

## ORIGINAL RESEARCH

# Prehospital Emergency Medical Services Challenges in Disaster; a Qualitative Study

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Received: February 2018; Accepted: April 2018; Published online: 26 April 2018

**Abstract:** **Introduction:** Prehospital Emergency Medical Care (EMC) is a critical service in disaster management. The aim of this study was to explore the challenges of prehospital Emergency Medical Services (EMS) during disaster response in Iran. **Methods:** A qualitative study was conducted from April 2015 to March 2017. Data were collected through in-depth, semi-structured interviews with 23 experienced individuals in the field of disaster that were selected using purposeful sampling. Data were analyzed using content analysis approach. **Results:** Fifteen sub-themes and the following six themes emerged in the analysis: challenges related to people, challenges related to infrastructure, challenges related to information management systems, challenges related to staff, challenges related to managerial issues and challenges related to medical care. **Conclusion:** Iran's prehospital EMS has been chaotic in past disasters. Improvement of this process needs infrastructure reform, planning, staff training and public education.

**Keywords:** Disaster planning; emergency medical services; qualitative research; earthquakes

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**Cite this article as:** Sorani M, Tourani S, Khankeh H, Panahi S. Prehospital Emergency Medical Services Challenges in Disaster; a Qualitative Study. *Emergency*. 2018; 6(1): e26.

## 1. Introduction

According to the Centre of Research on the Epidemiology of Disasters (CRED), disasters have become more frequent over the past decades (1). A wide range of health problems may result from disasters (2). Usually, the number of deaths and injuries associated with disasters increases significantly in the first hours and days after the disaster strikes (3). EMS is a critical component of the health-care systems in these situations (4). The main goal of EMS in disaster response is continuity of medical services through triage, life-saving support, rapid diagnosis and treatment, or

transfer of casualties to emergency departments (ED) (5). It has been shown that timely emergency medical care, especially in time-sensitive patients, improves outcomes (6).

Although a structured approach for EMS response exists (7), reports of recent studies on disasters show that there is still much room for improvement (8, 9). It is observed that lack of appropriate preparedness and response plan can cause serious challenges for prehospital emergency medical services. In a worst-case scenario, ED may be physically damaged or may not be able to provide services due to the overcrowding by casualties (4). It is also shown that the prehospital EMS may be disrupted due to resource limitations or road blockages (10).

Iran is a disaster-prone country. It is ranked as one of the world's most at risk countries (11). Three natural disasters with more than 10,000 deaths have occurred in Iran from

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1990 to 2007 (12). Annual average of 4000 reported deaths in Iran have been attributed to disasters in the past decades (12). Recently, Iran's healthcare system has focused on planning and preparing for disaster response, especially in the field of prehospital EMS. However, to date, few empirical studies have been conducted to explore the dimensions of prehospital emergency medical services in disaster situations in Iran. Research on EMS response to disaster can be used for policymaking or changing the method of practice. This study aimed to explore the challenges of prehospital emergency medical services during disaster response in Iran.

## 2. Methods

### 2.1. Study design and setting

This qualitative study was conducted from April 2015 to March 2017. Guidelines provided by Granheim were followed for applying content analysis (13). This is a suitable method when new areas are to be investigated in an explorative manner or if the area needs to be explored from a new perspective (14, 15). Ethical clearance of the study was obtained from the Research Ethics Review Board of the Iran University of Medical Sciences. Verbal consent was obtained and all participants were informed that they could refuse to participate or withdraw from the interviews at any time.

### 2.2. Participants

Purposeful sampling with maximum diversity was used to provide a realistic perspective concerning the EMS response in disasters. The participants of the study consisted of twenty-three EMS professionals; all had at least two prior disaster experiences in prehospital emergency care. The endpoint for sample selection was data saturation, meaning that further data collection failed to provide additional information or new codes were not developed.

### 2.3. Data gathering

Data were collected using in-depth, semi-structured interviews with participants regarding the process of EMS in the affected area. Interviews with the participants started with their experience about emergency medical response to disaster, and according to the interview guidelines, general open-ended questions were asked, for instance "Describe an instance when you participated in disaster response." Then, depending on the context of the responses, the interviewer continued with probe questions such as "Could you explain more?"

The time and location of the interviews were arranged by agreement with the participants. The interviews varied in length from 32 to 63 minutes. All interviews were conducted between April 2015 and February 2017.

### 2.4. Data analysis

Qualitative content analysis was used concurrently with data gathering. Recorded interviews were transcribed verbatim and verified by the participants. During the open coding phase, all the interviews were read several times for immersion, then line by line analysis began and primary codes were extracted. Data were compared for similarities and differences, then labeled and grouped into categories and subcategories. Finally, the underlying meanings were interpreted as themes. In accordance with the methodology of qualitative studies, data processing was performed by the same investigator for all interviews.

### 2.5. Rigor

Trustworthiness of research was established through memos, prolonged engagement with data, constant comparison analysis, maximum variation of sampling, member checks, and peer checks. The findings and interpretations of the study were reviewed by the research team, which consisted of people with experiences in various fields such as disasters, emergencies, public health management and qualitative research.

## 3. Results

23 people, including two nurses, four paramedics, three physicians, two dispatchers, five managers and seven experts in the field of disaster were studied. The participants ranged from 29 to 58 years of age with an average age of  $39.23 \pm 9.1$  years (78.3% male).

Prehospital EMC challenges were classified under six main categories including challenges related to people, challenges related to infrastructure, challenges related to information management system, challenges related to staff, challenges related to managerial issues, and challenges related to medical care.

### 1. Challenges related to people

#### 1.1. Inadequate knowledge about first aid

Laypeople do not have enough first aid knowledge and skills. Their involvement may lead to more serious injuries. As one of the participants stated:

"I saw many injured persons who could have had better physical conditions if laypeople did not intervene." (P9)

#### 1.2. Crowd of people

According to the participants, when disasters happen, many people from other regions move quickly to the affected area. Overcrowding at disaster scene will slow down the relief, medical care and transfer of injured patients. There are also safety concerns due to the unstable environment.

### 2. Challenges related to infrastructure



## 2.1. Communication disruption

Immediately after disaster impact, communication within the affected area as well as outside the region are usually disrupted or jammed due to physical damage to the communication systems or high number of calls made. One of the national managers said that:

“After the east Azerbaijan earthquake in 2012, our communication with the affected area and even Tabriz, which was not affected, was interrupted. There was no information from the affected area for up to 4 hours. We only knew that an earthquake has occurred. I had to go there by car to get information.” (P7)

## 2.2. Difficult access

Usually, after disasters, there is heavy road traffic in the affected area and the surrounding area due to destruction of roads and streets, narrowness of the streets and overcrowding. This will disrupt the EMS. One of the participants mentioned his experience:

“After Bam earthquake all roads were blocked for three days due to heavy traffic. The only way to perform relief operation was by aircraft.” (P6)

## 2.3. Vulnerability of local health facilities

One of the main health challenges in Iran, as the participants stated, is the high vulnerability of health facilities to disaster. Usually after a large or middle-scale disaster, local hospitals are severely damaged and unable to continue their normal daily functions. “In Azerbaijan earthquake, the only local hospital, which had not even been officially opened yet, was unusable due to severe structural and non-structural damage.” (P13)

## 3. Challenges related to information management system

### 3.1. Lack of patient tracking system

Lack of patient tracking system was another challenge mentioned by the study participants. As experienced by the study participants, after the disaster, most casualties are transported to hospitals outside the affected area while there is no system for following up the identity, medical information and location of patients.

“Due to the lack of patient information systems, some families did not know the fate of their family members until several months after the incident and they were looking for them in hospitals in different cities.” (P17)

### 3.2. Lack of integrated hospital information system

There is no easy access to hospital information and capacity at local, regional and national level. This information can facilitate distribution of casualties.

## 4. Challenges related to staff

**4.1. Inadequate skills in the field of disaster** Medical staff and even EMS managers have inadequate knowledge and

skills in disasters.

“Some staff did not know anything about Simple Triage and Rapid Treatment (START) algorithm.” (P6)

**4.2. Safety concerns** The results of this study showed that, safety considerations are not a priority for the medical staff in the disaster response. Also, there is not enough safety equipment available for staff. One manager emphasized that:

“Most staff are trained about safety but they act heroically and emotionally in disaster field. They don't take standard safety precautions, even in a situation that personal protective equipment is available.” (P4)

## 5. Challenges related to managerial issues

### 5.1. Unplanned response

There is no operational plan for managing the evacuation process from the scene to local, regional or national medical centers.

In disastrous events, EMS system tries to transfer patients to the hospitals with daily protocol. This leads to congestion of patients, and dysfunction in EDs.

### 5.2. Limitation of aero medical service

While there are numerous casualties, roads have been destroyed or there is a heavy road traffic, air evacuation is the most important system to transfer numerous casualties to the medical centers. The Iranian medical air fleet is worn out and does not have enough equipment to evacuate numerous casualties. Many cities in Iran also have no airport or helicopter pad. One of the participants mentioned his experience: “The great Bam earthquake in 2003 had two heroes: people and Bam airport. In Bam earthquake, more than 10,000 injured people were taken to other cities by air evacuation.” (P19)

### 5.3. Inefficient resources management

The findings of this study showed that there is no defined process for mobilization and utilization of rescuers at local, regional, and national level. It is chaotic and based on individual decisions. One manager stated that:

“In the response phase of Bam earthquake the number of rescuers was about twice the region's population and most of the resources were used by them.” (P14) And:

“A field hospital with Intensive care unit (ICU) capabilities was set up with limited supplies and no mechanism in place for resupplying.” (P1)

### 5.4. Lack of evaluation system

So far, no system has been designed to assess the performance of various parts of Iran's healthcare system in disasters. To date, assessments have been limited to publication of some inaccurate descriptive data, such as the number of deaths and the number of patients transmitted to hospitals.

## 6. Challenge related to medical care



### 6.1. Focus on traumatized patients

In the healthcare system of Iran, there is a misconception that all disaster patients are traumatic; therefore, there is no preparedness to respond to non-traumatic medical emergencies.

“In the disaster response phase, a large number of patients with diabetes or cardiovascular emergencies need immediate care.” (P8)

### 6.2. Focus on evacuation

Due to lack of Disaster Medical Assistance Teams (DMAT), lack of Advanced Medical Posts (AMP) and presence of unskilled staff, EMS focuses on patient evacuation to the outside area.

## 4. Discussion

In major emergencies and disasters, the capacity of emergency care systems is usually inadequate and it is likely that local community resources get overwhelmed (3, 16). Emergency care may not be available, especially in the early hours after the disaster (17). In this situation, the public can play an important role in providing first aid. Accordingly, some agencies across the world have now provided civilian-based pre-hospital guidelines, public education and exercises for communities (18). The results of our study showed that laypeople in Iran play a confounding role in disaster management. Other studies conducted in Iran have demonstrated that people usually have inadequate knowledge about first aid interventions (19). Nonetheless, they crowd around the scene and perform interventions that may worsen the problems of the injured person (20). Overcrowding may act as a barrier for proper and timely prehospital interventions. In some cases laypeople's involvement and overcrowding around the scenes have led to violence towards EMS staff (21).

Another category of challenges identified by this study was infrastructure disruption. Infrastructure disruption after disasters has also been pointed out by other researchers as a serious challenge (22, 23). Infrastructure plays an important role in the hospital and prehospital emergency medical services in disasters. Management of response teams, coordination between the medical staff, and other rescue teams, deployment of regional and national resources needs sustainable communication, which is usually disrupted in disasters. Difficult access to the affected area was identified as another aspect of infrastructure disruption. After disasters, traffic jam and damage to roads slow down the relief effort.

The last subcategory mentioned as a challenge by the study participants was vulnerability of local health facilities. Similar to other developing countries, previous instances in Iran have shown that local health facilities are damaged during disasters; therefore, patient evacuation to outside the affected area is needed (17, 24). Godschalk suggests that com-

munity infrastructure must be resilient and designed to continue functioning under extreme hazardous conditions (25). The early phase of response is the best chance for influencing health related outcomes. Therefore, early decisions are critical. The present study found that challenges related to information management system can be classified into two subcategories: issues related to patient tracking system and integrated hospital capacity information system.

Patient tracking systems are developed for several reasons, including registering and identifying patients, following up medical conditions, guiding patients' distribution, setting priority for evacuation, locating patients and reuniting family members (26). Disaster experience in Iran shows that there are no integrated hospital information systems to collect, record, and share data about hospitals' capacity and their surge capacity. According to the participants, lack of this system led to inappropriate distribution of casualties between hospitals.

Disaster response is a difficult career to get involved in without extensive experience in certain skill sets such as disaster medicine, triage, coordination, team work, mental health care, communication, and safety. According to the study participants, most Iranian EMS providers have inadequate skills in the field of disaster. For example, in the disaster plan of Iran's healthcare system, the need for activation of Incident Command System (ICS) and Emergency Operation Center (EOC) has been emphasized in the response phase, but many employees do not have enough knowledge, skills and motivation in this regard. Similar findings were seen in some other studies (27). According to the participants, safety concerns must be addressed as a priority of Iranian EMS providers in disasters but they are not sufficiently trained or well-equipped with personal protective equipment.

In Iran's past major disasters, most of the local healthcare facilities were disrupted and EMS was forced to evacuate numerous casualties out of the affected area (28). According to the findings, there were two main problems in providing EMC in disaster situation: first, lack of disaster protocols and second, resource management deficiency. Participants believed that lack of DMATs and AMPs, failure to execute triage, and lack of a plan for distribution of casualties led to chaotic evacuation of numerous casualties and overwhelming capacity of regional hospitals in large scale disasters. Our results correspond to the study by Juffermans J et al. (29).

Bam earthquake showed that aero-medical evacuation is the main and most effective way to transport disaster casualties (30). According to the study participants, Iran's health system does not have enough air-medical ambulances including medical helicopter or medical airplane.

Shortly after the disasters, lots of resources were allocated to the affected area by national and local organizations. The

participants agreed that, there is no evaluation system for resource management, and therefore, inattention to incident leveling, at local, regional and national levels, leads to chaotic allocation of financial and human resources as well as equipment. They believed that many scarce resources are wasted in the response phase of disasters.

It is necessary to assess and report the outcomes and processes of medical response measures in disasters. Assessments can improve emergency medical response (31). Based on the experiences of the participants, there is no indicator for assessment of EMS performance and medical care outcomes.

Based on the participants' points of view, while the EMS plan focused on the trauma, a considerable number of patients are usually non-traumatized patients, including internal, gynecology and psychiatric emergencies. This finding is consistent with the finding of a study by Klein (32). Cases of chronic medical conditions or non-traumatic emergencies do not fit the traditional triage algorithm. All prehospital EMS providers are trained in START algorithm, which is based on trauma situations.

The participants in this study indicated that prehospital emergency plan focuses on evacuation. Lack of DMATs, lack of AMPs and inadequate skills of staff lead to rapid evacuation of all casualties even minor injuries with a "scoop and run" strategy instead of "stay and play". This approach can lead to overcrowding in the EDs and resources being overwhelmed (33).

This qualitative study is one of the few studies gathering the viewpoints of various experts regarding prehospital EMS in disaster in the Iranian context. The findings point to a number of essential areas in need of improvement.

## 5. Limitation

As is the case in qualitative studies, the small number of participants is a limitation of this study, but all participants were experienced and expert and saturation was reached. Constant comparison analysis was also used to validate data. Since this is a qualitative study, it is not reasonable to seek generalizability, therefore, future research is needed in the same field.

## 6. Conclusion

The findings of this study showed that Iran's prehospital EMS has been chaotic in past disasters. Improvement of this process needs infrastructure reform, planning, training and public education.

## 7. Appendix

### 7.1. Acknowledgements

The authors would like to thank all the participants for their contribution to the study.

### 7.2. Author contribution

All authors passed four criteria for authorship contribution based on recommendations of the International Committee of Medical Journal Editors.

### 7.3. Funding/Support

This paper was supported financially by School of Health Management and Information Sciences, Iran University of Medical Sciences (IUMS/ SHMIS: 1394/34).

### 7.4. Conflict of interest

None declared.

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