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Pre-Hospital Emergency Medical Services: An Epidemiological Survey in Mashhad, Iran

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ABSTRACT

Introduction: Providing appropriate care, in the right place and at the right time, is the main goal of emergency medical services (EMS) to save lives. The present study aimed to assess the pre-hospital EMS in Mashhad, the second largest metropolis in Iran.

Materials and Methods: In this research, data were extracted from the pre-hospital emergency mission forms, which were collected from the EMS stations in Mashhad and suburbs through systematic random sampling. In addition, supplementary information was obtained from the ambulance dispatch cards and emergency communication center forms.

Results: Automobile accidents (33.7%) and cardiovascular events (17.8%) were the most common causes of contacts to the EMS. In the city and road stations, the mean response time was 2.6 and 1.6 minutes, while the mean time of arrival at the scene was 13.2 and 11.4 minutes, and the mean evacuation time was 13.2 and 11.4 minutes, respectively. Individuals aged 20-29 (25.2%) and more than 60 years (23.9%) constituted the majority of the cases receiving EMS.

Conclusion: According to the results, the 'golden time' for emergency care was of great importance in the patients injured in car accidents or affected by cardiovascular events. Furthermore, a significant difference was observed in the time indices of EMS in Mashhad city with the EMS standards due to the lack of human resources or EMS facilities. Some contacts to the EMS were unnecessary, and no expert team aid was needed in some cases. It is recommended that citizens be trained on solving the problems associated with road traffic by implementing mobile emergency, while transfer units must be established for the better provision of emergency care by the EMS in Mashhad.

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Introduction

Emergency medical services (EMS) are an important section in health services in all communities. Providing appropriate pre-hospital care and timely transfer of patients to hospitals is considered to be the first-line measure in fatality management (1-3). Pre-hospital services begin at the scene of the incident and end in the hospital emergency ward.

These services cover two types of patients, including the traumatic patients who are injured in accidents and those without trauma (2). As part of the healthcare system, improvement of pre-hospital emergency organizations to provide EMS plays a pivotal role in the timely and effective response to incidents, as well as reducing the subsequent mortalities and disabilities (3). EMS is aimed at providing an appropriate curing field, in the right place and at the right time, by using available, scientifically standard and updated resources (4).

Road accidents are among the major causes of mortality worldwide, especially in developing countries. Moreover, road accidents account for the leading cause of burden of disease in Iran (3), where, according to statistics, one individual dies due to road traffic accidents every 20 minutes. In this regard, the

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following causes of accidental events are poisoning, falling, and burns (2).

In developing countries, a substantial proportion of mortalities occur in pre- hospital units. In Iran, the rate of pre-hospital deaths has been reported to be as much as 40% in some studies (5, 6). In such cases, mortality is preventable through improving the EMS so as to provide an appropriate response and the required pre-hospital care in a timely manner (2).

Drastic rise of the urban population, traffic accidents, and emergent situations in Iran highlights the need for rapid EMS (2, 3). An important component of EMS improvement is effective evaluation and continuous high-quality data collection (7, 8).

This epidemiologic survey aimed to assess the pre-hospital EMS in terms of the time performance indices and human recourses in Mashhad, the second largest metropolis located in the north-east of Iran.

Materials and Methods

This descriptive-analytical study was conducted in 2009 in 15 EMS stations in Mashhad and suburbs, within a radius of 35 kilometers.

Data were collected from the records of the emergency missions of Mashhad EMS, and supplementary information was obtained from the ambulance dispatch cards and communication center forms in the emergency communication center.

Data were collected through systematic random sampling from each station at regular eight-day intervals to control the effect of weekdays. Sample size was calculated based on the EMS response time in a similar study.

Mashhad is a tourist attraction, and spring and summer are the peak seasons. Therefore, we collected the data during autumn due to the normal road traffic status and stability of the season for the EMS performance. Data analysis was performed in SPSS Version $_{11.5}$.

Results

In total, 264 EMS contact records were evaluated during the study, in which the final mission result was the transfer of the patient to the hospital in 151 contacts (57.2%), treatment of outpatients in 79 cases (29.9%), and cancelled missions in 34 cases (12.9%).

In terms of the age distribution, the majority of the individuals receiving pre-hospital EMS in Mashhad were aged 20-29 (25.2%) and more than 60 years (23.9%), followed by those who were in their fourth (15.7%), fifth (13.5%), third (11.7%), and first decade of life (9.1%), respectively.

A significant difference was observed between the age of the EMS recipients in terms of the gender (P=0.04). Moreover, men aged 20-29 (29.1%) and more than 60 years (22.1%) constituted the highest percentage of the patients receiving pre-hospital EMS.

As for women, the majority of the patients were aged more than 60 (27.1%) and 20-29 years (19.1%). Distribution was observed to be similar in both genders in the other age groups.

Table1: Frequency of Reasons for Contact with EMS Stations in Mashhad, Iran

Variable	N	%
Road Accidents	89	33.7
Cardiovascular Events	47	17.8
Internal Diseases	36	13.6
Coma	23	8.8
Respiratory Disorders	17	6.5
Neuropsychiatric Disorders	15	5.7
Trauma	15	5.7
Pain	9	3.4
Childbirth	2	0.7
Other	11	4.1
Total	264	100

The main causes of contact to the EMS stations of Mashhad are summarized in Table 1.

In general, the most frequent causes in this regard were road accidents (33.7%), followed by cardiovascular events (17.8%) and internal diseases (13.6%).

According to the collected data, the majority of the contacts to the EMS stations were during 12 PM to midnight (peak contact time: 10 PM), and the least frequent contacts were reported at midnight. Time distribution of the EMS contacts is depicted in Figure 1.

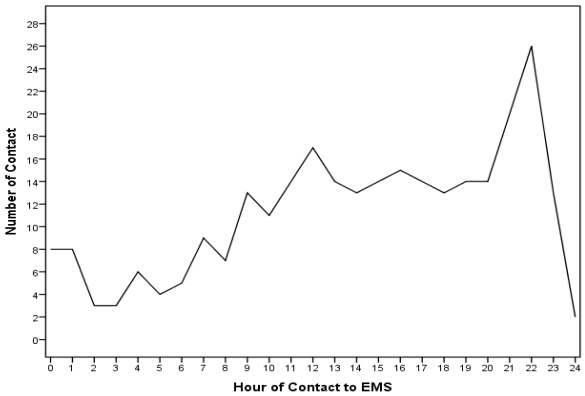

Figure1: Time Distribution of Contacts to EMS Stations of Mashhad, Iran.

Table 2 demonstrates the time performance indices, including the mean and time interval between the contact to the EMS station and initiation of the emergency care mission, arrival at the scene, evacuation time, and patient transfer to the hospital in the EMS stations of Mashhad and the suburbs.

Table 3 shows the coverage index for the incident management, performance of pre-hospital EMS, and human resources of the pre-hospital EMS in Mashhad.

Comparison of the manpower indices of EMS indicated that physicians constituted about 8% of the total staff and 17% of the EMS team with the emergency care nurses.

Table 2: Time Indices of EMS in Mashhad City and Suburbs

Index	Pre-Hospital Emergency Centers	Number of Missions	Mean Time (SD)	Range
Response Time (min)	City Station	213	2.6 (1.9)	0.5-16
	Road Station	17	1.6 (1.2)	
Arrival at Scene (min)	City Station	213	10.6 (5.1)	3-39
	Road Station	17	11.7 (4.6)	
Evacuation Time (min)	City Station	213	13.2 (8.1)	2-56
	Road Station	17	11.4 (6.2)	
Transfer Time (min)	City Station	137	13.8 (8.7)	4-72
	Road Station	14	26.2 (9.8)	

Table3: Human Resource and Coverage Indices for Incident Management

Index	%
Physician	8
Nurse	11
Assistant Nurse	11
Medical Emergency Technician	47
Other Paramedics	8
Operator	7
Other	8
Number of Pre-Hospital Emergency Centers	50
Number of Ambulances	59
Ratio of Emergency Center per 100,000 Population	0.66
Ratio of Ambulance per 100,000 Population	1.06

Discussion & Conclusion

In the present study, evaluation of the EMS performance indices in Mashhad revealed that the number of ambulances and emergency stations was respectively 5% and 8% lower than the standard EMS indices in Iran (2, 3). The standard response time for the EMS (i.e., interval between receiving an emergency contact until arrival at the scene) in Iran has been reported to be eight minutes in cities and 15 minutes in suburban areas in 80% of the missions, with the exception of Tehran, the capital of Iran (3, 8, 9).

However, in the present study, the response time was estimated to be 15.8 minutes in Mashhad city and 13 minutes in the suburbs.

In another survey conducted in Rasht (located in the north of Iran), the EMS response time was reported to be 6.5 with the total time of 26.5 minutes (sum of the response time and transfer time), whereas in a study in Yazd (located in the central part of Iran), approximately 80% of the EMS response times was within eight minutes. Nevertheless, it is notable that both the mentioned cities have significant differences in terms of the road traffic condition and total population compared to Mashhad (8, 9).

In a research performed in Tehran, the EMS response time was obtained to be 14.9 minutes (10), while the transfer time was reported to be 13.8 minutes in the city and 26.2 minutes in the road stations. This transfer time was reported 9.24 minutes in Rasht, but 18.5 minutes in Tehran (11, 12). The total time in the EMS of was determined at 40.2 and 50.9 minutes in the city and road stations, respectively, while these values have been estimated at 26.5 minutes in Rasht and 45.0 minutes in Tehran (9, 10).

With respect to the coverage index for the incident management in pre-hospital EMS in Iran, the number of the required ambulances has been estimated at 3.19 per 100,000 individuals, while this value was determined to be 1.06 in Mashhad (2).

Emergency systems mostly deliver services in the complex situations that require immediate care outside hospitals (4). Therefore, attempting to obtain successful and well-developed emergency system models and optimal standards for the infrastructure, healthcare team, and instruments is essential to providing effective EMS (11).

In the current research, evaluation of the emergency human resource index of Mashhad EMS indicated that less than 20% of the EMS personnel (e.g., physicians and nurses) have academic education in this regard.

Furthermore, inappropriate and unbalanced allocation of emergency care facilities and negligence of certain issues (e.g., dense geographic population) were among the other problems in the EMS of Mashhad city.

In developing countries, EMS is expected to meet the minimum international standards. In Iran, some of the main domains that require further reinforcement for improving the quality of EMS are management, transfer, facilities, and operational components (2, 8, 11). According to the results of the current survey, young individuals account for the most vulnerable group in road accidents, and similar findings have been reported in another research investigating motor vehicle accidents in Mashhad (13). On the same note, in a study performed in Rasht (Iran), more than half of the EMS recipients were male and aged 20-30 years, who constituted the majority of the patients in this area (9).

Findings of the present study revealed that most of the emergency contacts were made during the second half of the day, whereas in the study in Rasht, most of the emergency contacts were recorded during 11-12 AM (lowest rate: 4-5 AM) (9). Lack of qualified manpower has been reported to be a major problem in providing EMS in some countries, which could be partly overcome by recruiting healthcare team members with higher emergency care experience during the peak hours (2, 14). Of note, presenting routine training courses in this field could also be beneficial in improving the skills and knowledge of the emergency staff (1, 2, 4). Today, cardiovascular events and road accidents are considered to be the most frequent causes of mortality in Iran (3, 14). According to the findings of the present study, half of the emergency contacts were

due to road accidents and cardiovascular events, which highlights the need for providing general and specialized EMS, designing special protocols, and outfitting the equipment and facilities to offer the most effective services to the patients (15, 16). Indeed, training of expert EMS team members could remarkably enhance the management of patients as outpatients, while reducing their referral to hospitals (17). According to the international guidelines for emergency function indices, findings of the current survey indicated that the time taken to provide EMS was longer compared to the standard limits, with the exception of the index of lodgment time at the accident scene. This delay could be due to the crowded streets, unexpanded pathways, and lack of special ambulance routes. As observed in our research, the route for ambulances was similar to that of the other vehicles in almost all the roads and streets, which indicates the need for developing special routes to meet the required standards. Another cause of delayed EMS was that despite having several entryways, only one of the doors in hospitals (usually the most crowded one) is used for the arrival and departure of ambulances, which leads to the delayed transfer of patients to hospital units.

Another important observation in the present study was the reaction of the passers-by to the road accident scenes who mostly attempted to help the injured, which occasionally caused irreversible damage to the patient due to lack of knowledge and negligence of critical care measures. This finding highlights the urgent need for public education and training in this regard (18). Efficient communication between the hospital and emergency services during the mission plays a key role in the proper delivery of EMS.

Application of monitors in ambulances is necessary in order to keep the hospital updated on the status of the patient, as well as the need for rapid reception (19-21). On the other hand, lack of access to the essential information on the medical history of the injured patients largely influences the emergency aid process (21). According to the current survey, some of the contacts to the EMS of Mashhad were unnecessary, and no specialized care team was required in some cases.

Despite transferring more than half of the patients to hospitals, approximately 30% of the cases were treated as outpatients. This finding confirms that most of the road accidents in Mashhad are not fatal and only cause minor injuries; therefore, dispatching specialized, well-equipped ambulance to the location of the accident is not always necessary, and in certain cases, even a small motorcycle team would be adequate. On the other hand, establishing mobile emergency stations could be remarkably effective in the timely delivery of the required first-aids to the location. Of note, improving this issue requires new legislations, as well as the close cooperation and suitable interaction of different healthcare organizations. In the present study, non-compatibility of the EMS guidelines in Mashhad with the scientific EMS standards in terms of the delivery time and human recourses was found to be the major obstacle against the proper delivery of EMS. In this regard, some of the proposed solutions include providing continuous training for the public and emergency care staff, employing emergency motorcycles, using human resources with related academic education, planning for solving the issue of traffic, and providing mobile emergency facilities during the rush hours, which could decrease the EMS response time, rate of injuries, and the associated consequences.

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