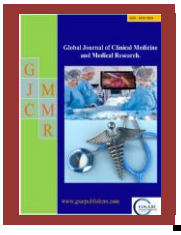

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Pre-hospital and in-hospital evaluation of cases intervened by disaster and emergency teams and medical rescue teams together in traumatic injuries occurring in Cappadocia region

Pre-hospital and in hospital evaluation of traumatic injuries in Cappadocia region

By

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Abstract

Aim: *To evaluate mortality in a province located in the center of the Cappadocia region by pre-hospital and in-hospital analysis of the data of patients who were intervened by disaster and emergency teams and national medical rescue teams together at the scene of disasters and accidents in the region.*

Materials and Methods: *This retrospective study was conducted in a state hospital in the Cappadocia region. Cases between 01.01.2019 and 31.12.2023 were evaluated in the study. Demographic data and types of traumatic events were analyzed. Patient data were evaluated in two stages, pre-hospital and in-hospital.*

Results: *Within the scope of the study, 108 patients were evaluated. 66.7% of the patients were male. The mean age was 40.66±19.16 years. The mean time between the time of notification to the call center and arrival to the hospital emergency department was 58.81±25.77 minutes. Traffic accidents (48.4%) were the most common reason for reporting in the region. As a result, 16 patients resulted in death. In the comparison between the survivors and the deceased, there was a significant difference between the type of event, systolic blood pressure, diastolic blood pressure, pre-hospital heart rate (in minutes), pre-hospital fingertip oxygen saturation, and Glasgow Coma Score values ($p<0.05$). Five of the deceased patients were foreign tourist patients.*

Conclusion: *In order to reduce morbidity and mortality in traumatic injuries in the Cappadocia region, it is recommended to increase security measures in tourism activities and to expand disaster and emergency teams and professional medical teams.*

Keywords: *Emergency Medicine, Disaster Medicine, Pre-Hospital, Disaster Medical Assistan Team, Cappadocia, Injury*

INTRODUCTION

Disasters are divided into two as natural and artificial. Disasters caused by natural events are classified as natural disasters and consist of events such as earthquakes, floods, avalanches, storms, natural fires, landslides, rock falls and lightning strikes (1,2). Artificial ones, on the other hand, are events caused by human influence and consist of events such as wars, nuclear and chemical accidents, terrorist attacks, industrial accidents, transportation-related accidents (1,2).

Disaster and emergency unit (DAEU) serves as the main unit under the Ministry of Internal Affairs of the Republic of Turkey (T.R.), which assumes authority and responsibility in cases of disaster and emergency in Turkey and ensures coordination between institutions (1,2). In disasters, morbidity and mortality rates may increase if the first medical intervention at the scene is not performed properly and appropriately. For this reason, national medical rescue teams (NMRT) affiliated to the Ministry of Health have been established in Turkey to provide professional healthcare

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services in disasters (1,3). These teams have the knowledge and equipment to perform the first medical intervention at the scene of the disaster or accident in all kinds of major accidents or disasters that may occur (1,3).

Registered in 1985 by UNESCO as a World Heritage Site, Cappadocia is a region where mountain ranges, valleys and fairy chimneys formed by volcanic erosion on the Central Anatolian plateau follow each other (4). In Cappadocia Region, it has been reported that rock fall incidents have been frequently experienced in the past history (5). In addition, balloon-related accidents have also been observed due to the popularity of hot air balloon tours in this region (6).

The aim of this study was to evaluate mortality by pre-hospital and in-hospital analysis of the data of patients who were intervened by DAEU and NMRT teams together at the scene of disasters and accidents in a province located in the center of the Cappadocia region.

MATERIAL AND METHODS

Data Collection and Analysis

This retrospective study was conducted in a state hospital in the Cappadocia region. The results obtained in the study were synthesized by synthesizing the data obtained from the state hospital in the province, the provincial Ambulance and Emergency Health Services Directorate and the provincial Disaster and Emergency Directorate. In the study, it was planned to evaluate the traumatic cases seen in the Cappadocia region between 01.01.2019-31.12.2023. After obtaining ethics committee approval for the study, the data of the study in the specified date range were requested from the institutions through official correspondence. The data were synthesized and the data of the patients were accessed using the electronic patient data system of the hospital where the study was conducted. Patient data that were not suitable for the scope of the study and for which sufficient data could not be obtained were excluded from the study.

During the study period, a total of 2526 incidents were reported to the provincial DAEU call center, 1864 of which were within the borders of the region. Health teams were directed to 178 of these calls by the provincial ambulance and emergency health services command center on the grounds that NMRT should intervene. Patients who received medical intervention at the scene and those who refused treatment and did not want to go to a health institution were excluded from the study. In addition, patients who did not receive medical intervention at the scene and were evaluated as code black were also excluded. As a result, the study was completed with 108 patients who were intervened at the scene and/or transported to the hospital in the region where the study was conducted. The results of the patients who were transferred from the scene of the incident or from the hospital to any health institution within or outside the region could not be evaluated and were excluded from the study.

In the study, age, gender, tourist status, forensic case notification, and the year and time of the incident were evaluated. Patient data were evaluated in two stages: pre-hospital and in-hospital. In the pre-hospital phase, the time of incident notification, type of incident, Glasgow Coma Score (GCS) value and vital signs of the patient, and first interventions (intubation, cardiopulmonary resuscitation, traumatic stabilization) performed at the scene were evaluated. In the in-hospital phase, arrival time to the hospital, GCS value and vital signs, tests performed, diagnosis, hospitalization status and treatments performed in the emergency department were evaluated. Mortality data were evaluated separately at pre-hospital and in-hospital stages by comparative analysis.

Statistical Analysis

Statistical Package for Social Sciences for Windows 21.0 (SPSS 21.0) program was used to analyze the data. Descriptive statistics (frequency, percentage distribution) and 'Chi-square test' were used for the comparison of categorical variables between two groups. For the comparison of independent groups, 'Student T test' and/or Mann Whitney U test were used. Chi-square analyses were performed by considering the frequency of the expected value in tables with n*n (2*2) matrices. In tables with n*p (2*3) matrices, the p value was given considering the percentage value of the probability of the expected value being less than 5. Results are presented as mean ± SD or frequency (percentage) and $p < 0.05$ was considered statistically significant at 95 percent confidence interval.

Ethics Committee Approval

Prior to the study, the approval of XXXX University Non-Interventional Clinical Research Ethics Committee' numbered 2024/07 and dated 25/07/2024 was obtained.

RESULTS

Data of 108 patients were evaluated within the scope of the study. 66.7% of the patients were male. The mean age was 40.66±19.16 (6-85). According to age ranges, the highest number of patients was in the 21-40 age range (40.7%). The most cases occurred in 2023 (36.1%) and the least cases occurred in 2020 (2.8%). When the distribution by month was analyzed, it was seen that the most incidents occurred in November (22.2%) and the least incidents occurred in December (0.9%). The most common time of incident notification was between 08.00-15.59 (50%). The mean time between the time of notification to the call center and admission to the hospital emergency department was 58.81±25.77 (15-140) minutes. 75.9% of the patients were Turkish citizens. 76.9% of the cases were reported as forensic cases. When the incident types were analyzed, it was observed that the most common type of incident reported in the region was traffic accidents (48.4%) (Table 1). The distribution of the calls made to the DAEU call center in the province where the study was conducted is given in figure 1. A significant difference was observed in the comparison of event types according to nationalities ($p<0.05$). The evaluation of the patients was performed in two stages: pre-hospital and in-hospital. Table 1 shows the vital signs, GCS values, interventions performed in the pre-hospital area and results of investigations and treatment performed in the in-hospital area.

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Pre-hospital GCS values were 86.1% between 13-15, 0.9% between 9-12 and 13.1% between 3-8, while in-hospital GCS values were 85.2% between 13-15, 0% between 9-12 and 5.6% between 3-8.

As a result, 16 patients died, ten at the scene, four in the emergency department and two in the intensive care unit. A comparison of the data of surviving and deceased patients is given in table 2. In this comparison, there was a significant difference between event type, systolic blood pressure (SBP), diastolic blood pressure (DBP), pre-hospital heart rate (per minutes), pre-hospital finger tip oxygen saturation, and GCS values ($p<0.05$). The details of the data of the patients who died in the study are shown in Table 3. When table 3 is analyzed, the most common event types causing death were traffic accidents and hot air balloon accidents. Five of the deceased patients were foreign tourist patients. Comparison of the data of patients who died pre-hospital and in-hospital is given in table 4.

DISCUSSION

The Cappadocia region has always been the center of attention and attracted visitors due to its unique, unspoiled and preserved natural areas and formations (7). Apart from visiting cultural sites, touristic activities based on the natural structure and characteristics of the area such as valley walks on horseback or on foot, bicycle and all-train vehicle (ATV) tours , jeep safari, hot air balloon tours are also organized in the region (6,7). Traffic density increases in the region due to tourism and traffic accidents can be seen frequently. In this study, it was planned to evaluate patients injured in disasters and accidents occurring in the Cappadocia region.

In the province where the study was conducted, transportation accidents were the leading cause of notification to the DAEU call center. In a similar study, it was reported that the most common reason for call was stranding (2). In our study, we observed that the highest number of calls was between 08.00-15.59 hours (50%). In the study conducted by Oruc et al. the most frequent call was between 06.00-12.00 hours (33%) (2).

In the study, a significant difference was observed in the comparison of incident types according to nationalities ($p<0.05$). Accordingly, foreign tourist patients were more common in hot air balloon accidents with a rate of 72.7% and in falls/trapped in the valley with a rate of 66.6%, while Turkish national patients were more common in other event types. We anticipate that this is due to the fact that hot air balloon tours attract more attention especially by foreign tourists. In addition, if foreign tourists are not accompanied by a guide, especially during valley walks, rocky terrain and cultural sites, situations such as falling, getting lost and getting stuck in rocky areas may occur.

Injuries, disabilities and deaths related to hot air balloon accidents have been reported in studies (6,8). In a study conducted in the United States of America (USA), 78 hot air balloon accidents occurred between 2000 and 2011, 91 passengers were seriously injured and five passengers died (8). In another study conducted in the Cappadocia region, 12 hot air balloon accidents occurred between 2013-2017 and 33 passengers were seriously injured and three passengers died (6). In another study, 11 hot air balloon accidents occurred in Mexico between 1972 and 2021 and 21 passengers died (9). In this study, seven passengers were seriously injured and four passengers died due to hot air balloon accidents.

In studies, it was reported that more than half of pre-hospital deaths were due to multitrauma injuries (10-12). Gewiess et al. reported that the most common causes of pre-hospital death were traffic accidents and suicide attempts (13). In the same study, the mean age of those who died in the pre-hospital area was 45.3±19.5 years and 74% of the deceased were male (13). In a study in Mallawi in which the causes of trauma leading to pre-hospital deaths were investigated, it was reported that the most common cause of death was motor vehicle accidents with a rate of 47.1% (14). In the same study, the mean age of those who died in the pre-hospital area was 28.9±15.5 years and 88.4% of the deceased were male (14). In this study, 62.5% of the patients who died after medical intervention died in the pre-hospital area. It was observed that most of the deaths in the pre-hospital area were due to hot air balloon accidents and ATV accidents. Eighty percent of the deceased patients were male and the mean age was 43.40±16.53 years.

In a study in Qatar in which traumatic cardiac arrests were evaluated as pre-hospital and in-hospital, the GCS value was calculated as 3.44 ± 1.9 in pre-hospital cases and 6.56 ± 4.68 in in-hospital cases and a significant difference was reported between them (15). In the same study, the rate of hypovolemia in patients who died pre-hospital and in-hospital was significantly higher in pre-hospital patients, while there was no significant difference between the rates of patients with hypoxia (15). In this study, a significant difference was observed between GCS values in pre-hospital and in-hospital deceased patients. In a study conducted on vital signs of trauma patients in the pre-hospital area, SBP was 128±35 mmHg, heart rate was 93±26/min and the rate of patients with fingertip oxygen saturation <95% was 15.5% (16). In the same study, the GCS value was 82% between 13-15, 7.5% between 9-12 and 10.4% between 3-8 (16). In this study, pre-hospital vital signs and pre-hospital GCS values were 86.1% between 13-15, 0.9% between 9-12 and 13.1% between 3-8.

Prehospital emergency care is the emergency medical care provided to patients after emergency medical services are activated, before they arrive at the hospital. The service starts with the activation of ambulance services by the eyewitness or the person himself/herself, continues with the evaluation of the scene and the patient and the initiation of emergency treatment, and ends with the transfer of the patient to the hospital (17). There are two different approaches in prehospital hospital management; “stay and play/treat, then transfer” and “scoop and run/load and go” (18). In the stay and treat approach, the patient is stabilized at the scene and then transferred to hospital. In the scoop and run/load and go approach, the recommendation is to transfer patients to trauma centers as soon as possible without trying to stabilize them at the scene (18).

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While some existing studies have shown that the survival rate of injured patients cared for by prehospital teams increases, more recent studies have argued that interventions at the scene increase the mortality and morbidity of patients by causing loss of time and that the patient should be transported to the relevant trauma center as soon as possible (19-22). Some studies have shown that the probability of survival increases and disability decreases in traumatic patients if the time between the patient's transportation from the scene to the hospital is less than 60 minutes (22,23). In this study, 62.5% of the deceased patients died after intervention at the scene of the incident and the mean time between the time of incident notification and the time of admission to the hospital was 56.66±21.59 minutes.

In conclusion, security measures should be increased in the Cappadocia region, especially in tourism activities to prevent traumatic injuries to people who are not familiar with the region. Reducing morbidity and mortality in patients may be possible especially by reducing the time of rescue and transportation to the hospital. Therefore, the number of DEAU and NMRT teams should be increased in different locations in the region to reach the wounded more quickly and start treatment.

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Author contributions:
Conception and design: MA,NB; Provision of study materials or patients: MA
Collection and assembly of data: MA; Data analysis and interpretation: MA,NB Manuscript writing: MA,NB, Final approval of manuscript; MA,NB

TABLES

Table 1. Demographic data, general evaluation of patients in pre-hospital and in-hospital area

Demografic and Pre-Hospital Datas	n / % / mean	Hospital Datas	n / % / mean
Gender		**Assessment and vital signs***	
Male	72 (66.7)	Systolic blood pressure (mean)	117.95±13.76
Female	36 (33.3)	Diastolic blood pressure (mean)	72.24±8.18
Age (average)	40.66±19.16	Pulse rate (average/minute)	89.84±17.76
0-20	17 (15.7)	Fingertip oxygen saturation	85.80±10.62
21-40	44 (40.7)	Glasgow coma score	14.31±2.70
41-60	27 (25)	**Examinations and imaging performed***	
61-80	17 (15.7)	X-ray	88 (89.8)
81-100	3 (2.8)	Computed tomography	53 (54.1)
Incident notification time		Ultrasonography	6 (6.1)
08.00-15.59	54 (50)	Magnetic resonance	2 (2)
16.00-23.59	44 (40.7)	Laboratory	58 (59.2)
24.00-07.59	10 (9.3)	**Diagnosis***	
Patient nationality		Soft tissue trauma	63 (64.3)
T.R.	82 (75.9)	Tibia fracture	7 (7.1)
Foreigner	26 (24.1)	Femur fracture	5 (5.1)
Forensic incident reporting		Thoracolumbar fracture	5 (5.1)
Normal case	25 (23.1)	Multi-organ-tissue injury	4 (4.1)
Forensic case	83 (76.9)	Hemopneumothorax	3 (3.1)
Event type		Humerus fracture	3 (3.1)
Traffic accident	48 (44.4)	Pelvis fracture	3 (3.1)
Falling / stranded in the valley	12 (11.1)	Fibula fracture	2 (2)

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Hot air balloon accident	11 (10.2)	Muscle-tendon injury	2 (2)
Work accident	10 (9.3)	Aspiration pneumonia	1 (1)
Falling / getting stuck / stranded in a rocky area	10 (9.3)	**Termination status***	
Trapped / trapped under a cave-in	10 (9.3)	Discharged	73 (74.5)
All train vehicle accident	4 (3.7)	Hospitalization	19 (19.4)
Lightning strike	2 (1.9)	Hospitalization in the intensive care unit	2 (2)
Drowning in water	1 (0.9)	Ex	4 (4.1)
Assessment at the scene and vital signs		**Consulted clinic***	
Systolic blood pressure (mean)	113.88±18.28	Orthopedics and traumatology	42 (42.8)
Diastolic blood pressure (mean)	69.81±10.67	Brain and neurosurgery	12 (12.2)
Pulse rate (average/minute)	101.57±13.17	Thoracic. cardiac and vascular surgery	8 (8.1)
Fingertip oxygen saturation	92.68±6.08	General Surgery	4 (4)
Glasgow coma score	13.59±3.57	Plastic surgery and reconstruction	3 (3)
First interventions at the scene		Chest diseases	1 (1)
Intubation	8 (7.4)	**Inpatient procedure**	
Cardiopulmonary resuscitation	13 (12)	Surgical procedure	19 (19.4)
Fluid replacement	17 (15.7)	Patient treatment in intensive care unit	2 (2)
Fixation with splint	36 (33.3)	**Termination status of the inpatient**	
Immobilization with trauma board	105 (97.2)	Discharged	19 (19.4)
Fixing with a neck collar	104 (96.3)	Ex	2 (2)
Wound care	93 (86.1)		
Result at the scene			
Decision to transfer to hospital	98 (90.7)		
On-scene intervention and ex	10 (9.3)		

* Data from the emergency department

Table 2. Comparison of data of surviving and deceased patients

Datas	Survivors (n/%/mean)	Deceased (n/%/mean)	p value*
Gender			
Male	59 (81.9)	13 (19.1)	p=0.254
Female	33 (91.6)	3 (8.4)	
Age (average)	39.77±19.42	45.81±17.21	p=0.564
Patient Nationality			
T.R.	71 (86.6)	11 (13.4)	p=0.411
Foreigner	21 (76.2)	5 (23.8)	
Even type			
Traffic accident	44 (83.3)	4 (16.7)	p<0.05
Falling / stranded in the valley	12 (100)	0 (0)	
Hot air balloon accident	7 (63.6)	4 (36.4)	
Work accident	8 (80)	2 (20)	
Falling / getting stuck / stranded in a rocky area	9 (90)	1 (10)	
Trapped / trapped under a cave-in	9 (90)	1 (10)	
All train vehicle accident	1 (25)	3(75)	
Lightning strike	2 (100)	0 (0)	

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Drowning in water	0 (0)	1 (100)	
Incident notification time			
08.00-15.59	45 (83.3)	9 (16.7)	
16.00-23.59	37 (84)	7 (16)	p=0.381
24.00-07.59	10 (100)	0 (0)	
Arrival time to hospital (minutes)	58.95±26.12	56.66±21.59	P=0.554
Vital signs			
Systolic blood pressure (mean) (pre-hospital)	118.15±9.93	89.37±32.13	p<0.05
Systolic blood pressure (mean) (hospital)	118.58±9.44	108.33±44.00	p<0.05
Diastolic blood pressure (mean) (pre-hospital)	72.28±5.76	55.62±18.96	p<0.05
Diastolic blood pressure (mean) (hospital)	72.82±5.99	63.33±23.38	p<0.05
Pulse rate (mean/minute) (pre-hospital)	97.60±7.43	124.37±15.9	p<0.05
Pulse rate (mean/minute) (hospital)	86.68±12.71	138.33±13.29	p=0.452
Fingertip oxygen saturation (pre-hospital)	94.86±1.31	80.12±7.50	p<0.05
Fingertip oxygen saturation (hospital)	86.61±10.28	73.33±8.16	p=0.093
Glasgow coma score (pre-hospital)	14.98±0.10	5.56±3.24	p<0.05
Glasgow coma score (hospital)	15.00±0.00	3.83±1.32	p<0.05

*'Chi-square test' for the comparison of categorical variables between two groups and 'Student T test' for the comparison of independent groups were used for statistical analysis. The results are presented as mean ± SD or frequency (percentage) and $p < 0.05$ is statistically significant at 95 percent confidence interval.

Table 3. Detailed analysis of the data of deceased patients

	Even Type	Age	Gender	Time of notification	Nationality	Glascow Coma Score*	Systolic blood pressure (mm/Hg) (	Diastolic blood pressure (mm/Hg)*	Pulse rate (beats per minute)*	Fingertip oxygen saturation*	Place of death
Patient 1	Hot air balloon accident	66	Female	07.40	Foreigner	7	100	50	120	80	In-hospital
Patient 2	Work accident	48	Male	14.18	T.R.	3	180	100	100	90	In-hospital
Patient 3	Work accident	19	Male	14.25	T.R.	7	110	70	140	80	In-hospital
Patient 4	Drowning in water	38	Male	14.58	T.R.	15	120	80	90	95	In-hospital
Patient 5	Traffic accident	70	Male	22.43	T.R.	10	100	60	130	92	In-hospital
Patient 6	Traffic accident	58	Male	22.51	T.R.	3	80	50	120	80	In-hospital
Patient 7	Falling / getting stuck / stranded in a rocky area	40	Male	14.38	Foreigner	5	60	40	120	80	Pre-hospital
Patient 8	All train vehicle accident	17	Male	18.15	T.R.	3	50	30	140	70	Pre-hospital
Patient 9	Trapped / trapped under a cave-in	32	Male	12.36	T.R.	6	70	50	130	75	Pre-hospital
Patient 10	Traffic Accident	38	Male	21.34	T.R.	3	100	60	110	85	Pre-hospital

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Patient 11	Traffic Accident	65	Male	19.35	T.R.	4	80	50	150	80	Pre-hospital
Patient 12	All train vehicle accident	51	Male	18.36	T.R.	5	60	40	120	70	Pre-hospital
Patient 13	Hot air balloon accident	27	Male	07.40	T.R.	7	110	70	140	80	Pre-hospital
Patient 14	Hot air balloon accident	64	Female	07.40	Foreigner	3	70	40	120	80	Pre-hospital
Patient 15	Hot air balloon accident	62	Female	07.40	Foreigner	5	60	30	140	75	Pre-hospital
Patient 16	All train vehicle accident	38	Male	21.58	Foreigner	3	80	60	120	70	Pre-hospital

* Data assessed at the pre-hospital scene.

Table 4. Comparison of data of patients who died pre-hospital and in-hospital

Datas	Pre-hospital (n/%)	In-hospital (n/%)	p value*
Gender			
Male	8 (61.5)	5 (38.5)	p=0.696
Female	2 (66.7)	1 (33.3)	
Age (average)	49.83±19.12	43.40±16.53	p=0.805
Even type			
Traffic accident	2 (50)	2 (50)	
Falling / stranded in the valley	0	0	
Hot air balloon accident	3	1	
Work accident	0 (0)	2 (100)	
Falling / getting stuck / stranded in a rocky area	1 (100)	0 (0)	p=0.540
Trapped / trapped under a cave-in	1 (100)	0 (0)	
All train vehicle accident	3 (100)	0 (0)	
Lightning strike	0 (0)	0 (0)	
Drowning in water	0 (0)	1 (100)	
Patient Nationality			
T.R.	11 (63.7)	4 (36.3)	p=0.696
Foreigner	0 (0)	1 (100)	
Assessment at the scene and vital signs			
Systolic blood pressure (mean)	115±34.49	74±18.97	p=0.329
Diastolic blood pressure (mean)	68.33±19.40	48±14.75	p=0.449
Pulse rate (average/minute)	116.66±18.61	129±12.86	p=0.381
Fingertip oxygen saturation	86.16±6.94	76.5±5.29	p=0.149
Glasgow coma score	7.5±4.54	4.40±1.42	**p<0.05**

*'Chi-square test' for the comparison of categorical variables between two groups and 'Student T test' for the comparison of independent groups were used for statistical analysis. The results are presented as mean ± SD or frequency (percentage) and p < 0.05 is statistically significant at 95 percent confidence interval.

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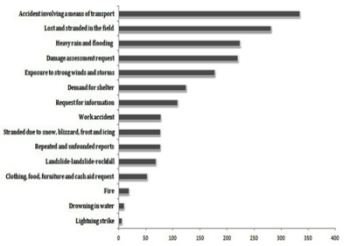
Table 2. Comparison of data of surviving and deceased patients

Table 3. Detailed analysis of the data of deceased patients

Table 4. Comparison of data of patients who died pre-hospital and in-hospital

Figüre 1. Distribution of incidents reported to disaster and emergency unit call center



Figüre 1. Distribution of incidents reported to disaster and emergency unit call center

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