

Research Article

Analysis of the Patients Transported by a Helicopter Ambulance in Turkey

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Abstract

Objectives: The aim of this study is to define the characteristics of HEMS use in Turkey.

Methods: All EMS cases in Turkey are recorded in a database called the ASOS. In our study, vital signs and diagnoses of the patients and information about the provinces and hospitals transferred were obtained from this database. We also evaluated the demographic characteristics of the patients, their triage codes, whether they were transferred to a hospital, and on which days the cases occurred.

Results: A total of 4,248 HEMS assignments were included in the study. The mean age of the patients in the study was 51.2±26.5 years. Of all cases, 61.9% (2628) were men. The mean Glasgow Coma Score of the patients was 13.5±3.4, systolic blood pressure of these patients was 119.8±30.9 mmHg, diastolic blood pressure was 72.3±18.0 mmHg. The mean fever was 36.4±0.5 °C for all patients. Of the patients, 92.7% had a regular pulse. Cardiovascular system diseases (39.5%), trauma and poisonings (15.4%), and nervous system diseases (12.9%) were the top 3 reasons for ambulance assignments. HEMS cases were most frequent in Çanakkale region (12.1%). The mean flight time in patient transports was 35.5±23.3 minutes. The mean operation time of the transports was 150.6±279.3 minutes.

Conclusion: In Turkey, HEMS are used quite frequently for transport between hospitals. The most common causes of transport were cardiovascular system diseases, trauma-related injuries, and nervous system diseases.

Keywords: Air ambulance, transportation of patients, Turkey

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Helicopters were first used as ambulances to transport wounded soldiers in Burma in 1945. They were then used as primary vehicles for the evacuation of patients during the Korean War.^[1] As air transport has evolved over the years, helicopter emergency medical services (HEMS) have become an integral part of healthcare systems in developed countries.^[2,3] Although transporting patients by helicopter is not part of the actual treatment, thanks to the short transport time, it ensures that patients are delivered to definitive treatment very quickly.^[1]

In emergency medical services (EMS), rapid and accurate evaluation of critical patients at the scene, initiation of appropriate treatment, presence of experienced personnel, and rapid transport to the appropriate health center are essential. HEMS can reduce mortality and morbidity by enabling faster transfer of time-dependent critical patients—such as those with acute coronary syndrome or those who have had a stroke—than by land ambulance.^[4,5] HEMS are also very effective in their rapid response to trauma patients in the field, especially in search and rescue activities

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in rural geographical areas where land ambulances cannot easily penetrate.^[1,6]

Helicopter ambulances have limitations such as weather conditions and only being able to work at certain times of the day (sunrise, sunset). The use of HEMS is frequently questioned because of the helicopters' high cost of operation and infeasibility in terms of cost for short distances.^[7] HEMS are used for emergency response purposes in some countries, while in others they are used for inter-hospital transport, and yet in other places they are used at the forefront of search and rescue missions. The use of civilian HEMS in Turkey began in 2008. There, HEMS are usually used to transport patients between hospitals. To date, there have been no studies published on the use of national HEMS in Turkey.

The aim of this study is to define the characteristics of HEMS use in Turkey.

Methods

In our study, HEMS cases between 22.07.2019 and 03.09.2021 were evaluated retrospectively in Turkey. This study was approved by the Non-Invasive Ethics Committee of the Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital (Number: 2021-11/1494).

HEMS in Turkey

There are HEMS in a total of 17 provinces in Turkey (Adana, Afyonkarahisar, Ankara, Antalya, Bursa, Çanakkale, Diyarbakır, Erzurum, İstanbul, İzmir, Kayseri, Konya, Malatya, Samsun, Sivas, Trabzon, and Van). A helicopter ambulance not only serves the city where it is located but also nearby cities, as designated by the Ministry of Health (Fig. 1). There are 2 types of helicopter ambulances in the country. These are the Bell 439 (Bell Helicopter, USA) and the Eurocopter 135 (Airbus Helicopters, France). In Turkey, helicopter ambulances cannot fly at night, so they operate between sunrise and sunset. Helicopter ambulances have four officers: a physician, a nonphysician practitioner, a pilot, and a co-pilot.

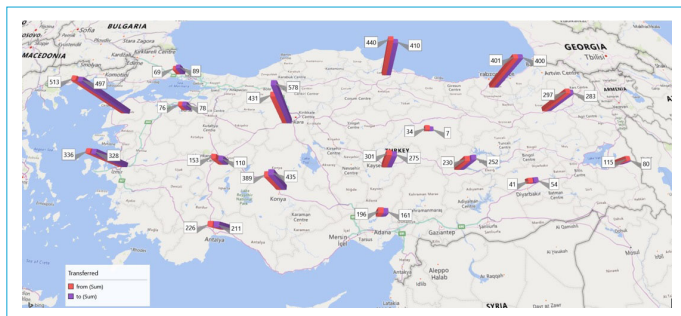


Figure 1. 17 provinces with helicopter ambulances and the number of cases.

Helicopter ambulances are directed by the EMS Call Center of the province they are located in. After receiving the call, the HEMS is activated, if and as necessary. Helicopter ambulances are also deployed in appropriate cases for inter-hospital patient transfer. The use of HEMS is free of charge, as is the use of land ambulances in Turkey. In Italy, health services are free of charge for the users; emergency services are publicly funded, and no fee is charged for a visit to the health center or for ambulance or helicopter transport.

All EMS cases in Turkey are recorded in a database called the ASOS, which is managed by the Turkish Ministry of Health. In our study, vital signs and diagnoses of the patients and information about the provinces and hospitals transferred were obtained from this database. We used the International Classification of Diseases-10 (ICD-10) for our study. We also evaluated the demographic characteristics of the patients, their triage codes, whether they were transferred to a hospital, and on which days the cases occurred.

Statistical Analysis

All data were analyzed using IBM SPSS for Windows version 25.0 (Armonk, NY, IBM Corp.) Descriptive statistical methods (frequency, percentage, mean, standard deviation, median, min-max, IQR) were used to evaluate the study data. The compliance of the data to normal distribution was evaluated by the Kolmogorov-Smirnov test, Skewness-Kurtosis, and graphical methods (histogram, Q-Q Plot, Stem and Leaf, Boxplot). In the study, the Independent Samples t-test was used to evaluate quantitative data compatible with normal distribution. Statistical significance was accepted as $\alpha=0.05$.

Results

A total of 4,434 HEMS assignments were included in the study. As 118 of these HEMS assignments were due to health measures, no patients were excluded from the study. However, 68 assignments were excluded from the study because of missing patient information. After excluding these cases, 4,248 HEMS cases were ultimately included in the study.

The mean age of the patients in the study was 51.2 ± 26.5 years. Of all cases, 61.9% (2628) were men. There was no statistically significant difference between the mean ages of men and women (Table 1).

The mean Glasgow Coma Score of the patients was 13.5 ± 3.4 . While the mean systolic blood pressure of these patients was 119.8 ± 30.9 mmHg, their diastolic blood pressure was 72.3 ± 18.0 mmHg. The mean fever was 36.4 ± 0.5 °C for all patients. Of the patients, 92.7% had a regular pulse (Table 2).

Table 1. Demographic characteristics the patients

	All (n=4,248 – %100.0)	Women (n=1,620 – %38.1)	Men (n=2,628 – %61.9)	P*
Age (Years)	51.2±26.5	51.0±28.2	51.3±25.5	0.713

*: Independent Samples t Test.

Table 2. Vital findings of the patients transported by HEMS

	Mean±SD	Median (IQR)
GCS	13.5±3.4	15.0 (15.0-15.0)
SBP (mmHg)	119.8±30.9	120.0 (100.0-140.0)
DBP (mmHg)	72.3±18.0	70.0 (60.0-80.0)
Fever (°C)	36.4±0.5	36.5 (36.0-36.7)
Pulse	n	%
Regular	3.940	92.7
Arrhythmic	225	5.3
Filiform	77	1.8
Unmeasured	6	0.1

Cardiovascular system diseases (39.5%), trauma and poisonings (15.4%), and nervous system diseases (NSD) (12.9%) were the top 3 reasons for ambulance assignments. Acute myocardial infarction (AMI) was the most common cause of cardiovascular disease (79.5%). The other most common cardiovascular diseases were arrhythmias (6.3%) and return of spontaneous circulation after cardiac arrest (ROSC) (2.7%). The most common cause of trauma-related injuries was lower extremity injuries (14.1%) and head and neck injuries (12.5%) as a result of a car accident (19.6%). Among the nervous system diseases, the most common transport reasons were ischemic cerebrovascular diseases (73.3%), intracranial hemorrhage, and convulsions (Table 3).

HEMS cases were most frequent in Çanakkale region (12.1%). The other two regions with the most frequent HEMS cases were Samsun (10.4%) and Ankara (10.1%). Helicopter ambulances transported patients most frequently within their regions (85.9%). Only the Diyarbakır and Sivas region helicopters transported patients mostly outside of their regions. The region that received the most transports from outside of its own region was Ankara.

The mean flight time in patient transports was 35.5±23.3 minutes. The mean operation time of the transports was 150.6±279.3 minutes. The first 3 regions with the longest flight times were Sivas (79.1±30.3), Erzurum (68.5±23.8), and Diyarbakır (61.8±25.3), respectively. The 3 regions with the shortest flight times were Çanakkale (19.7±10.2), Trabzon (21.1±14.2), and Samsun (28.8±22.7) (Table 5).

Table 3. Diagnosis of the patients transported by HEMS

Diagnostic Groups	n	%
Cardiovascular System Diseases	1,679	39.5
Acute Myocardial Infarction	1,334	79.5
Arrhythmia	105	6.3
Cardiac arrest	46	2.7
Others	194	11.6
Injury, poisoning and certain other consequences of external causes	654	15.4
Traffic accidents	128	19.6
Lower Extremity Injuries	92	14.1
Head and Neck Injuries	82	12.5
Others	352	53.8
Diseases of the Nervous System	550	12.9
Cerebrovascular Diseases	403	73.3
Subarachnoid Hemorrhage	54	9.8
Convulsions	51	9.3
Others	42	7.6
Diseases of the respiratory system	212	5.0
Dyspnea	80	37.7
Pneumonia	44	20.8
Pulmonary Embolism	36	17.0
Others	52	24.5
Congenital Malformations	195	4.6
Cardiovascular Malformations	132	67.7
Central Nervous System Malformations	27	13.8
Multiple Sclerosis	2	1.0
Others	34	17.4
Diseases of the respiratory system	190	4.5
Acute abdomen	102	53.7
Gastrointestinal Hemorrhage	74	38.9
Esophagus, Stomach and Duodenal Diseases	3	1.6
Others	11	5.8
Neonatal Diseases	186	4.4
Dyspnea	102	54.8
Premature birth - Low birth weight	54	29.0
Retinopathy of prematurity	12	6.5
Others	34	18.3
Covid-19	141	3.3
Covid-19	141	100.0
Endocrine, nutritional and metabolic diseases	109	2.6
Metabolic Disorders	41	37.6
Hepatic failure	23	21.1
Anaphylactic Shock	9	8.3
Others	36	33.0
Pregnancy, childbirth and the puerperium	72	1.7
Pregnancy, childbirth and the puerperium	72	100.0
Others	260	6.1
Total	4,248	100.0

Table 4. Number of HEMS cases by regions

To	From														Total			
	Adana	Afyon	Ankara	Antalya	Bursa	Çanakkale	Diyarbakır	Erzurum	İstanbul	İzmir	Kayseri	Konya	Malatya	Samsun		Sivas	Trabzon	Van
Adana	131		2	1			11				2	4	9		1			161
Afyon		80	6	5	1				3	9		6						110
Ankara	6	36	406	10	7				3		44	9		40	17			578
Antalya		18	1	182						7		3						211
Bursa		2	2		59	5			8	2								78
Çanakkale						495			2									497
Diyarbakır	9						10				1	4					30	54
Erzurum							1	267				1				5	9	283
İstanbul	1	4	7	1	8	10			51	4								89
İzmir		3		5	1	3			2	314								328
Kayseri	17		2								236	1	9	1				275
Konya	25	10		22							10	366			2			435
Malatya	7						15	8			7		205	1	2	11	7	252
Samsun														393	2			410
Sivas											1		1	1	1			7
Trabzon																385	1	400
Van							4	7					1			68		80
Total	196	153	431	226	76	513	41	297	69	336	301	389	230	440	34	401	115	4,248

Discussion

In our study, 4,248 HEMS transports were evaluated retrospectively, and the most common reason for ambulance assignment was cardiovascular system disease (the most common subgroup was AMI). HEMS cases were most frequent in the Çanakkale region. Helicopter ambulances transported patients most frequently within their own regions. The region that received the most transports from outside of its own region was Ankara. The mean flight time in patient transport was 35.5±23.3 minutes. The mean operation time of the transports was 150.6±279.3 minutes.

In a study conducted in Australia, the mean age of patients transferred by air ambulance was found to be 36.5 years in Aboriginals versus 49.7 years in non-Aboriginals.^[8] In another study, the median age of male patients was 60 years, while that of females was 59 years.^[9] In a study by Astrup et al., it was found that the majority of patients transferred by helicopter ambulance were men.^[10] The mean age and gender ratios of the patients included in our study were found to be similar to the literature.

In another study, the mean heart rate of patients who were transferred by helicopter ambulance was 130±25 minutes, while SBP was 95±14 mmHg, DBP was 63±10 mmHg, and GCS was 7±3.^[11] In our study, SBP and DBP were within normal limits, similar to the literature, while GCS was higher. We suggest that the reason for the higher GCS of the patients in our study is that HEMS are frequently used for secondary patient transport in Turkey. Since the heart rate data in Turkey was recorded as "regular", "filiform", or "arrhythmic" instead of numerical, we could not perform a comparison in terms of heart rate.

Björkman et al.^[12] and Rzonca et al.^[13] found that HEMS cases were most frequently linked to trauma patients. VanderBurgh et al. found that patient transports with air ambulances were frequently due to gastrointestinal diseases.^[14] Edwards et al.^[15] and Wu et al.^[16] found that cardiac emergencies were the most common diagnosis group in patients transported by helicopter ambulances. In our study, the most common diagnosis group in HEMS cases were those suffering from cardiovascular system diseases (the most common subgroup was AMI). We suggest that the difference in the frequency of diagnosis in helicopter ambulance cases in the literature is due to the geographical characteristics of the countries in which the studies were conducted.

Table 5. Flight times and operation times of the HEMS

Total Flight Time (DK)	Mean±SD	Median (IQR)
Adana (n=196)	51.1±29.3	42.0 (26.0-70.0)
Afyon (n=153)	35.1±19.1	30.0 (21.0-41.0)
Ankara (n=431)	35.2±17.3	33.0 (23.0-40.0)
Antalya (n=226)	43.4±20.5	40.0 (30.0-49.0)
Bursa (n=76)	31.2±22.2	22.0 (20.0-32.3)
Çanakkale (n=513)	19.7±10.2	17.0 (15.0-20.0)
Diyarbakır (n=41)	61.8±25.3	61.0 (45.5-73.0)
Erzurum (n=297)	68.5±23.8	64.0 (55.0-78.0)
İstanbul (n=69)	35.3±22.8	25.0 (19.5-44.0)
İzmir (n=336)	30.2±15.1	27.0 (23.0-30.0)
Kayseri (n=301)	35.6±21.6	26.0 (24.0-33.5)
Konya (n=389)	36.5±11.3	35.0 (28.0-42.0)
Malatya (n=230)	31.9±17.2	28.0 (25.0-30.0)
Samsun (n=440)	28.8±22.7	22.0 (19.0-25.8)
Sivas (n=34)	79.1±30.3	96.0 (50.8-102.5)
Trabzon (n=401)	21.1±14.2	17.0 (15.0-21.0)
Van (n=115)	53.8±31.9	42.0 (27.0-78.0)

In addition, differences in HEMS study methods may have caused these results. While some countries predominantly use helicopter ambulances for search and rescue purposes, Turkey uses them primarily for patient transport between hospitals.

A study in Italy reported that helicopter ambulances were placed according to population and regional geographical conditions.^[17] In Turkey, helicopter ambulances are located according to regional geographical conditions and population density. In our study, we found that HEMS cases were most frequent in Çanakkale, Samsun, and Ankara regions. The reason for the differences in the number of HEMS cases between the regions may be that it is safer to use helicopter ambulances for patient transport between hospitals and because the transport time is shorter in mountainous regions surrounding cities like Çanakkale.

In a study conducted in Poland, the mean transport time by helicopter ambulance was 25.61 m, and the total operation time was 61.50 minutes.^[17] In another study, the helicopter ambulance transfer time was 23±5 minutes.^[11] We suggest that the reason for both the transport and total operation times being longer in our study than in the literature is due to the use of HEMS for patient transport between hospitals in Turkey. In Turkey, patients are usually transported from 1st and 2nd level hospitals to 3rd level hospitals a long distance away or transported from small cities to big cities.

Conclusion

In Turkey, HEMS are used quite frequently for transport between hospitals. The most common causes of trans-

port were cardiovascular system diseases (most common subgroup: AMI), trauma-related injuries (most common subgroup: traffic accidents), and nervous system diseases (most common subgroup: ischemic cerebrovascular diseases). There is a difference in the number of HEMS cases between regions. HEMS cases were most frequent in the Çanakkale region (12.1%), which is a mountainous region. The region that received the most transports from outside of its own region was Ankara.

Disclosures

Ethics Committee Approval: In our study, HEMS cases between 22.07.2019 and 03.09.2021 were evaluated retrospectively in Turkey. This study was approved by the Non-Invasive Ethics Committee of the Dr. Abdurrahman Yurtaslan Ankara Oncology Training and Research Hospital (Number: 2021-11/1494).

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Conflict of Interest: None declared.

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