

ORIGINAL RESEARCH

Differences in the determination of manner of death for death certificates by physicians in South Korea: questionnaire survey

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Abstract

In South Korea, the manner and cause of death are determined by physicians. The present study aimed to investigate the differences in decisions made by physicians when completing death certificates and the factors that lead to these differences in South Korea. Questionnaires were used to survey 210 physicians who routinely complete death certificates, and demographic data along with information on their decisions regarding the manner and cause of death as well as natural and unnatural contributory causes were ascertained for eight representative cases. The study sample comprised 149 (71.0%) and 61 (29.0%) male and female physicians, respectively, and the mean age in this sample was 36.93 ± 4.51 years. We found that 64.7%, 61.4%, 7.6%, 4.3%, 4.3%, 65.7%, 84.3% and 53.3% of the physicians considered cases 1, 2, 3, 4, 5, 6, 7 and 8 as unnatural deaths, respectively, while 27.6%, 32.0%, 91.9%, 95%, 8.5%, 26.6%, 6.7% and 38.1% considered them to be natural deaths, respectively. In Case 5, 81.7% considered death to be due to an indeterminate cause. We found that differences may exist in how physicians select the manner of death when completing a death certificate and that this decision is influenced by several factors.

Keywords

Cause of death certification; Death certificate; Manner of death certificate

1. Introduction

Death certificates (DC) serve two critical functions. They provide documentation for legal/administrative purposes and they facilitate the reporting of vital statistics for epidemiological or health policy purposes. For both of these functions, it is critical that a DC be filled out completely, accurately, and promptly [1]. However, multiple studies have previously documented a high error rate in death certification [2–6].

In terms of domestic death intimation to the government, the rate of DC inclusion has steadily improved in South Korea, although it ranks 29th among the 35 Organization for Economic Cooperation and Development countries with regard to the percentage of well-certified causes of death [7]. The most common errors in DCs include: failure to specify the time between illness onset and death; combined description of the mechanism and cause of death; and listing the underlying disease(s)—instead of the mechanism—as the cause of death. These errors are mostly attributable to a lack of education on the completion of DCs for medical students and physicians, a lack of interest, and problems in social institutions [8–10]. The Korean Medical Association published a new edition of the Case Book of Death Certificates [11] in 2018 in an attempt to decrease these errors. However, there are still various instances that leave room for decisions on the DC to be made

at the physician's discretion. A previous study reported that 50.5% of physicians face difficulties in completing DCs because of challenges in specifying the underlying cause of death [12].

Korean law stipulates that a medical doctor, dentist, or oriental medical doctor shall not refuse, without justifiable grounds, a request to issue a medical certificate, report, or autopsy certificate concerning an individual who he/she has examined [13]. The public opinion and popular perception is that all physicians, regardless of profession qualifications or abilities other than doctoral licenses, have a uniform duty to issue DCs, while no organization or committee can be consulted for the completion of DC. Thus, the manner and cause of death are stated at the physician's discretion. When physicians issue a DC at the request of bereaved families, the certificates immediately come into effect as official documents despite the lack of an appropriate system with which to manage the DC that has been issued.

The present study was conducted with the aim of investigating the mechanism and cause of death specified in the DC for eight selected cases managed by emergency physicians to ascertain the current status of physician perception of DC completion, differences in the decisions made by physicians, and the contributory factors for these differences. The findings

of this research are intended to provide basic data to guide education and policy directions for experts in the completion of the DC.

2. Methods

From 01 September to 30 October 2017, questionnaires (in Korean) were distributed *via* email or mail in a nationwide survey of physicians who had previously issued a DC. We excluded doctors, interns, and residents who had not prepared DCs. In addition to the questions pertinent to DC and autopsy certificates writing experience, we collated demographic data—such as sex, level of hospital in which they worked and job title—of the survey respondents. Eight representative cases were presented, and the participating physicians were asked to specify the manner of death, cause of death, external (unnatural) contribution, and internal (natural) contribution for each case. The survey provided 20,000 Korean Won as an incentive for completing the questionnaire (**Supplementary material**).

3. Case selection

The eight cases presented in the questionnaire were selected by four emergency physicians who routinely complete DCs and two medical examiners. The questionnaire comprised eight hypothetical case scenarios, each indicating a different level of contributory factors such as whether or not there was trauma, underlying conditions, age, and the duration from trauma to death. Each case was modified to resemble an actual real-life case. All eight cases were designed to comprise different conditions that may influence the decision regarding the manner of death specified in the DC. Fleiss' kappa method was used to obtain inter-rater agreement and free-marginal kappa. The statistics program used for this research was SPSS for Windows version 26.0 (IBM Corp., Armonk, NY, USA).

3.1 Case 1. Burns

The patient was a 27-year-old male found at the scene of a fire. The initial cardiac rhythm was asystole; therefore, cardiopulmonary resuscitation (CPR) was performed for 3 minutes. Return of spontaneous circulation (ROSC) was subsequently achieved, and the patient was brought to an emergency room and admitted to the intensive care unit for therapeutic hypothermia. Initial brain computed tomography (CT) showed findings of hypoxic brain damage. Magnetic resonance imaging (MRI) of the brain on Day 3 after the completion of therapeutic hypothermia showed diffuse hypoxic ischemic encephalopathy suggestive of brain death.

Pulmonary edema improved after admission, and chest radiography conducted on Day 8 of hospitalization did not show any abnormal findings. On Day 9 of hospitalization, indications of pneumonia were identified on chest radiography, and *Acinetobacter baumannii* was identified. Oxygen saturation started to decrease while the patient was on different courses of antibiotics and monitoring, and an arterial blood gas analysis (ABGA) showed findings in partial pressure of carbon dioxide (pCO₂) of CO₂ retention. No improvement was noted de-

spite the use mechanical ventilation, and acidosis progressively worsened along with the onset of adult respiratory distress syndrome (ARDS). The patient became bradycardic and hypotensive and died on Day 14 of hospitalization.

3.2 Case 2. Police water cannon

A 69-year-old male fell after he was hit by a police water cannon while he was pulling on a rope tied around a bus with other demonstrators to penetrate a police bus wall. The patient was brought to A University Hospital in an ambulance at 7:30 PM and underwent a 4-hour surgery for brain hemorrhage, but subsequently went into a mental coma and died on Day 317 of admission.

The death certificate that was issued certified this as a natural death. The attending physician argued that resuscitation was not impossible in the patient and stated that he obtained two do-not-resuscitate (DNR) permissions from the patient's family as evidence for the family's refusal for continuation of the patient's treatment. The patient had a traumatic subdural hemorrhage (SDH) due to external force; he developed acute renal failure that was independent of the primary cause and subsequently developed hyperkalemia. According to the attending physician, the family members and caregivers declined active treatment, including hemodialysis, and the patient died of cardiac arrest. The attending physician also emphasized that the death certificate would have been completed differently if the patient had died despite active life-sustaining treatment without the family's treatment refusal. Officially, the police have accepted that the patient died of trauma from the water cannon.

3.3 Case 3. Bedridden

A 76-year-old female patient had a traumatic epidural hemorrhage from a fall approximately 12 years ago, did not regain consciousness postoperatively, and had been admitted to a nursing hospital with a tracheotomy and Foley catheter *in situ*. The patient did not have any particular complications, such as pressure ulcers, and suddenly developed fever 4 days prior. Urinalysis showed pyuria, and *Escherichia coli* was identified on urine culture. The symptoms did not improve despite antibiotic treatment; the patient developed hypotension that was refractory to inotropics, and died subsequently.

3.4 Case 4. Quadriplegia

A 39-year-old male patient was a quadriplegic who had sustained a cervical spine injury at age 17 after a fall from a 4-storey building in an attempted suicide. The patient was conscious and did not have any problems with communication. However, his physical movements were limited to slight finger movements. A Nelaton catheter was used to drain the urine.

Except for a past history of occasional acute pyelonephritis (APN) that necessitated hospitalization, the patient had been able to maintain a daily routine and pursue his studies for more than 22 years. However, he presented to the hospital after 2 days of fever as his caregiver was absent, and he died a week later from APN-induced sepsis.

3.5 Case 5. Traffic accident

An 84-year-old female patient presented with right upper arm pain. She reported that she was hit by a car near her apartment building and fell. Past medical and surgical history was negative except for hypertension. Her vital signs were normal, she was conscious, and there was no abnormal laboratory finding.

A right humeral fracture was found on imaging. A cast was placed, and the patient was scheduled for follow-up by orthopedics. The patient presented to the orthopedics outpatient clinic 1 week later for follow-up X-ray, which did not show any abnormal findings.

Two days later, she presented to the emergency room with dyspnea. Her caregivers reported that the patient was unable to eat much after the accident and systemically deteriorated. No abnormal finding was noted on a repeat chest X-ray.

At the time of emergency room presentation, the patient's saturation was 78% and the respiratory rate was 42/min. As the saturation remained low despite oxygen administration, the patient was intubated. While waiting for laboratory results, the patient had a cardiac arrest. Although CPR was performed, the patient died. The caregivers declined an autopsy.

3.6 Case 6. Hepatic coma

A 56-year-old male patient was brought in an ambulance for altered mental status. He had previously been diagnosed with alcoholic liver cirrhosis and had been hospitalized several times for hepatic coma. The patient had not had any bowel movement since the preceding week. The daughter reported that the patient had fallen several times while returning from the bathroom with an unsteady gait 2 days ago but did not seem to have sustained any serious head trauma from the falls.

At the time of presentation, the patient was unresponsive, and laboratory and imaging tests were subsequently conducted. Imaging showed a subdural hemorrhage (SDH), and laboratory investigations showed a pH of 6.9, ammonia of 312, elevated prothrombin time (PT) and activated partial prothrombin time (aPTT), and an international normalized ratio (INR) of 7. The patient was admitted to the neurosurgical intensive care unit and died 7 days later.

3.7 Case 7. Anticoagulant

At 8 PM on a Sunday, a 78-year-old female patient was brought to the emergency room in an ambulance with abrasions on her face, arms and legs with stable vital signs at the time of presentation. The patient seemed slightly drowsy, but was able to answer questions slowly. The emergency medical responder reported that a bystander called an ambulance when the patient fell on the street after she was hit by a car. The patient's caregiver, who arrived later, reported that the patient was on antihypertensive medications and warfarin for hypertension and arrhythmia.

Laboratory findings showed hemoglobin of 8.0, PT 4.0 and aspartate transaminase/alanine transaminase 100/90, with other blood levels being normal. Chest CT showed a right 5th rib fracture and contusion of both lungs, and an abdominopelvic CT showed possible liver contusion and multiple subcutaneous hematomas. No other fracture was

noted on imaging.

The patient's level of consciousness diminished with declining saturation and she was subsequently intubated. RBCs (Red blood cells) were transfused due to decreased Hb, and conservative treatment with vitamin K and similar interventions were administered. Subsequently, increased bleeding was noted from abrasions, and progressive edema was apparent in the contused areas.

Despite conservative treatment upon admission to the intensive care unit, the patient's condition declined progressively and alternated between deterioration and improvement, and the patient eventually died on Day 56 of hospitalization.

3.8 Case 8. Aspiration

An 86-year-old female patient was a known hypertensive who had undergone brain surgery for spontaneous intracranial hemorrhage 3 years ago. She received hospitalized treatment for dementia and was admitted to a nursing home 12 months ago. The patient became progressively weaker and eventually bedridden due to impaired mobility. On the day of her death, the patient was having breakfast with the help of the nursing home staff when she developed dyspnea and died. Undigested food was noted in the airway on laryngoscopy conducted at the time of emergency room presentation, and postmortem imaging revealed findings of aspiration pneumonia.

4. Result

In total, 210 physicians satisfied the study eligibility criteria and submitted complete questionnaires that were included in the final analysis.

5. Participant characteristics

In this study, there were 149 (71.0%) male and 61 (29.0%) female physician participants. The mean age of the physicians in the survey sample was 36.93 ± 4.51 years; 149 (71.0%) of the physicians were salaried employees. In terms of clinical experience, 105 (50.5%) had more than 5 years of experience, 48 (23.0%) had more than 10 years of experience, and 64 (27.0%) had more than 15 years of experience (Table 1).

Investigation of Manner and Cause of Death Through Completion of Mock DC for Eight Cases (Tables 2,3, Fig. 1).

5.1 Case 1. Burns

The manner of death was ascertained to be unnatural and natural by 136 and 58 respondents, respectively; 16 physicians responded that the cause of death was indeterminate. Pneumonia was the most common cause of unnatural death ($n = 51$), followed by acute respiratory distress syndrome (ARDS) and carbon monoxide intoxication. Among respondents who considered it to be a natural death, 33 and 20 attributed the cause to pneumonia and ARDS, respectively.

To the question "Please list the manner of death for the above case in the order of contribution", the physicians responded that external and internal factors contributed 67% and 33% of causation, respectively.

TABLE 1. Characteristics of study participants.

Characteristics	n = 210
Age (yr, mean \pm SD)	36.93 \pm 4.51
Sex, n (%)	
Male	149 (71.0)
Female	61 (29.0)
Status, n (%)	
Salaried physicians	149 (71.0)
Self-owned private practice	1 (0.5)
Fellow	10 (4.7)
Professor	49 (23.0)
Public health doctors and army doctors	1 (0.4)
Clinical experiences, n (%)	
More than 5 years	105 (50.0)
More than 10 years	48 (23.0)
More than 15 years	57 (27.0)

SD: Standard deviation.

TABLE 2. Physicians' decision of the manner of death in eight cases.

Manner of death (n (%))	Unnatural/indications for unnatural	Natural	Undetermined	% Agreement among physicians	Free-marginal kappa
Cases					
1. Burns	136 (64.8)	58 (27.6)	16 (7.6)	49.9	0.25
2. Police water cannon	129 (61.4)	67 (31.9)	14 (31.9)	48.1	0.22
3. Bed-ridden	16 (7.6)	193 (91.9)	1 (0.5)	85.0	0.77
4. Quadriplegia	9 (4.3)	200 (95.2)	1 (0.5)	90.9	0.86
5. Traffic accident	9 (4.3)	18 (8.6)	183 (87.1)	76.8	0.65
6. Hepatic coma	138 (65.7)	56 (26.7)	16 (7.6)	50.6	0.26
7. Anticoagulant	177 (84.3)	14 (6.7)	19 (9.0)	72.2	0.58
8. Aspiration	112 (53.3)	80 (38.1)	18 (8.6)	43.4	0.15

5.2 Case 2. Police water cannon

For Case 2, 129, 67 and 14 physicians responded that the manner of death was unnatural, natural and indeterminate, respectively. Of the physicians who considered the death to be unnatural, 64 attributed the death to hyperkalemia, 43 attributed it to traumatic brain hemorrhage (subdural hemorrhage (SDH)), and 21 attributed it to acute renal injury. Among the respondents who considered this to be a natural death, 52 and 15 indicated hyperkalemia and acute renal injury, respectively, as the cause of death.

The physicians considered external and internal factors to have contributed 55.1% and 44.9%, respectively, to causation of death.

5.3 Case 3. Bedridden

For this case, 16, 193 and 1 physicians considered the manner of death to be unnatural, natural and indeterminate, respectively. Among respondents who considered this to be an unnatural death, 11 attributed causation to septic shock whereas

4 chose urinary tract infection (UTI). Of the respondents who considered it to be a natural death, 153 and 40 reported the cause to be septic shock and UTI, respectively. The physicians thought that external and internal factors contributed 14.9% and 85.1%, respectively, to causation of death.

5.4 Case 4. Quadriplegia

In this case, 9, 200 and 1 physician(s) considered the manner of death to be unnatural, natural and indeterminate, respectively. Among respondents who considered this to be an unnatural death, 6 and 3 attributed it to septic shock and acute pyelonephritis, respectively. Of the respondents who considered it to be a natural death, 169 and 41 attributed it to septic shock and UTI, respectively. The physicians thought that external and internal factors contributed 17.4% and 82.6%, respectively, to causation of death.

TABLE 3. Causes of death by the manner of death in cases 1–8.

Cause of death when the manner of death was deemed unnatural	N (%)	Cause of death when the manner of death was deemed natural	N (%)
Case 1 (Burns)			
Pneumonia	51 (37.5)	Pneumonia	33 (56.9)
Acute respiratory distress syndrome	46 (33.8)	Acute respiratory distress syndrome	20 (34.5)
Carbon monoxide intoxication	17 (12.5)	Post-cardiac arrest syndrome	2 (3.4)
Hypoxic brain damage	12 (8.8)	Hypoxic brain damage	2 (3.4)
Burns	3 (2.2)	Multiorgan failure	1 (1.7)
Multiorgan failure	3 (2.2)		
Inhalation burn	3 (2.2)		
Post-cardiac arrest syndrome	1 (0.7)		
Total	136 (100)	Total	58 (100)
Case 2 (Police water cannon)			
Hyperkalemia	64 (49.6)	Hyperkalemia	52 (77.6)
Traumatic brain hemorrhage-subdural hemorrhage	43 (33.3)	Acute renal injury	15 (22.4)
Acute renal injury	21 (16.3)		
Multiorgan failure	1 (0.8)		
Total	129 (100)	Total	67 (100)
Case 3 (Bedridden)			
Septic shock	11 (68.8)	Septic shock	153 (79.3)
Urinary tract infection	4 (25.0)	Urinary tract infection	40 (20.7)
Traumatic brain hemorrhage	1 (6.2)		
Total	16 (100)		193 (100)
Case 4 (Quadriplegia)			
Septic shock	6 (66.7)	Septic shock	162 (81.0)
	3 (33.3)	Acute pyelonephritis	38 (19.0)
	9 (100)		200 (100)
Case 5 (Traffic accident)			
Fat embolism	6 (66.7)	Pulmonary embolism	8 (44.4)
Pulmonary embolism	3 (33.3)	Natural death	5 (27.8)
		Fat embolism	3 (16.7)
		Acute respiratory distress syndrome	1 (0.6)
		Myocardial infarction	1 (0.6)
Total	9 (100)	Total	18 (100)
Case 6 (Hepatic coma)			
Traumatic brain hemorrhage	134 (97.1)	Traumatic brain hemorrhage	35 (62.5)
Metabolic acidosis	4 (2.9)	Hepatic encephalopathy	18 (32.1)
		Metabolic acidosis	1 (1.8)
		Multiorgan failure	1 (1.8)
Car accident		Disseminated intravascular coagulation	1 (1.8)
Total	138 (100)	Total	56 (100)

TABLE 3. Continued.

Cause of death when the manner of death was deemed unnatural	N (%)	Cause of death when the manner of death was deemed natural	N (%)
Case 7 (Anticoagulant)			
Hypovolemic shock	79 (44.6)	Hypovolemic shock	6 (42.9)
DIC	27 (15.2)	Disseminated intravascular coagulation	3 (21.4)
Multiple contusion	23 (13.0)	Coagulation disorder	3 (21.4)
Lung contusion	22 (12.4)	Hepatic failure	2 (41.3)
Car accident	18 (10.2)		
Multiorgan failure	8 (4.6)		
Total	177 (100)	Total	14 (100)
Case 8 (Aspiration)			
Asphyxia	103 (92.0)	Aspiration pneumonia	46 (57.5)
Aspiration pneumonia	9 (8.0)	Asphyxia	32 (40.0)
		Nontraumatic brain hemorrhage	2 (2.5)
	112 (100)		80 (100)

N: Number.

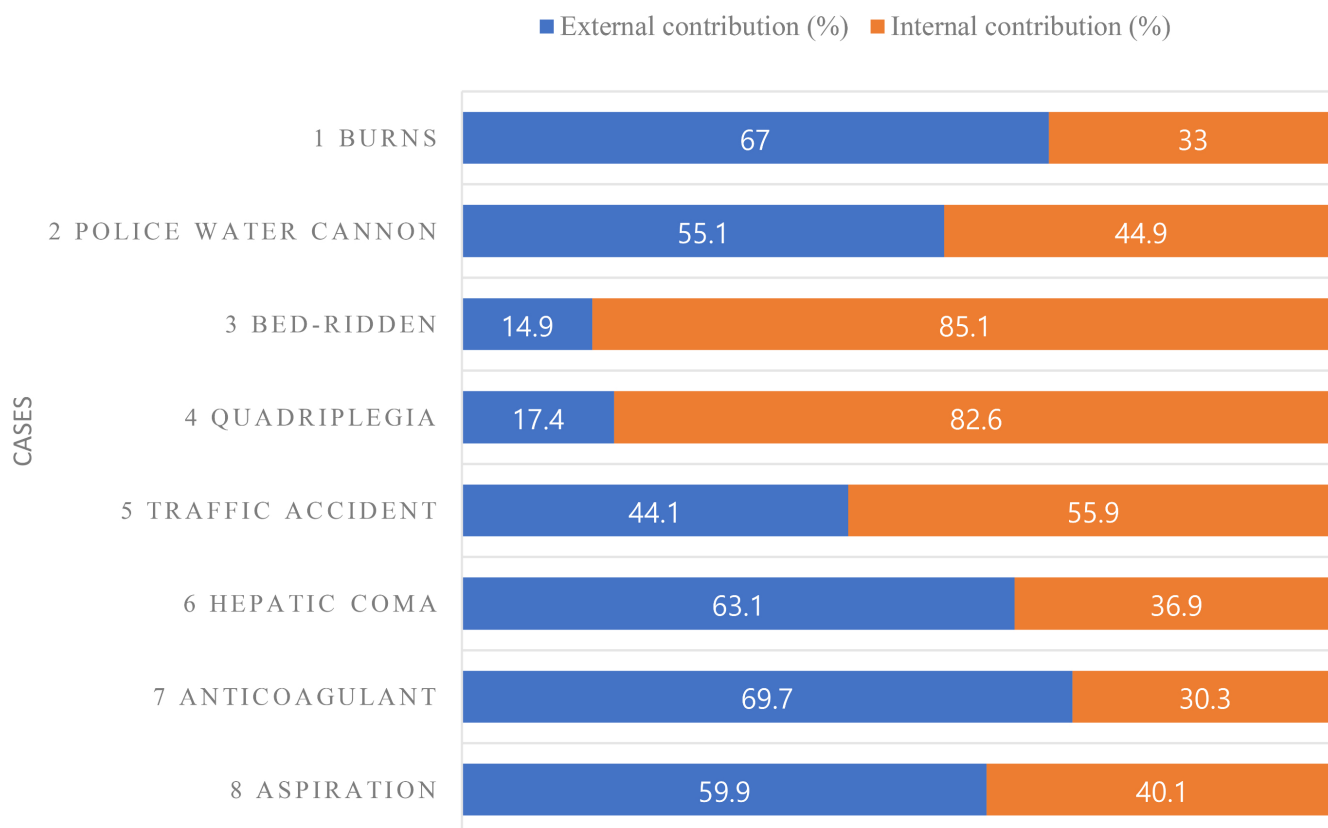


FIGURE 1. Contribution survey either internal or external (contribution survey not related to death manner decision).

5.5 Case 5. Traffic accident

In this case, 9, 18 and 183 physicians responded that the manner of death was due to unnatural, natural and 183 indeterminate causes. Among respondents who considered this to be an unnatural death, 6 and 3 considered it to have been caused by fat embolism and pulmonary embolism, respectively. Of those who responded that it was a natural death, 8 thought that the cause was a pulmonary embolism, 5 considered it to be a natural death, 3 thought it was fat embolism, and 1 each attributed death to have been caused by ARDS and myocardial infarction. The physicians considered external and internal factors to have contributed 44.1% and 55.9%, respectively, to causation of death.

5.6 Case 6. Hepatic coma

Regarding the manner of death, 138, 56 and 16 physicians responded that it was unnatural, natural and indeterminate, respectively. Of the physicians who responded that it was an unnatural death, 134 and 4 responded that death was caused by traumatic brain hemorrhage (including traumatic SDH) and metabolic acidosis, respectively. Among physicians who responded that it was a natural death, 35 and 18 thought the cause was a traumatic brain hemorrhage (including traumatic SDH) and hepatic encephalopathy, respectively, while 1 each thought it was caused by metabolic acidosis, multiorgan failure, and disseminated intravascular coagulation. The physicians thought that external and internal factors contributed 63.1% and 36.9%, respectively, to causation of death.

5.7 Case 7. Anticoagulant

Regarding the manner of death, 177, 14 and 19 physicians responded that it was unnatural, natural and indeterminate, respectively. Of the physicians who responded that it was an unnatural death, 79, 27, 23, 22 and 18 replied that it was caused by hypovolemic shock, DIC (Disseminated intravascular coagulation), multiple contusion, lung contusion, and car accident, respectively; hypovolemic shock was the most commonly selected cause of natural death. The physicians thought that external and internal factors contributed 69.7% and 30.3%, respectively, to causation of death.

5.8 Case 8. Aspiration

For the manner of death in this case, 112, 80 and 18 physicians responded that it was unnatural, natural and indeterminate, respectively. Of the physicians who responded that it was an unnatural death, 103 and 9 replied that it was caused by asphyxiation and aspiration pneumonia, respectively. Among those who responded that it was a natural death, 46, 32 and 2 thought that the cause was aspiration pneumonia, asphyxiation, and nontraumatic brain hemorrhage, respectively. The physicians thought that external and internal factors contributed 59.9% and 40.1%, respectively, to causation of death.

6. Discussion

In South Korea, there is no coroner system [14]. The importance of DC emerged as a major issue after the death of

Namgi Baek in 2016. Baek had a traumatic SDH due to the use of a water cannon by the police to repress a demonstration, was admitted to the department of neurosurgery, and remained in a coma for approximately 300 days. Baek subsequently developed acute renal failure, and life-sustaining treatment was withdrawn at the request of his family. The attending physician completed his DC and specified the manner of death as natural, the legality of which is currently being decided in the courts. In other words, it remains an ongoing question whether the physician made a wrong decision or if it was against the law.

Here, eight cases were selected by specialists who had written the DC: These were cases of death after 10 days of treatment without recovery of consciousness after severe inhalation burns (case 1), death due to progression of multi-organ failure during treatment for 1 year without recovery of consciousness after trauma (case 2), death of an old age patient who developed fever (case 3), death of a young age patient who had a recovery of consciousness after trauma and died of an infectious disease caused by a disability after living with it for 30 years (case 4), death of a healthy old-age patient within a few days of minor trauma (case 5), death due to trauma caused by a change of consciousness due to disease (case 6), death due to minor trauma in patients with poor underlying conditions (case 7), and death from respiratory arrest due to food aspiration in an old age bedridden patient (case 8). These cases included a variety of situation that physicians actually face. Lu TH reported that a questionnaire was conducted with 145 doctors about four vignettes. DC experience was significantly related to the exact form of certification, but it was not consistent with the subject. The study found that differences in DC, and especially UCOD (Underlying cause of death) choices, were due to differences in information interpretation rather than differences in knowledge about death certification [15].

6.1 Death with an external factor serving as the main cause or preceding the death

The first principle in determining the manner and cause of death is specifying the death as natural only when it is certain to be natural [12]. However, as learning about and treating diseases remain the priorities for physicians, they sometimes underestimate external factors. Moreover, because emergency physicians do not regularly follow up with patients while forming trusted relationships with patients who have specific diseases, these physicians may find it difficult to make decisions based on patient history.

For cases 1–4, the underlying causes of death were external factors. With increasing duration in time between the underlying cause and death, fewer physicians thought that they were unnatural deaths. This characteristic was even present for cases for which the history was provided. Therefore, this difference is expected to be even greater in emergency medical settings wherein it is often difficult to ascertain the patient's complete medical history.

Considering that the causes of death did not differ for natural and unnatural deaths, it seems that the physicians did not find it very difficult to determine the cause of death. By contrast, although the manner of death should be determined upon careful consideration, as it requires consideration of the

legal aspects of death, many physicians had differing opinions.

For cases 1 and 2, where the time interval between the underlying accident and death was relatively short, more physicians replied that the deaths were unnatural (64.8% and 61.4%, respectively), and more physicians also thought that unnatural (external) causes contributed more (67% and 55.1%, respectively). Further, although differences in the time interval between the underlying accident and death brought about differences in responses to some degree, the responses focused more on the continuation of the underlying causes at that time. As patients in cases 3 and 4 were able to maintain daily life or had no particular complications between the underlying accident and death, most physicians replied that the influence of underlying accidents and diseases did not continue until death.

According to guidelines on DC completion, deaths are considered to be unnatural when the underlying cause is an accident. However, it is difficult for emergency physicians—who do not follow up with patients—to know the underlying causes of death from several decades ago, thus leading to these findings. Most physicians who thought that cases 3 and 4 were natural deaths replied that the time between the underlying accident and death was too long. To determine the manner of death, the time between the underlying accident and death, symptomatic stabilization, and duration of symptoms should be clearly defined. As the DC may be used to determine the scope of responsibility for the accident for unnatural deaths, the causative relationship for each case should be determined differently to facilitate reasonable decisions without exaggerating the responsibility that should be assigned to the accident. Here, the decision will differ substantially based on medical knowledge, the legal perspective, the personal values of physicians, and differences in experience.

6.2 When the influence of internal and external factors is unclear

In case 3, an external factor preceded the death, but there was a lack of continuity between the mechanism of the accident and death. Here, 87.1% of physicians thought that the death was due to an indeterminate cause. When physicians are unsure of the manner and type of death, the guidelines recommend that they document their opinions and supporting evidence in medical records and issue the DC with “undetermined cause” to leave room for other experts to intervene.

6.3 When underlying diseases influence the outcome of external factors

In real life, it is sometimes difficult to determine the manner and cause of death, even for patients with chronic diseases. Moreover, the demands of caregivers change in different situations. More than half of the physicians chose unnatural deaths in accordance with the rules.

In Case 7, no fatal injury was confirmed based on the mechanism of motor vehicle accident, and the medications used to treat underlying diseases may have worsened the patient’s conditions. The role of the motor vehicle accident preceding the death may be evaluated differently, thus leading to different conclusions. The manner of death may be considered to be nat-

ural if the motor vehicle accident did not directly lead to death. However, the role of external accidents is not determined solely based on medical knowledge and often depends on witness accounts. When determining causality, acute factors are weighted more than chronic factors and external factors are weighed more than internal factors. If this rule is applied, external forces, which may not be medically significant, may need to be considered as the cause of death.

We also aimed to ascertain how physicians perceive the contribution of external and internal factors to each death, regardless of their decisions on the manner of death. As shown in Fig. 1, the contribution from internal and external factors and the decision of unnatural or natural manner of death showed similar distributions. ISD Roberts [16] reported that many deaths are gray areas with both natural and unnatural parts. There are no guidelines for dealing with these cases, and for this purpose, when investigating opinions with coroners in the United Kingdom, considerable variation was reported.

Medicine is often considered separate from law; however, the role of physicians has expanded beyond simple treatment or medical actions with social development, and it has become more complex. In particular, medical documents have legal effects and are thus becoming increasingly important. However, there is a lack of education on the role of physicians as well as administrative and legal support for this aspect. Therefore, experts and organizational expertise are needed to inform the completion of DCs. When physicians need to issue DC or autopsy certificates for patients that they have not treated in the past, it may be a good idea to delegate the task to licensed individuals who have received additional education in DC preparation. This study was limited to the analysis of the manner and cause of death. However, as the aforementioned decisions are thought to differ greatly depending on the time of death, place of death, and additional considerations for unnatural deaths, further research should attempt to validate these preliminary findings.

The present study focused on the determination of unnatural or natural deaths for each case; however, we found many other errors in the completion of DC. For instance, one DC was completed as follows: immediate cause of death as cardiopulmonary arrest, secondary cause as acute renal failure, and underlying cause as acute subdural hemorrhage. According to the current laws, there are two significant errors in this DC: First, cardiopulmonary arrest, respiratory arrest, or cardiac arrest cannot be the cause of death on a DC. A bigger issue is that whether the death was natural or unnatural was determined based on the underlying cause of death. However, in this DC, the underlying cause of death was traumatic whereas the manner of death was natural. Further, as shown in Table 3, the cause of death also differed depending on the doctor. There has been a study showing that Internists of different sub-specialties have different opinions for cause of mortality when a patient has multiple diseases [17].

The limitations of this study are as follows: The study adopted convenience sampling for the study sample. The findings on the knowledge and experience of DC preparation cannot be generalized to all emergency departments in Korea. Moreover, the questionnaire used in this study was developed by the researcher and lacks reliability and validity.

7. Conclusions

This study demonstrated that, in addition to simple errors in the DC, physicians may differ in their decisions on the manner of death based on various factors.

The physicians selected different manners of death for each case, including cases where death was caused mostly by or preceded by an external factor, cases where the influence of internal and external factors was uncertain, and cases where underlying diseases influenced the outcome of an external factor. We found that differences may exist when physicians select the manner of death in the completion of a death certificate and that several factors influence this decision. The findings of this study suggest the need to establish additional organizations, administrative support, and systems for DC to standardize the issuing of accurate DCs.

AVAILABILITY OF DATA AND MATERIALS

The dataset analyzed during the current study is available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

DHL—Conception and design; Drafting the manuscript for intellectual content. JYL—Acquisition, analysis, and interpretation of data; Statistical analysis. DHL and JYL—Study supervision. All authors—reviewed, revised and approved the manuscript for submissions.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the institutional review board of Ewha Womans University Seoul Hospital (IRB No: EUMC-015-002), and the requirement for written informed consent was waived.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at <https://oss.signavitae.com/mre-signavitae/article/1693535874998779904/attachment/Supplementary%20material.docx>.

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