ORIGINAL RESEARCH

# Epidemiology of out-of-hospital cardiac arrest: comparison of Turkish nationals and refugees

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## Abstract

The aim of this study is to conduct an epidemiological examination of Turkish citizens and refugees who requested an ambulance due to Out-of-hospital cardiac arrest (OHCA) at the Kayseri 112 emergency services between 2019 and 2020. This study was carried out in the province of Kayseri, which is one of the largest cities in Turkey. The study population includes OHCA patients for whom EMS were activated for any reason in 2019-2020. Data were taken from the Emergency Healthcare Automation System used by Kayseri Emergency Medical Services. A total of 5977 OHCA cases (Turkish 5736, Refugees 241) in which Emergency Medical Servises (EMS) was activated during the research period were included. A rate of 55.6% of patients Turkish nationality and 66.0% refugees were male ($p<0.001$). Observing at the cause of arrest, we find that 95.7% of cases among Turkish citizens and 82.6% of cases among refugees had a medical cause; while the suicide rate among Turkish citizens was 0.9%, this rate was 5.0% in refugee patients ($p<0.001$). It was found that the rate of OHCA increased with age and that the average OHCA age was lower in men and refugees. In addition, there is no difference between Turkish nationals and refugees in the use of emergency services for OHCA cases.

**Keywords:** Cardio pulmonary resuscitation, Out-of-hospital cardiac arrest, Emergency Medical Servises, Refugees

## Background

Cardiac arrest is the cessation of heartbeats and the interruption of blood flow in the circulatory system. It can occur suddenly and be caused by many different factors. If the duration of cardiac arrest is long and the heart does not restart, all vital functions come to a halt. For this reason, it is of great importance that the heart is restarted to continue life. Cardiac arrest can occur in a healthcare facility such as a hospital or outside of a hospital. Out-of-hospital cardiac arrest (OHCA) is a major public health burden worldwide. OHCA is a major health condition worldwide[1,2]. For this reason, it is very important to provide prehospital emergency medical services.

Effective treatment of OHCA depends on the concept of "chain of survival," which defines the rapid initiation and smooth delivery of rescue measures[3]. Although activation of EMS is an important step in the chain of survival and is constantly evolving to improve OHCA outcomes, survival rates are still low[1,4,5]. OHCA outcomes vary between communities (countries) due to patient characteristics and differences in emergency care[3,6]. OHCA is an important reason for calls to emergency medical services (EMS)7 and initiation of resuscitation and restoration of spontaneous circulation are important performance indicators for emergency medical services[8].

This study was conducted in Kayseri province, which is one of the largest cities in Turkey. The total population of Kayseri province was 1,407,409 in 2019 and 1,421,455 in 2020[9]. According to the Ministry of Interior of the Republic of Turkey, Migration Administration, there are about 3.5 million refugees living in Turkey in 2020. However, the distribution of refugees by geographic region is not disclosed[10].

The 112 emergency team consists of a physician, paramedic, driver, and ambulance, and operates in 24-hour shifts. Emergency medical care is provided by the Kayseri EMS system through 52 EMS stations, 656 healthcare workers and 80 ambulances. The universal emergency number 1-1-2 can be used to reach the police, fire and ambulance services from anywhere in Turkey. If the person calling 1-1-2 needs medical assistance, the services of EMS are activated by confirming the address and requesting the nearest ambulance. Calls, including the medical priority system, are answered in eight different languages, including Turkish.

Health care costs in Turkey are covered by the Social Insurance Institution (SSI). SSI is a state insurance institution. Citizens who are not studying or unemployed are not subject to SSI and pay for their own health care costs. In emergency situations where EMS is activated, all costs are covered by SSI[11].

Examination of the literature reveals several differences in the sociodemographic characteristics of OHCA patients for whom EMS is activated[2,4-7].

The aim of this study is to make an epidemiological examination of the Turkish citizens and refugees who requested an ambulance due to OHCA from the Kayseri 112 emergency services between 2019 and 2020.

## Materials and Methods

### *1. Setting and Design*

Our study is of descriptive type and the Turkish EMS cardiac arrest protocol followed the 2015 ERC CPR guidelines for CPR and defibrillation at the time of the calls examined in this study.

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**Table 1: Average Age and Ambulance Transportation Time Values of OHCA Cases by Year**

| | 2019 | | | | | | 2020 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Turkish Citizen | | Refugee | | | | Turkish Citizen | | Refugee | | | |
| | Mean | SD | Mean | SD | t | p | Mean | SD | Mean | SD | t | p |
| Age | 70.93 | 16.01 | 50.75 | 16.01 | 12.603 | <0,001* | 70.94 | 16.12 | 56.87 | 25.48 | 9.469 | <0,001* |
| Transportation time (minute) | 7.38 | 6.85 | 6.71 | 4.41 | 1.031 | 0.128 | 7.78 | 6.72 | 7.75 | 7.05 | 0.049 | 0.796 |

*p<0.05, Transportation time: The time from the time of the call to 112 for OHCA until the EMS team reaches the patient.

In both 2019 and 2020, the OHCA average age was lower for refugees (Table 1).

**Table 2: Average Age and Ambulance Transportation Time Values of OHCA Cases by Place of Residence**

| | City Center | | | | | | Rural | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Turkish Citizen | | Refugee | | | | Turkish Citizen | | Refugee | | | |
| | Mean | SD | Mean | SD | t | p | Mean | SD | Mean | SD | t | p |
| Age | 71.15 | 15.88 | 53.28 | 25.42 | 14.443 | <0,001* | 70.42 | 16.53 | 56.42 | 26.25 | 6.145 | <0,001* |
| Transportation time (minute) | 5.53 | 3.47 | 5.37 | 2.83 | 0.613 | 0.746 | 12.55 | 9.56 | 13.40 | 9.08 | -0.657 | 0.687 |

*p<0.05, Transportation time: The time from the time of the call to 112 for OHCA until the EMS team reaches the patient.

*p<0.05, Transportation time: The time from the time of the call to 112 for OHCA until the EMS team reaches the patient.

The mean age of OHCA was lower for refugees, both in the city center and in the countryside (Table 2).

**Table 3: Average Age and Ambulance Transportation Time Values of OHCA Cases by Sex**

| | Male | | | | | | Female | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Turkish Citizen | | Refugee | | | | Turkish Citizen | | Refugee | | | |
| | Mean | SD | Mean | SD | t | p | Mean | SD | Mean | SD | t | p |
| Age | 68.36 | 16.18 | 51.06 | 23.92 | 12.793 | <0,001* | 74.16 | 15.34 | 59.76 | 27.84 | 8.083 | <0,001* |
| Transportation time(minute) | 7.59 | 6.73 | 7.36 | 6.87 | 0.423 | 0.790 | 7.66 | 6.84 | 7.09 | 4.17 | 0.743 | 0.053 |

*p<0.05, Transportation time: The time from the time of the call to 112 for OHCA until the EMS team reaches the patient.

## *2. Participants*

The study population includes OHCA patients for whom EMS was activated in 2019-2020. OHCA patients transferred between hospitals were excluded from the study.

## *3. Data Sourcing/ Management*

The data were taken from the Emergency Healthcare Automation System (ASOS) used by Kayseri EMS. All patients and injured treated through EMS are recorded in the ASOS system, which is used nationwide in Turkey EMS. Each patient/injured person who activates EMS in the ASOS system is assigned a unique serial number.

During the screening process, information was collected on sociodemographic characteristics of patients/injured persons with OHCA such as age, gender, the presence of social security coverage, and the time frame in which an ambulance was sent to the patient, as well as patient outcomes (transfer to hospital, stay on site, transfer to the morgue, etc.) in terms of ambulance utilisation.

## *4. Population Studied*

No sample selection method was used in this study. A total of 5977 OHCA cases (Turkish 5736, Refugees 241) were included for which EMS was activated during the study period. All OHCA cases were confirmed by EMS staff. In the ASOS database used by EMS, there are options for patients' social security coverage. Here, there are three options: SSI, precarious, and refugee. Citizens who do not study or are unemployed are not subject to SSI and pay for their own health care costs. In emergency situations where EMS is activated, all costs are covered by SSI11. SSI and precarious OHCA patients were classified as Turkish citizens and the rest as refugees.

## *5. Statistical Methods*

The statistical analysis was performed using Excel and the Statistical Package for Social Sciences (IBM SPSS Version 23, NY, USA). The chi-square analysis method was used for the comparison of the relevant data with independent variables, expressed in numbers and percentages for descriptive features.

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**Table 4: Comparison of Some Socio-Demographic Characteristics of Between Turkish Citizen and Refugee OHCA Cases**

| | Turkish Citizen | | Refugee | | | |
|---|---|---|---|---|---|---|
| Age | n | % | n | % | Chi-square | p |
| <16 | 69 | 1.2 | 22 | 9.1 | | |
| 17-44 | 289 | 5.0 | 51 | 21.2 | | |
| 45-59 | 697 | 12.2 | 55 | 22.8 | 17.771 | <0.001 |
| 60-74 | 1922 | 33.5 | 53 | 22.0 | | |
| 75-89 | 2403 | 41.9 | 47 | 19.5 | | |
| >90 | 356 | 6.2 | 13 | 5.4 | | |
| Gender | | | | | | |
| Male | 3190 | 55.6 | 159 | 66.0 | 10.309 | 0.001 |
| Female | 2546 | 44.4 | 82 | 34.0 | | |
| Cause of Arrest | | | | | | |
| Medical | 5490 | 95.7 | 199 | 82.6 | | |
| Traffic accident | 105 | 1.8 | 12 | 5.0 | | |
| Injury | 6 | 0.1 | 8 | 3.3 | 73.217 | <0.001 |
| Work-related accident | 9 | 0.2 | 2 | 0.8 | | |
| Suicide | 52 | 0.9 | 12 | 5.0 | | |
| Other Accident* | 74 | 1.3 | 8 | 3.3 | | |
| Case outcome | | | | | | |
| Transportation to hospital | 3361 | 58.6 | 123 | 51.0 | | |
| Left at side | 2350 | 41.0 | 116 | 48.1 | 5.740 | 0.057 |
| Transfer to morgue | 25 | 0.4 | 2 | 0.9 | | |

* Fall from height, falling down the stairs etc.

The t-test was applied to the independent group to compare the mean age and timeframe of transportation with the variables of year, sex and place of residence. P<0.05 was deemed to be significant in the study.

### *6. Ethics*

Permission to carry out the study was obtained from the Provincial Directorate for Healthcare of Kayseri and the Ethics Commission for Nonclinical Studies of the Gazi University on 24.06.2021 by decision number 11. This study was conducted in accordance with the Principles of the Declaration of Helsinki.

### *7. Limitations*

A significant proportion of OHCA cases may arrive at the hospital by their own means of transport rather than through EMS. Therefore, it cannot be claimed that this study is representative of all OHCA cases. In this study, no information was presented about post-resuscitation care and treatment in the intensive care unit. No information on long-term survival is provided in this research. In addition, it is not possible to standardize data entry into the database, since it is a retrospective data scanning study. This may have affected the data quality.

## Results

During the study period, a total of 5977 OHCA cases were treated by EMS. Ambulances were requested as a result of OHCA in 2458 of the cases in 2019 and 3519 of the cases in 2020. These results correspond to 174.65 arrests per 100,000 persons in 2019 and 247.56 arrests per 100,000 persons in 2020. The mean age of OHCA cases treated by EMS was 70.01±17.08 years in 2019 and 70.42±16.76 years in 2020, with no significant difference found between the mean ages. The age mod value of OHCA patients was 87.00 and the median was 74.00.

## Discussion

The factors affecting survival after out-of-hospital cardiac arrest are well known but sociodemographic differences in the study group caused significant differences in OHCA incidence and outcomes[12]. This retrospective study carried out in Kayseri during which records were screened, is the first in-depth study of OHCA in Turkey. Based on the data obtained, the OHCA rate was 174.65 per 100,000 people in 2019 and 247.56 per 100,000 people in 2020. For OHCA cases transferred to the hospital and resuscitated, the incidence was 112.19 per 100,000 people in 2019 and 134.02 per 100,000 people in 2020. For OHCA cases that were transferred to the hospital and resuscitated, the incidence was 112.19 per 100,000 persons in 2019 and 134.02 per 100,000 persons in 2020[13]. Becker et al. (1993) found that the incidence of out-of-hospital cardiac arrests in which EMS intervened ranged from 36-128/ 100,000 per year in 20 different communities and that there was an association between higher incidence and lower survival rates[14]. In a study conducted by Czapla et al. (2020) in which the epidemiology of out-of-hospital cardiac arrest cases in Poland was examined, the OHCA rate was found to be 102 per 100.000 persons per year[7]. Notably, in Europe, some EMS services are required to transfer OHCA cases to the hospital upon arrival at the scene without discontinuing treatment. As a result, the reported OHCA incidence treated by EMS was over 90 per 100,000

people[12]. Therefore, we are of the opinion that this might be the reason the OHCA incidence was high in this study. In our opinion, the cause of the high OHCA resuscitation is due to the relatively short EMS response time.

The average transportation time was 7.35 minutes. In the study conducted by Erdur et al. (2008) in the province of Denizli in Turkey, the average EMS response time was found to be 5.4 minutes[15]. In at study conducted by Hasan et al. in which OHCA cases in Kuwait were evaluated, the EMS response time was found to be 9.3±5[16]. According to the results of the OHCA study conducted by Ong et al. in seven Asian countries, the median EMS reaction time in Taiwan was 17.4 minutes[4]. In this study, the median EMS reaction time was 7.0 minutes. It was found that a median EMS response time of less than ten minutes for urban areas in Europe was only achieved in 32% of countries[12]. Response times of ≤ 7.5 minutes are associated with better neurological outcomes in OHCA patients[1,17]. Transportation times for OHCA cases have increased significantly in 2020. In our opinion, there are two reasons for this situation. Primarily, the COVID-19 pandemic in 2020 might have prolonged the transportation times to OHCA cases due to the increased workload of EMS. Secondly, the longer transportation times might be a result of the increase in the number of rural OHCAs due to the fact that people living in the city center settled in rural areas, especially during COVID-19 quarantine measures. The incidence of OHCA may differ across subgroups within the population, such as ethnic or socioeconomic groups[18]. The average age of refugees residing in Kayseri who suffered OHCA was found to be quite low. In addition, when the out-of-hospital cardiac arrest age distribution of refugees is examined (Table 4), we find that half of them are younger than 60 years old. For Turkish nationals, this rate is only 18%. Refugees living in Turkey are mostly citizens from resource-poor countries such as Syria, Afghanistan and Iraq. According to WHO, the life expectancy of citizens of these countries is shorter than that of Turkish citizens[19]. In this context, we are of the opinion that the average OHCA age of refugees is expected to be lower. Previous studies from the United States of America, Singapore, and New-Zealand reported substantial ethnic differences in EMS-attended OHCA incidence rates[20-22]. Another reason for the lower average age of refugees is the problems with EMS activation and communication (e.g., lack of Turkish language skills). The incidence of out-of-hospital cardiac arrest increases with age[23]. In our study, it was observed that the mortality rate increased with higher age for Turkish citizens. Many studies in the literature support this finding[17]. However, this was not the case for refugees. We believe this is due to the fact that the older refugee population is relatively less than the younger population. According to the data of the Refugee Association in Turkey, only 3.13% of the refugees living in Turkey are over 60 years old[24].Socio-cultural differences between genders may have a direct or indirect impact on health, such as differences in health behaviours or participation in preventive treatments[18]. When examining the gender distribution of OHCA cases, it was found that the incidence was higher in men and the average age was lower in men. In many studies, the number of male OHCA cases was found to be higher than female cases[3,4,6,8,13,23]. In our opinion, the main reason for this is that cardiac arrests in adults are often due to cardiac causes and the incidence of cardiovascular disease is higher in men[4,25]. It is noteworthy that refugees have a high rate of out-of-hospital cardiac arrest due to suicide. Many studies that have examined the mental health status of refugees show that rates of anxiety, depression and suicide among refugees range from 30% to 36%[26,27]. This is quite high when compared to other members of the society. The majority of cases (58.6% for Turkish Citizens, 51.0% for refugees) were hospitalized. This means that resuscitation attempts were made. Similar results were observed in the study conducted by Nichol et al. (2008) in the United States[13]. In the study conducted by Gräsner concerning the epidemiology of arrest in Europe, it was also reported that 50-60% of OHCA cases (between 19-97 per 100.000 people) were resuscitated by EMS[12].

## Conclusion

OHCA is a common and fatal event and there is substantial regional variation in the incidence and outcome of OHCA. As a result of this study, it was found that the rate of OHCA increases with age and that the mean OHCA age is lower in men and refugees. In addition, there is no difference between Turkish citizens and refugees regarding the use of ambulance services in OHCA cases. In light of this study, it is recommended that more comprehensive studies covering the post-hospital period are carried out. Nonetheless, these data may provide a basis for future, more focused research.

## Conflict of Interest

No potential conflict of interest was reported by the authors.

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## Author Contribution

İÇ: Idea/Concept, Design, Literature review, Analysis, Writing; AC: Idea/Concept, Design, Literature review

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