Korea to expand the withholding of CPR in the pre-hospital setting for patients with severe illness or advanced frailty, as practiced in the United States.

In this study, we observe an increasing trend of patients opting for comfort-focused treatment each year, such as pain management, nutrition, and oxygen therapy, after completion of LST plans each year. Despite the implementation of the LST Decision Act aimed at improving EOL care, the rate of full life-support treatment, including CPR, remains high at approximately 50% for patients with chronic illness and frailty. This is consistent with findings by Kim *et al.* [24], who reported that 63.5% of ED deaths are cancer-related, and approximately 40% of these patients received critical care such as CPR. Similarly, in Taiwan, the acceptance of hospice and palliative care services for patients with terminal illnesses, organ failure, and frailty ranges between 50.1% and 61.4% [25]. EPs are trained to provide aggressive treatment for patients with acute, life-threatening conditions, and LST plans and high-quality EOL care are not often a priority. Additionally, EDs in Korea lack systematic high-quality EOL and after-death care for the deceased and bereaved families, such as sufficient pain control, quiet rooms, family visitation, religious needs, music, and touch. Previous studies suggest that the use of POLST forms, ethical guidelines, and the establishment of ED-based EOL care services could be beneficial in addressing these gaps [4, 7, 11, 17]. These interventions could help align medical treatments with patient preferences more effectively, ensuring

that EOL care in EDs not only respects patient autonomy but also enhances the overall quality of care.

Our results show that the rate of upholding patients' self-determination for LST plans is only 12.7%, which is markedly lower than the 22.5% reported in another study [24]. The ED is a unique environment that presents challenges in obtaining consent from patients due to their unstable condition and altered mental state. The LST plans in Korea involve many procedures and the recording of several data points, and the process becomes more complicated when a legal representative signs the form, rendering it difficult to use in ED settings. Also, the continued use of DNR orders to guide decisions on withholding CPR was observed in this study. The documents and consent procedure of DNR orders also vary, and they are only useful within respective hospitals [26, 27]. Therefore, in EDs, where prompt judgments and decision-making are required due to time constraints, the development of an ED-based LST plans document that is short and concise is necessary, besides streamlining the physician's decision-making and form-filing processes.

This study has some limitations. First, we classified the four DTs based on medical records and death certificates, which may not be entirely accurate for patients with multiple comorbidities or insufficient diagnostic data. Additionally, the use of a hierarchical model for DT assignment may oversimplify the patient's dying process, as the boundaries can sometimes be blurred, and assignment to a single trajectory can be difficult. Second, the judgment of the EOL processes and registration of LST plans cannot be uniformly applied in all EDs due to varying medical personnel and medical institution ethics committee composition. Third, this study was conducted at two tertiary care hospitals; however, the level of EDs is determined according to the facility, region, and specialty, and larger and more advanced hospitals tend to have more patients with cancer, dementia, designated rare diseases and severe conditions. Thus, the findings of this study cannot be generalized to all hospitals.

5. Conclusions

In conclusion, this study reveals persistent gaps in advanced care planning for patients at the EOL, even with the imple-

mentation of the LST Decision Act. Our findings highlight that a significant proportion of patients with chronic illness or advanced frailty continue to receive full life-support treatments rather than comfort-focused care that aligns with their preferences and needs. This underscores the necessity of proactively preparing and implementing LST plans that respect patient autonomy, especially as their functional decline aggravates. In the ED, an appropriate workflow system is needed to provide high-quality EOL care to patients with irreversible conditions and imminent death in their last hours or days of life due to severe chronic illness or advanced frailty.

AVAILABILITY OF DATA AND MATERIALS

The datasets generated and/or analyzed during the current study are not publicly available due to information containing the privacy of each patient but are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

JKK and DEL—conceptualization; formal analysis; methodology; writing-original draft. JKK, DEL and SYP—data curation. JP and KSS—validation. DEL, JKK and JP—investigation. DEL, JKK, JP, KSS and SYP—writing-review & editing. All authors have read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was performed in accordance with the Declaration of Helsinki. The study design was reviewed and approved by the Institutional Review Boards of Kyungpook National University Chilgok Hospital (approval No. KNUCH 2023-08-021) and Kyungpook National University Hospital (approval No. KNUH 2023-09-020). The need of informed consent was waived by Institutional Review Board of Kyungpook National University Chilgok Hospital and Kyungpook National University Hospital.

ACKNOWLEDGMENT

Not applicable.

FUNDING

This research received no external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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How to cite this article: Dong Eun Lee, Jong Kun Kim, Jungbae Park, Kang Suk Seo, Sin-Youl Park. Death trajectories and treatment decisions in emergency departments: evaluating the effects of the life-sustaining treatment decision act. *Signa Vitae*. 2025; 21(5): 39–48. doi: 10.22514/sv.2025.064.