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Beyond Injuries: February 6th Kahramanmaras Earthquakes and Other Patients Transported by Ambulance

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Abstract

Objective: This study evaluates the Emergency Medical Service system and overall emergency preparedness by analyzing ambulance-transported patients during the February 6, 2023 earthquakes, focusing on those without earthquake-related injuries (medical emergencies and traumas not caused by earthquakes).

Methods: A retrospective, observational case series was conducted, involving patients aged 18 and above transported by ambulance between February 6 and March 6, 2023. Patient demographic characteristics, vital signs, diagnoses, treatments, and outcomes were recorded. Predisposing factors for ambulance transportation including post-earthquake health facility issues, housing problems, hygiene, heating, and smoke exposure were meticulously analyzed.

Results: The study included 1872 patients, with a 55.4% hospitalization rate and a 13.7% mortality rate. Cardiovascular emergencies were the primary reason for admission (28.9%). Patients from the hospital in the study's location form Group 1, whereas those from other earthquake-affected provinces constitute Group 2. Significant predisposing factors for ambulance transportation included post-earthquake health facilities ($P < 0.001$), housing problems ($P < 0.001$), hygiene ($P < 0.001$), heating ($P = 0.001$), and smoke exposure ($P < 0.001$). In Group 2, pneumonia ($P = 0.001$), soft tissue infection ($P = 0.002$), sepsis ($P = 0.004$), carbon monoxide poisoning ($P < 0.001$), and diabetic emergencies ($P = 0.013$) were statistically significantly more frequent.

Conclusions: Analyzing post-earthquake ambulance-transported patients is vital to comprehend the demand for emergency health care and address post-disaster health care challenges.

On February 6, 2023, at 04:17 local time in Turkey, a 7.7 Mw earthquake struck along the Eastern Anatolian Fault Line with its epicenter in Pazarcık, Kahramanmaraş, followed by a 6.7 Mw aftershock just 11 minutes later. Approximately 9 hours later, another seismic event, not classified as an aftershock but as an induced earthquake, occurred approximately 95 kilometers away from the initial epicenter in Elbistan, Kahramanmaraş, registering a magnitude of 7.6 Mw. A subsequent induced earthquake on February 20, 2023, in Yayladagı, Hatay, had a magnitude of 6.4 Mw. Over the following three months until May 6, 2023, the region experienced a total of 33 591 earthquakes.[1] The data on earthquake magnitudes from the U.S. Geological Survey (USGS) differed slightly from those of the Disaster and Emergency Management Authority of the Republic of Turkey (AFAD). The USGS reported the initial earthquake as 7.8 Mw and the second earthquake as 7.5 Mw. The rupture lengths and widths were estimated at approximately 190 km by 25 km for the first earthquake and ~120 km by ~18 km for the second earthquake.[2,3] According to AFAD, surface ruptures of around 300 km and 130 km in length occurred during the earthquakes, resulting in displacements exceeding 6.5 meters.[1]

The earthquakes impacted an area covering 108 812 square kilometers, equivalent to 13.9% of Turkey's total land area, and affected a population of 14 013,196 individuals across 11 provinces (Kahramanmaraş, Hatay, Adıyaman, Gaziantep, Malatya, Kilis, Diyarbakır, Adana, Osmaniye, Şanlıurfa, and Elazığ), as reported by AFAD (Figure 1). The extensive impact resulted in 50 783 fatalities and 115 353 injuries. It ranks as the fifth deadliest earthquake in the 21st century, among events such as the 2004 Indonesia-Indian Ocean earthquake (183 172 deaths and 40 320 missing)[4], 2010 Haiti earthquake (222 570 deaths)[5], 2008 China Sichuan earthquake (69 197 deaths and 18 222 missings)[6], and 2005 Pakistan

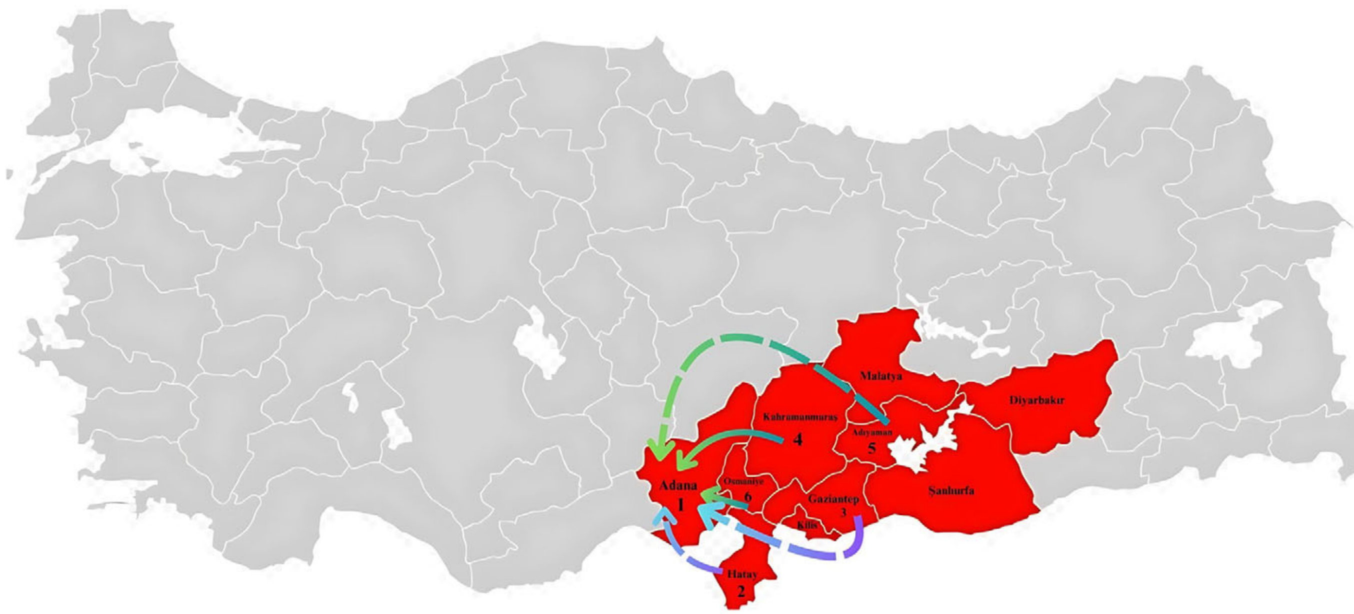

Figure 1. The 11 provinces affected by the earthquake and Group 1 and Group 2 provinces where the cases in the study were transported. (Group 1; Adana province, *n* = 1268) (Group 2; Hatay province, *n* = 504; Gaziantep province, *n* = 30; Kahramanmaras province, *n* = 25; Adıyaman province, *n* = 24; and Osmaniye province, *n* = 21).

Kashmir earthquake (74 636 deaths)[7], with a death toll of 59 259.[1] According to the Ministry of Environment, Urbanization, and Climate Change, 37 984 buildings collapsed, while 311 000 buildings, comprising 872 000 independent units, became uninhabitable.[8] The earthquake's total cost in Turkey was estimated at $148.8 billion, surpassing the economic loss caused by the 1999 Marmara Earthquake by approximately sixfold, equivalent to 9% of Turkey's gross domestic product in 2023, as per the 2023 Parliamentary Earthquake Research Commission's report.[1,9]

In the largest earthquakes in the history of the Republic of Turkey, a total of 271 060 individuals, including security forces, health teams, Kızılay, AFAD, civil society organizations, and health care professionals, were involved in the response efforts.[10] Health teams from all over the country participated in both prehospital and hospital settings, including field hospitals, tent hospitals, and hospitals that were not affected by the earthquake. Prehospital Emergency Medical Services (EMS) are a crucial public health service that ensures the rapid transportation and treatment of critically injured patients in emergency departments (ED) with serious injuries.[11] In natural disasters, it may not be possible for EMS to respond to a large number of cases. In such situations, the proper transportation of the suitable patient to the appropriate medical center becomes even more crucial. The post-earthquake period is fraught with significant challenges related to patients reaching health care facilities, the care of victims, and the implementation of preventive measures and treatments. The lack of swift, reliable, and efficient management can lead to comprehensive health issues, including the exacerbation of chronic diseases, the intensification of mental health disorders, and the potential for outbreaks.[12]

Earthquake-related studies often focus on injuries developed due to trauma during earthquakes and efforts related to their treatment.[13,14] There is insufficient data on the other emergencies transported to the ED by EMS. In this study, our aim was to determine the reasons for transporting patients with non-earthquake-related injuries (medical emergencies and traumas not caused by earthquakes) to the hospital by ambulance during such a large-scale disaster, identify medical deficiencies in the earthquake-stricken area (infrastructure and medical care), explore the challenges in living conditions, and assess the outcomes of the patients. We hope that the data obtained from this study will contribute to determining the effectiveness of the EMS system and assist in taking necessary precautions in the event of another potential disaster, such as war, flood, earthquake, pandemic, etc.

Methods

Study Design

The study was a retrospective cross-sectional study. The study included patients aged 18 and over who were transported to the ED (medical reasons and non-earthquake trauma) by land and air ambulances within the first month after the earthquake (between February 6 and March 6, 2023). Patients for whom complete file information could not be accessed, as well as those who were trapped in rubble and transported due to trauma during the earthquake, were excluded from the study. The study commenced with the approval of the local ethics committee.

Data collection

Patient demographic characteristics, vital signs, the day of admission following the earthquake (Figure 2), type of ambulance bringing the patient (ground-air ambulance), diagnoses received in the ED, specific treatment needs (inotropic therapy, mechanical ventilation, hemodialysis, blood transfusion), and outcomes (discharge, ward admission, intensive care unit admission) were recorded. Additionally, information regarding the patients' origin from which earthquake-affected region (Adana, Hatay, Kahramanmaraş, other provinces), their temporary accommodation for earthquake victims (tent, container, car, home, transfer from another hospital), and triggers leading to the patients' ED visits (medical reasons, lack of social support) was recorded. Patients were divided into two groups based on the cities they presented from. Group 1 comprised patients brought from the city of Adana where the study hospital is located, while Group

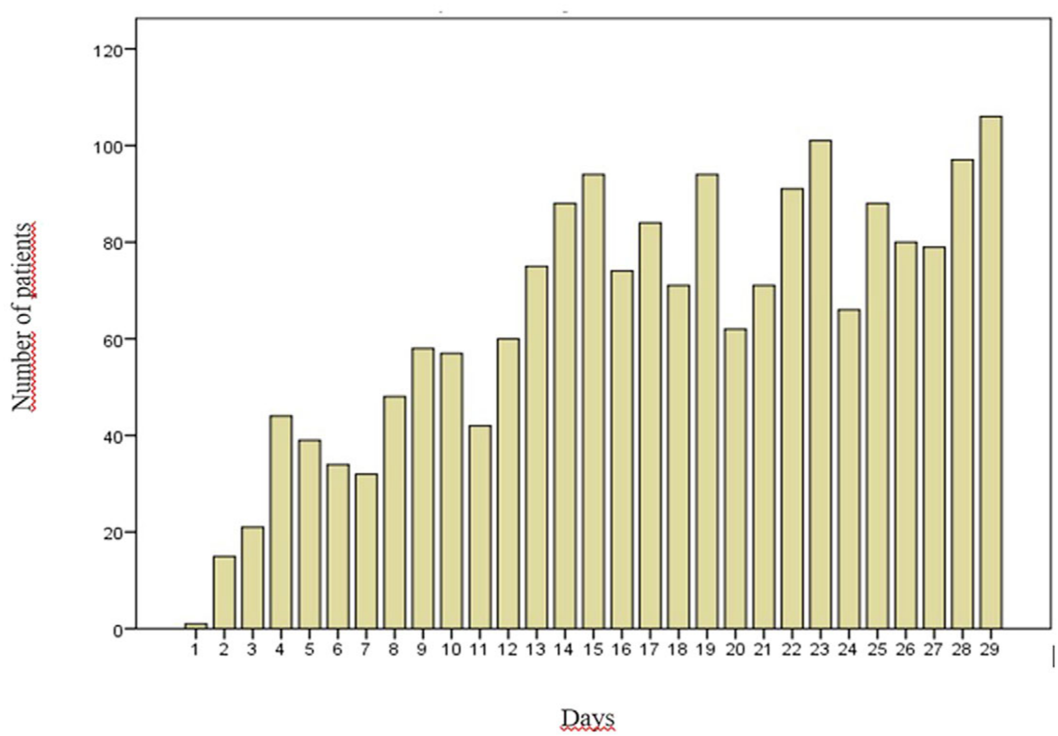

Figure 2. The daily number of patients included in the study between February 6 and March 6. The peak on the 15th day is due to the evacuation of university hospitals in Adana and Hatay, which were damaged in the earthquake on February 20th.

2 consisted of patients brought from other cities (Hatay, Kahramanmaras, Gaziantep, Adıyaman, Osmaniye) affected by the earthquake (Figure 1). The data were recorded on a standardized data collection form. Access to the data was obtained through patient files, hospital information management system records, and EMS system records. If access to predisposing factors could not be obtained through file data, patients were contacted by phone to obtain the necessary information.

Emergency medical service system and hospitals updated after Kahramanmaraş Earthquake in Adana city. The study was conducted in the ED of a tertiary hospital in Adana, one of the 11 cities affected by the earthquake. Adana has 3 university hospitals, 15 state hospitals, and 14 private hospitals. Following the earthquake on February 20, a university hospital with a capacity of 1400 beds was evacuated due to damage. The study took place in the ED of a tertiary hospital in Adana, one of the 11 cities affected by the earthquake. Patients were transferred to our hospital and other hospitals in the city.[15] The hospital where the study was conducted is equipped with seismic isolators, making it earthquake-resistant. Its adult ED, where an average of 325 422 patients are seen annually, and 31 120 arrive by ambulance, is divided into three sections: adult, gynecological-obstetric, and pediatric emergencies. The adult ED is equipped with 4 separate observation rooms with monitored patient tracking and 48 patient beds. During the first week post-earthquake, the ED's endoscopy unit's 4 observation rooms were used to care for affected patients. Two observation rooms were allocated for outpatient and ambulance arrivals (Figure 3). Each examination cabin was staffed with an emergency room physician and 2 nurses for evaluations and interventions. Specialty consultants (orthopedics, thoracic surgery, general surgery, neurosurgery, cardiovascular surgery, plastic surgery, etc.) were also available. One observation room served as a critical care unit for patients awaiting intensive care beds, including those needing mechanical ventilation. Hemodialysis was provided bedside. Concurrently, 192 patients were monitored in 8 observation rooms in the ED. Despite having 3 computed tomography (CT) machines and 8 x-ray devices, patients requiring radiological imaging faced prolonged wait times during the initial 3 days.

The hospital originally had 1336 ward beds and 259 intensive care beds. On the first day of the earthquake, the ward beds were increased to 1600, and intensive care beds to 380. Similar adjustments were made during the COVID pandemic by bringing in spare beds and converting rooms into double occupancy. The hospital's operating theater comprises 60 separate operating rooms (Figure 4). In the first month following the earthquake, 2 154 surgeries were performed. The hospital's heliport, linked to the ED via a dedicated stretcher elevator, facilitated the transfer of 780 patients via air ambulance during the initial week of the earthquake, totaling 180 sorties (Figure 5). As the hospital reached full capacity, patient transfers to other hospitals in the capital, Ankara, were arranged by air ambulance.[16] A total of 5037 injured patients, including children and adults, were treated at the hospital, with 122 patients receiving hyperbaric oxygen therapy at the hyperbaric center.[17]

In the city where the study was conducted, there are 66 ambulance stations equipped with a total of 115 ambulances. During the third day of the earthquake in the disaster area, 2397 ground ambulances, 5 air ambulances, and 7 helicopter ambulances were active. Turkey's ED and EMS system is entirely free of charge and provided as a public service. The emergency call system is activated by dialing 1-1-2 in Turkey. EMS personnel at the Command and Control Center dispatch the nearest and most suitable team to the incident site. However, during this earthquake period, infrastructure issues in the affected cities hindered communication within the first 48 hours.

Figure 3. Emergency department diagram.

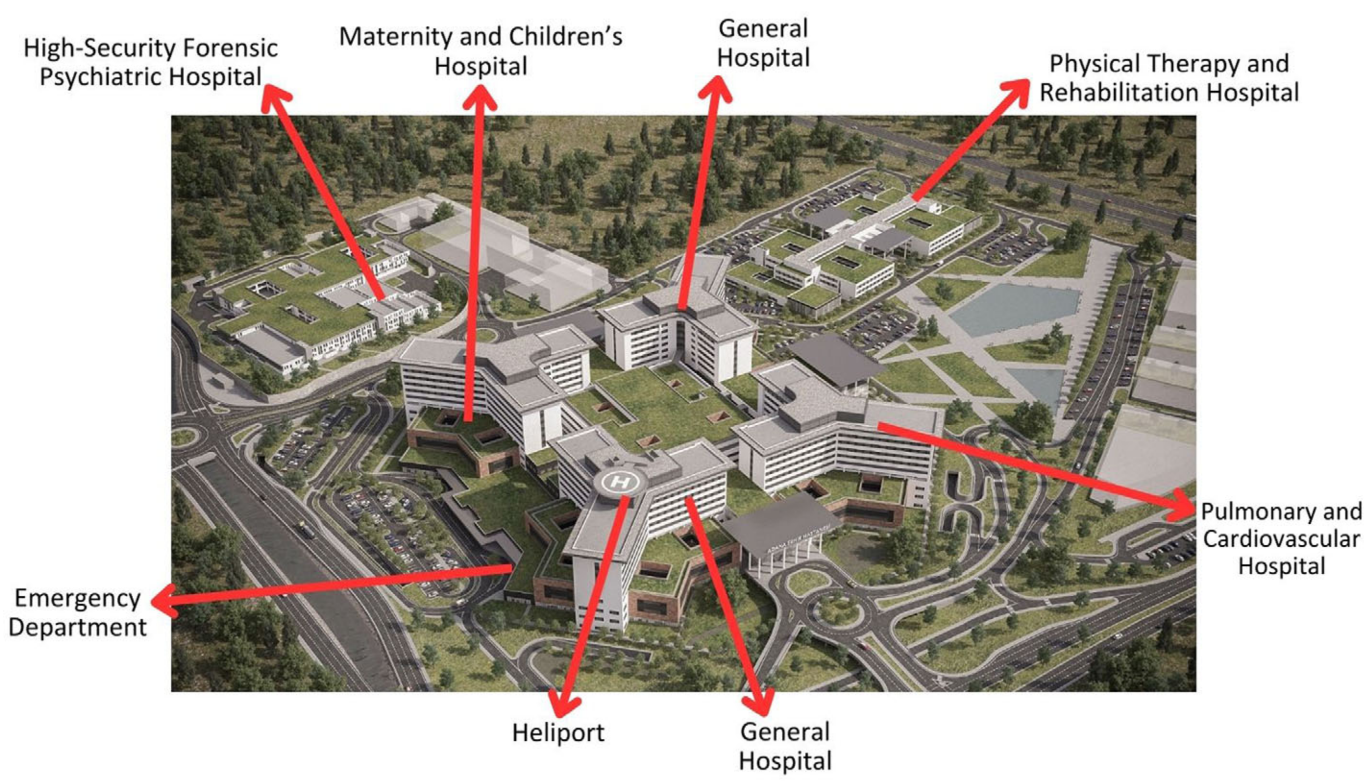

Figure 4. A bird's-eye view of the hospital where the study was conducted, illustrating the relationship between the emergency department and the heliport.

Patients were transported from the disaster area to neighboring provinces without prior communication.[16,18] Our hospital became the reference center for patients due to its earthquake-resistant structure, experienced health care teams, and ample hospital beds. After reaching full capacity, communication with other hospitals was established for patient transfers, although centralizing patients occasionally led to chaos in managing the massive influx (Figure 6). Our city assumed medical care responsibilities for patients from Hatay, located 190 km away, where the most destruction occurred, as well as from Kahramanmaraş, Osmaniye, Kilis, Gaziantep, and Adıyaman.[16] In Hatay, one tertiary care hospital, three state hospitals, and three private hospitals were destroyed in the earthquakes. Only two state hospitals and four private hospitals were operational in the first month following the events.[19]

Figure 5. A patient transported by helicopter and undergoing cardiopulmonary resuscitation initiated at the heliport.

Figure 6. On the second day of the earthquake, congestion of patients at the ambulance entrance.

Outcome

The primary outcome was to determine the diagnosis and prognosis of non-trauma patients transported by ambulance to the emergency department after the earthquake. The secondary outcome is the identification of predisposing factors that cause patients to be transported by ambulance.

Statistical Analysis

Statistical evaluation was performed using the SPSS 22 software package (SPSS Inc, Chicago, Illinois, USA). Continuous data were summarized as mean and standard deviation, while categorical data were summarized in terms of count and percentage. Categorical data were compared using the Chi-square test. In comparing the means of the examined parameters, the Kolmogorov-Smirnov test was employed, and in cases where variables were normally distributed, the Student's t test was used for two-group comparisons. In situations where normal distribution was not met, the Mann-Whitney U test was applied.

Results

During the dates when the study was conducted, a total of n = 17 830 outpatient patients presented to the ED, and n = 3 349 patients arrived by ambulance. In the first 29 days of January of the same year, the number of outpatient patients who presented to the ED was n = 31 021, while n = 2 313 patients arrived by ambulance. While the number of outpatient patients decreased by 42.5%, the number of patients brought by ambulance increased by 44.8%. The final study population comprised 1872 patients transported to the emergency department by ambulance, excluding those with earthquake-related injuries (medical emergencies and traumas not caused by earthquakes). The flowchart depicting this is provided in Figure 7.

Demographic characteristics and details of the patient presentations are presented in Table 1. The distribution of patients based on the cities they were brought from is as follows: Group 1; city where the study was conducted (Adana [n = 1268, 67.7%]) and Group 2; other cities affected by the earthquake (Hatay [n = 504, 26.9%], Gaziantep [n = 30, 1.6%], Kahramanmaraş [n = 25, 1.3%], Adıyaman [n = 24, 1.3%], and Osmaniye [n = 21, 1.1%]). All of the patients 61.5% (n = 1152) were male, and the overall mean age of all patients was 57.4 ± 19.1. The most common comorbidity was hypertension 43.5% (n = 814). When examining the accommodation locations of patients, it was statistically significant that patients in Group 2 (65.1%, n = 393) stayed in tents, compared to Group 1 (3.7%, n = 47) ($P < 0.001$). Patients from other cities (Group 2) were statistically significantly referred more due to technical inadequacy, lack of health care personnel and materials, and hospital building collapses ($P < 0.001$). Patients in Group 2 statistically significantly required more mechanical ventilation ($P < 0.001$) and inotropic therapy ($P = 0.001$) in the ED.

When evaluating the outcomes of patients in the ED, it was observed that 47.6% of patients in Group 1 and 33.8% in Group 2 were discharged from the ED. In Group 1, 45.7% of patients were hospitalized (15.2% general ward admission, 30.5% intensive care unit admission), while in Group 2, 55.1% were hospitalized (20.5% general ward admission, 34.6% intensive care unit admission). There was a statistically significant difference in the outcomes of patients between the groups ($P < 0.001$). The average length of hospital stay was statistically significantly higher in Group 2 (9.2 ± 12.9 days) ($P = 0.027$).

The earthquake-affected region faces numerous challenges that threaten public health. The distribution of predisposing factors triggering diseases by provinces is shown in Table 2. According to this, the most significant predisposing factor in Group 2 is the unavailability of health care facilities, leading to the referral of patients due to a lack of health care personnel and technical deficiencies. This is statistically significantly higher in Group 2 ($P < 0.001$). In addition, accommodation problems ($P < 0.001$), hygiene problems ($P < 0.001$), heating problems ($P = 0.001$), and exposure to smoke ($P < 0.001$) are statistically significantly higher in Group 2. The emotional stress factor, which is believed to be due to the less destructive impact and lower mortality frequency of the earthquake in the province of Group 1 compared to the provinces of Group 2, was statistically significantly higher in Group 2 ($P = 0.001$). Heavy effort/exercise ($P < 0.001$) and violent incidents (assault, firearm, and sharp object injuries) were statistically significantly higher in Group 1 ($P = 0.015$).

The distribution of diagnoses that patients received in the ED according to provinces is shown in Table 3. All the diagnoses of the patients were recorded. Cardiovascular emergencies (15.7%

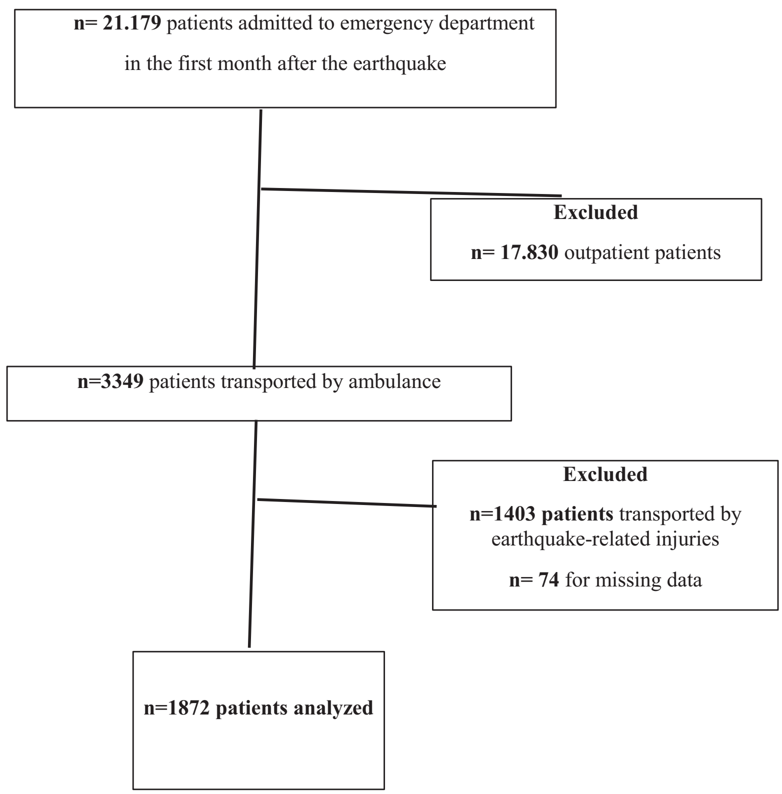

Figure 7. Flow chart of the patients included in the study.

acute coronary syndrome, 6.7% stable angina pectoris, 6.5% decompensated heart failure), soft tissue injuries (10.2%), pneumonia (6.7%), and stroke (5.5%) were the most common diagnoses. Due to the current living conditions, infectious causes (pneumonia P = 0.001, soft tissue infection P = 0.002, sepsis $P = 0.004$), CO poisoning ($P < 0.001$), bone fractures ($P = 0.004$), and diabetic emergencies ($P = 0.013$) were statistically significantly higher in Group 2. Stable angina ($P = 0.017$), soft tissue trauma ($P = 0.007$), intoxications ($P = 0.023$), syncope ($P = 0.047$), and vertigo ($P = 0.032$) were statistically significantly higher in Group 1.

A total of 256 patients (13.7%), 28 of whom were under ED follow-up (1.5%), were mortal. The mortality that occurred during hospital follow-up was significantly higher in Group 2 (19%) compared to Group 1 ($P < 0.001$) (Table 1). The distribution of mortality causes by provinces is shown in Table 4. All 8 patients who presented to the ED with sudden cardiac death had a fatal outcome, with 4 of them in the ED and 4 in the intensive care unit. The highest mortality rates among other diagnoses were observed in sepsis (74.3%), fluid-electrolyte imbalance (46.9%), subarachnoid hemorrhage (42.4%), and pneumonia (40.8%). A patient who had a fatal outcome due to sepsis died from generalized tetanus. This patient in Group 2 had injured his hand from debris remnants on the 7th day after the earthquake and could not be immunized against tetanus during that period because the tetanus vaccine was not accessible in the region. The patient was brought to the ED on the 23rd day of the earthquake with the need for mechanical ventilation and inotropic support. Unfortunately, the patient passed away on the second day of hospitalization. Deaths due to pneumonia were statistically significantly higher in Group 2

Table 1. Characteristics of the patients

	Total Patients (n = 1872)	Group 1 (n = 1268)	Group 2 (n = 604)	P value
Age (year) mean ± SD	57.4 ± 19.1	56.8 ± 19.1	58.4 ± 19.2	0.090
Gender (n) (%)				0.434
Female	720 (38.5)	480 (37.9)	240 (39.7)	
Male	1152 (61.5)	788 (62.1)	364 (60.3)	
Vital signs mean ± SD				
Pulse (beats/min)	88.1 ± 18.7	88 ± 19.4	88.3 ± 17.3	0.741
Mean arterial pressure (mmHg)	93.4 ± 17.7	93.9 ± 18	92.3 ± 17.1	0.068
Respiratory rate (breath/min)	16.1 ± 3.4	16 ± 3.4	16.2 ± 3.5	0.207
O_2 saturation (%)	96 ± 5.7	96 ± 5.7	95.9 ± 5.5	0.516
Glaskow coma scale	14.2 ± 2.8	14.4 ± 2.3	13.7 ± 3.5	**< 0.001**
Comorbidities (n) (%)				
Hypertension	814 (43.5)	558 (44)	256 (42.4)	0.508
Coronary artery disease	561 (30)	374 (29.5)	187 (31)	0.518
Diabetes mellitus	483 (25.8)	341 (26.9)	142 (23.5)	0.118
Chronic obstructive pulmonary disease	160 (8.5)	110 (8.7)	50 (8.3)	0.774
Malignancy	154 (8.2)	111 (8.8)	43 (7.1)	0.229
Chronic renal failure	96 (5.1)	68 (5.4)	28 (4.6)	0.505

(*Continued*)

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Table 1. (*Continued*)

	Total Patients (*n* = 1872)	Group 1 (*n* = 1268)	Group 2 (*n* = 604)	*P* value
Cerebrovascular disease	75 (4)	51 (4)	24 (4)	0.960
Alzheimer's / Dementia	31 (1.7)	22 (1.7)	9 (1.5)	0.698
Chronic liver disease	18 (1)	12 (0.9)	6 (1)	0.922
Accommodation (*n*) (%)				**< 0.001**
Home	1113 (59.5)	1070 (84.4)	43 (7.1)	
Tent	440 (23.5)	47 (3.7)	393 (65.1)	
Referral from another hospital	254 (13.6)	116 (9.1)	138 (22.8)	
In the car	50 (2.7)	35 (2.8)	15 (2.5)	
Container	15 (0.8)	0 (0)	15 (2.5)	
Air ambulance (*n*) (%)	22 (1.2)	1 (0.1)	21 (3.5)	**< 0.001**
Treatment (*n*) (%)				
Mechanical ventilation	168 (9)	85 (6.7)	83 (13.7)	**< 0.001**
Inotropic treatment	150 (8)	84 (6.6)	66 (10.9)	**0.001**
Blood transfusion	73 (3.9)	47 (3.7)	26 (4.3)	0.532
Hemodialysis	66 (3.5)	44 (3.5)	22 (3.6)	0.850
Outcome *n* (%)				**< 0.001**
Discharged	807 (43.1)	603 (47.6)	204 (33.8)	
Admitted to the intensive care unit	596 (31.8)	387 (30.5)	209 (34.6)	
Admitted to the ward	317 (16.9)	193 (15.2)	124 (20.5)	
Referred to another hospital	117 (6.3)	67 (5.3)	50 (8.3)	
Referred to another city	7 (0.4)	1 (0.1)	6 (1.0)	
Dead in the emergency department	28 (1.5)	17 (1.3)	11 (1.8)	
Length of emergency department stay (hours)	5.6 ± 8.3	5.5 ± 8.4	5.7 ± 8.2	0.648
Length of hospital stay (days)	8.1 ± 11.2	7.5 ± 10	9.2 ± 12.9	**0.027**
Mortality (*n*) (%)	256 (13.7)	141 (11.1)	115 (19)	**< 0.001**

Bold text indicates a statistically significant difference with a *P* value <0.05.
Group 1: Patients transported from the city where the study was conducted (Adana).
Group 2: Patients transported from other provinces (Hatay, Gaziantep, Kahramanmaraş, Adıyaman, Osmaniye) affected by the earthquake.

(P = 0.011), while deaths due to multi-trauma were statistically significantly higher in Group 1 (P = 0.041).

Discussion

In this study, the most common medical reason for ambulance transport during the first month after the earthquake was identified as cardiovascular emergencies with a frequency of 28.9%. The most significant predisposing factor for patients transported by ambulance from other cities (Group 2) was the unusability of health care facilities after the earthquake. In addition, accommodation issues ($P < 0.001$), hygiene problems ($P < 0.001$), heating problems (P = 0.001), and exposure to smoke ($P < 0.001$) were other statistically significant predisposing factors in Group 2 patients. In correlation with these factors, infectious diseases (pneumonia P = 0.001, soft tissue infection P = 0.002, sepsis P = 0.004), CO poisoning ($P < 0.001$), and diabetic emergencies (P = 0.013) were found to be statistically significantly higher in Group 2 patients.

After the earthquake, there were health problems that led to emergency room visits in addition to injuries caused by the earthquake. Individuals with chronic illnesses may experience problems, such as not being able to take their medications or disruptions in their regular treatment processes, due to earthquakes.[20] In this study, the most common reasons for ED visits were cardiovascular emergencies (acute coronary syndrome 15.7%, decompensated heart failure 6.7%). In another study conducted in our clinic in 2021, it was found that 13.2% of patients brought by ambulance had acute coronary syndrome, and 5.5% had decompensated heart failure.[21] Looking at the predisposing factors, the damage to health care facilities in the region, patients' inability to access their medications (closure of pharmacies, difficulties in obtaining medications and medical supplies), and nutritional disorders are believed to have increased the incidence of cardiovascular emergencies. Additionally, traumatic events like earthquakes can trigger panic attacks and anxiety. Emotional stress can lead to an increase in the frequency of cardiovascular events and disruptions in blood pressure regulation.[22,23] In our study, it was also found that patients in Group 2 had a statistically significant higher need for mechanical ventilation and inotropic support. It is believed that all these

Table 2. Predisposing factors for ambulance transport and the current disease

Predisposing Factors (*n*) (%)	Total Patients (*n* = 1872)	Group 1 (*n* = 1268)	Group 2 (*n* = 604)	*P* value
Inability to reach the healthcare facility	768 (41)	165 (13)	603 (99.8)	**< 0.001**
Malnutrition	596 (31.8)	408 (32.2)	188 (31.1)	0.648
Inability to access medications	592 (31.6)	403 (31.8)	189 (31.3)	0.831
Emotional stress	412 (22)	251 (19.8)	161 (26.7)	**0.001**
Accommodation	253 (13.5)	73 (5.8)	180 (29.8)	**< 0.001**
Hygiene problem	247 (13.2)	136 (10.7)	111 (18.4)	**< 0.001**
Intense exercise/ exertion	214 (11.4)	171 (13.5)	43 (7.1)	**< 0.001**
Immunosuppression	173 (9.2)	121 (9.5)	52 (8.6)	0.515
Heating problem	117 (6.3)	63 (5)	54 (8.9)	**0.001**
Traffic accident	95 (5.1)	62 (4.9)	33 (5.5)	0.597
Violence incidents (beating, firearm, stabbing injuries)	92 (4.9)	73 (5.8)	19 (3.1)	**0.015**
Fall from the same level	91 (4.9)	67 (5.3)	24 (4)	0.218
Smoke exposure	45 (2.4)	17 (1.3)	28 (4.6)	**< 0.001**
Intoxication (drugs, narcotics, alcohol, corrosive, CO)	45 (2.4)	28 (2.2)	17 (2.8)	0.423
Fall from height	35 (1.9)	21 (1.7)	14 (2.3)	0.323

Bold text indicates a statistically significant difference with a *P* value <0.05.
Group 1: Patients transported from the city where the study was conducted (Adana).
Group 2: Patients transported from other provinces (Hatay, Gaziantep, Kahramanmaraş, Adıyaman, Osmaniye) affected by the earthquake.

Table 3. Diagnosis of patients according to provinces

Diagnoses	Total Patients (*n* = 1872)	Group 1 (*n* = 1268)	Group 2 (*n* = 604)	*P* value
Acute coronary syndrome	294 (15.7)	208 (16.4)	86 (14.2)	0.229
Soft tissue trauma	191 (10.2)	144 (11.4)	47 (7.8)	**0.017**
Stabile angina pectoris	126 (6.7)	99 (7.8)	27 (4.5)	**0.007**
Pneumonia	125 (6.7)	68 (5.4)	57 (9.4)	**0.001**
Decompensated heart failure	121 (6.5)	83 (6.5)	38 (6.3)	0.834
Stroke (ischemic/ hemorrhagic)	103 (5.5)	67 (5.3)	36 (6.0)	0.549
Renal failure (acute-chronic)	94 (5)	61 (4.8)	33 (5.5)	0.545
Bone fracture	89 (4.8)	48 (3.8)	41 (6.8)	**0.004**
Malignancy related admission	59 (3.2)	34 (2.7)	25 (4.1)	0.091
COPD/Asthma attack	53 (2.8)	39 (3.1)	14 (2.3)	0.355
Arrhythmia	50 (2.7)	36 (2.8)	14 (2.3)	0.513
Violence/Assault	47 (2.5)	38 (3)	9 (1.5)	0.051
Dyspepsia	46 (2.5)	32 (2.5)	14 (2.3)	0.788
Epilepsy	45 (2.4)	30 (2.4)	15 (2.5)	0.877
Soft tissue infection	42 (2.2)	19 (1.5)	23 (3.8)	**0.002**
Urinary tract infection	40 (2.1)	29 (2.3)	11 (1.8)	0.515
Sepsis	39 (2.1)	18 (1.4)	21 (3.5)	**0.004**
Gastrointestinal bleeding	35 (1.9)	19 (1.5)	16 (2.6)	0.086
Subarachnoid hemorrhage	33 (1.8)	18 (1.4)	15 (2.5)	0.102
Fluid/electrolyte disorder	32 (1.7)	22 (1.7)	10 (1.7)	0.901
Pneumothorax	31 (1.7)	18 (1.4)	13 (2.2)	0.245
Acute abdomen	30 (1.6)	18 (1.4)	12 (2)	0.361
Diabetic emergencies	30 (1.6)	14 (1.1)	16 (2.6)	**0.013**
Gunshot injury	29 (1.5)	22 (1.7)	7 (1.2)	0.345
Intoxication	26 (1.4)	23 (1.8)	3 (0.5)	**0.023**
Anemia	24 (1.3)	14 (1.1)	10 (1.7)	0.321
Syncope	23 (1.2)	20 (1.6)	3 (0.5)	**0.047**
Myalgia	22 (1.2)	19 (1.5)	3 (0.5)	0.060
Dizziness/Vertigo	20 (1.1)	18 (1.4)	2 (0.3)	**0.032**
Carbon monoxide intoxication	19 (1)	5 (0.4)	14 (2.3)	**<0.001**
Stabbing injury	19 (1)	16 (1.3)	3 (0.5)	0.123
Multitrauma	19 (1)	15 (1.2)	4 (0.7)	0.293
Biliary tract and pancreas diseases	17 (0.9)	8 (0.6)	9 (1.5)	0.067
Aortic aneurysm/ dissection	16 (0.9)	9 (0.7)	7 (1.2)	0.324
Headache	15 (0.8)	13 (1.0)	2 (0.3)	0.115
Pregnancy	15 (0.8)	12 (0.9)	3 (0.5)	0.308
Acute gastroenteritis	13 (0.7)	10 (0.8)	3 (0.5)	0.477
Upper respiratory tract infection	12 (0.6)	8 (0.6)	4 (0.7)	0.937
Vascular diseases	11 (0.6)	8 (0.6)	3 (0.5)	0.722
Pulmonary embolism	9 (0.5)	6 (0.5)	3 (0.5)	0.945
Hypertension	9 (0.5)	7 (0.6)	2 (0.3)	0.518
Sudden cardiac death	8 (0.4)	7 (0.6)	1 (0.2)	0.231
Pericardial diseases	7 (0.4)	4 (0.3)	3 (0.5)	0.548
Chronic liver disease	6 (0.3)	4 (0.3)	2 (0.3)	0.955
Ophthalmic emergencies	6 (0.3)	2 (0.2)	4 (0.7)	0.071
Peripheral facial paralysis	5 (0.3)	3 (0.2)	2 (0.3)	0.711

(*Continued*)

Table 3. (*Continued*)

COPD: chronic obstructive pulmonary disease.
Bold text indicates a statistically significant difference with a *P* value < 0.05.
Group 1: Patients transported from the city where the study was conducted (Adana).
Group 2: Patients transported from other provinces (Hatay, Gaziantep, Kahramanmaraş, Adıyaman, Osmaniye) affected by the earthquake.

predisposing factors and delayed admissions to health care institutions were effective in this situation. The long distance of patient transfers (~190 km) necessitated the securement of airway and respiratory support in these patients. Therefore, it was observed that a higher proportion of patients were intubated with sedo-analgesia and transferred with a mechanical ventilator. In the 2021 study[21] evaluating patients transported by ambulance, the rate of diabetic emergencies was 0.5%[21], while in our study, it was observed to be 1.6%. The reason for this increase is thought to be that diabetic patients had difficulty controlling their blood sugar levels due to irregular nutrition and disruptions in medication intake after the earthquake.

During earthquakes, dust, smoke, and debris can lead to respiratory problems. Additionally, conditions in shelters, lack of hygiene, and crowded living spaces can increase the risk of infections. Asthma and COPD exacerbations, acute bronchitis, and pneumonia frequency may increase during and after an earthquake.[22,24-26] In our study, especially in patients coming from the city in Group 2, the frequency of pneumonia was statistically significantly higher. Additionally, the frequency of carbon monoxide poisoning was also higher in Group 2 patients. We believe this is also due to factors such as structural damage, power outages, and temporary housing conditions that occur after earthquakes. Power outages and damage to gas lines directed people towards alternative heating methods.[27] Especially in tents, the improper use of stoves or barbecues placed inside for heating purposes caused cases of poisoning. It is crucial to avoid these inappropriate heating methods and raise awareness in the community about the symptoms and risks of carbon monoxide poisoning. Especially in communal living spaces, awareness campaigns of this kind on social media are of critical importance.[27]

The damaged infrastructure after an earthquake can potentially harm water and sewage lines, leading to sewage leaks and water contamination. The lack of clean water, water contamination, and disruption in food supply chains due to damaged storage facilities

Table 4. Mortality rate of patients according to provinces

Diagnoses (*n* = Total patients)	Mortal Patients (*n* = 256)	Mortality rate (%)	Group 1 (*n* = 141)	Group 2 (*n* = 115)	*P* value
Pneumonia (*n* = 125)	51 (19.9)	40.8	20 (14.2)	31 (27)	**0.011**
Renal failure (acute–chronic) (*n* = 94)	35 (13.7)	37.2	16 (11.3)	19 (16.5)	0.231
Acute coronary syndrome (*n* = 294)	33 (12.9)	11.2	21 (14.9)	12 (10.4)	0.290
Sepsis (*n* = 39)	29 (11.3)	74.3	12 (8.5)	17 (14.8)	0.115
Stroke (ischemic/ hemorrhagic) (*n* = 103)	17 (6.6)	16.5	9 (6.4)	8 (7)	0.855
Decompensated heart failure (*n* = 121)	17 (6.6)	14	8 (5.7)	9 (7.8)	0.491
Malignancy related admission (*n* = 59)	15 (5.9)	25.4	9 (6.4)	6 (5.2)	0.693
Fluid/electrolyte disorder (*n* = 32)	15 (5.9)	46.9	10 (7.1)	5 (4.3)	0.352
Subarachnoid hemorrhage (*n* = 33)	14 (5.5)	42.4	8 (5.7)	6 (5.2)	0.873
Acute abdomen (*n* = 30)	10 (3.9)	33.3	5 (3.5)	5 (4.3)	0.742
Sudden cardiac death (*n* = 8)	8 (3.1)	100	7 (5)	1 (0.9)	0.061
Epilepsy (*n* = 45)	7 (2.7)	15.6	3 (2.1)	4 (3.5)	0.510
Aortic aneurysm/ dissection(*n* = 16)	6 (2.3)	37.5	5 (3.5)	1 (0.9)	0.159
Gastrointestinal bleeding (*n* = 35)	5 (2)	14.3	3 (2.1)	2 (1.7)	0.823
Arrhythmia (*n* = 50)	5 (2)	10	4 (2.8)	1 (0.9)	0.258
Multi–trauma (*n* = 19)	5 (2)	26.3	5 (3.5)	0 (0)	**0.041**

Bold text indicates a statistically significant difference with a *P* value < 0.05.
Group 1: Patients transported from the city where the study was conducted (Adana).
Group 2: Patients transported from other provinces (Hatay, Gaziantep, Kahramanmaraş, Adıyaman, Osmaniye) affected by the earthquake.

and non-functional markets can increase the risk of infections and pose food safety issues. Consuming contaminated foods can increase the risk of infections.[22,28,29] Additionally, psychosocial stress and trauma can weaken the immune system, reducing resistance to infections.[26] In our study, urinary tract infections and gastroenteritis were particularly prominent, especially in patients staying in shelter areas. Collapsed buildings and structures at risk of collapse can lead to accidental injuries. Injuries can occur while navigating around debris even if not during the earthquake. Hygiene standards may decline in the affected areas, leading to inadequate wound care. This can increase the risk of infection.[29] These infections can cause anything from simple soft tissue infections to life-threatening gas gangrene, leading to limb loss. Therefore, the prophylaxis of tetanus, a vaccine-preventable disease, should not be forgotten in this patient group.[26,28] In this study, a patient was lost due to generalized tetanus after a simple injury because they could not receive a tetanus vaccine. Soft tissue infections and diabetic foot wounds were also statistically significantly higher in patients from Group 2 cities. We believe that nutrition conditions, shelter, hygiene issues, and uncontrolled blood sugar contribute to the increased frequency of these infections. During this period, stray animals may face nutrition problems, which may lead to an increase in animal attacks. Protection through vaccination is crucial for suspected rabies bites that may occur due to bites from stray animals. Earthquake survivors, particularly in areas with disrupted health care services, can be vulnerable to various health risks. Vaccination campaigns and preventive health services are crucial in mitigating these risks and ensuring the well-being of the affected population. After an earthquake, health care providers and emergency teams should take measures to reduce the risk of infections, including adhering to hygiene standards, providing clean water, implementing vaccination campaigns, and offering health education.

With today's technology, it is still not possible to predict earthquakes in advance. However, having a detailed and up-to-date disaster plan tailored to the geographical location and risks of each hospital during the pre-earthquake period can help minimize the post-earthquake effects.[30] Hospitals, particularly those situated in high-risk seismic zones, must prioritize earthquake preparedness by ensuring building safety, maintaining adequate supplies, providing staff training, and establishing robust communication systems. Structural designs should prioritize earthquake resistance, with regular safety inspections conducted.[31] Additionally, emergency exits and evacuation routes need careful planning for swift and safe evacuation, including provisions for individuals with disabilities. Post-earthquake response areas should be designated, equipped with necessary medical supplies, and alternative communication methods should be in place due to potential infrastructure damage.[32,33] This includes access to radios, walkie-talkies, and reliable telephone systems. Hospitals must also have backup power generation and water supply systems to manage outages. Continuous monitoring of hospital premises via security cameras and surveillance systems is essential, along with regular emergency drills for staff. Training should encompass evacuation procedures, first aid, and patient transfer protocols. Adequate storage of medical supplies and essential resources for disaster situations is crucial, alongside the establishment of communication plans to ensure effective coordination among staff and with other health care facilities.[33,34] The main reason for the hospital where the study was conducted to be selected as a reference center for patients from earthquake-prone areas is its earthquake-resistant structure and comprehensive disaster preparedness plan. The hospital, constructed with 1512 seismic isolators in 2017, was one of the world's largest hospitals equipped with seismic isolators.[35]

With these three-dimensional pendulum type earthquake isolators, it continued to carry out all its activities without any interruption even during and after the most severe earthquake. Unfortunately, the third-tier hospital in Hatay, which is the most affected province by the earthquake, sustained serious damage during the seismic event and became unusable. During the evacuation of patients, the identification of first aid and emergency intervention areas, as well as the provision of supplies, faced serious challenges in the infrastructure (electricity, telephone, and water) during the first 48 hours.[19] The extensive area affected by the earthquake (13.9% of the country's territory) compounded these challenges, along with the enormity of its magnitude, further complicating the situation. Furthermore, the fractured fault lines caused damage to the highways reaching the region and led to fractures in the runway of the Hatay airport. This made transportation and the arrival of aid via road and air routes challenging in the area.[19] Due to severe damage to main roads, infrastructure (including water, gas, and electricity), and many hospitals, a situation unfolded that surpassed the intervention capacity of the EMS system and emergency medical care system. Many affected hospitals were completely isolated. Mobilizing assistance from other provinces became necessary. However, patient flow, especially in the first 72 hours, could not be well-coordinated. Rather than consolidating patients in a single center (reference hospital), involving all hospitals in the unaffected areas of the province in patient care would have led to fewer disruptions in diagnosis and treatment. In the case of large-scale disasters, mortality and morbidity correlate with the extent of the disaster when timely and appropriate medical interventions are not performed. Therefore, the activation of the EMS system in the field and the appropriate transfer of patients to central facilities are crucial. In this study, challenges that occurred during the earthquake in terms of health care service efficiency, particularly in the disaster zone, emergency services, and the EMS system, were attempted to be discussed.

Limitations

This study has some limitations. The first limitation was that the study was single-centered and retrospective. In this study, due to insufficient data systems for patients in other hospitals in the city during the earthquake, we could only report the emergency response on a single-hospital scale. Another limitation is the unavailability and unassessability of data for gynecological-obstetric emergencies and pediatric emergency patients due to the design of the ED.

Conclusion

We believe that this study will help assess the current status of EMS and emergency services and guide the planning of emergency health care services in future potential disaster situations. The restriction of access to health care services after an earthquake affects the treatment process for all diseases. Disaster plans should be developed concerning how health care systems will operate more effectively after an earthquake. In the face of such large-scale destruction, the organization of support from neighboring provinces should be predetermined from the outset. For individuals to maintain good health, the efforts of health care providers alone are not sufficient. Authorities need to take measures to protect environmental health as soon as possible. Post-earthquake emergency planning should include strategies to ensure people have safe access to food, shelter, and heating conditions. Patients and the community should have access to long-term psychosocial support and rehabilitation services in addition to physical support after an earthquake.

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