**Title:** Explaining the Factors Influencing the Time of Arrival of Pre-Hospital Emergency Services to Emergency scenes: A Qualitative Study

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**Abstract**

**Background:** The Time taken for pre-hospital emergency services to arrive at the scene of an accident plays an effective role in saving patients' lives, and identifying factors affecting this time needs to be investigated. Therefore, the present study was conducted to explain the factors influencing the arrival time of pre-hospital emergency personnel at the emergency scenes.

**Materials and Methods:** The present qualitative study was conducted in Shahrekord University of Medical Sciences in 2022 using the conventional content analysis method. Seventeen pre-hospital emergency staff were purposively (inclusion criteria: willingness and ability to express experiences, having at least 6 months of experience working in pre-hospital emergency) selected, and data were collected through in-depth, individual, semi-structured interviews and analyzed using Granheim and Lundman's approach**.**

**Results:** The results included three categories (barriers to care, systemic barriers, and environmental barriers) and seventeen subcategories (human barriers, barriers related to inter-organizational inconsistency, inappropriate urban planning, unsafe care environment, facility and equipment deficiencies, lack of professional staff, and systemic barriers).

**Discussion:** The results of various studies show that a wide range of obstacles, including equipment, human resources, organizational and urban structure, can affect the time it takes emergency personnel to reach the scene of an accident.

**Conclusion:** Effective training and the provision of sufficient manpower to meet regional needs play an effective role in improving the performance of the emergency response system. Coordinating with city managers to improve area and city addresses can significantly reduce the time it takes for personnel to reach the scene of an incident.

**Keywords:** Emergency management, emergency scenes, pre-hospital emergency, staff

## Introduction

Accidents are one of the challenges of today's world, and the deaths caused by them are among the most common causes of death in different countries, including Iran [1]. The high statistics of accidents and subsequent deaths, and disabilities have led to the consideration of the pre-hospital emergency system as one of the most important and inseparable components of the health care system [2]. Trauma patients at the scene of an accident are the primary type of patient requiring prehospital care [3]. In Iran, pre-hospital emergency centers are responsible for transporting the injured and patients from the accident site to the first medical center [4]. Such medical services aim to provide appropriate treatment at the right place and time using available resources [5].

The speed of service provided by prehospital emergency centers plays an essential role in reducing death and disability, especially in the first minutes after an accident [6]. Surveys have shown that with the development of prehospital care, mortality due to hospital trauma will decrease dramatically [7]. In this context, the most important indicator for evaluating emergency care is time. [8]. According to the existing standards for calculating the response time, there can be different bases. Among them, we can mention the time of the first phone call from the caller, the time the operator answers the phone, the time the dispatcher starts talking to the caller, and the time the information is recorded in the computer system for dispatching an ambulance. In these cases, the first phone call is considered to be the start of the time calculation [9,10]. Arriving at the scene of an accident as quickly as possible, caring for casualties at the scene, and transferring them to the hospital are of particular importance and require proper management and supervision. The ambulance, personnel, and equipment play an important role [11]. Arriving on time can be a valuable factor in patient survival and reducing side effects. [12]. Skinner states that a time of less than eight minutes to reach the scene, rescue the sick or injured, and transport them to the hospital is ideal [13]. For many traumas and accidents, such as falls, drowning, burns, and road traffic accidents, there is very little and limited golden time to provide vital services. Therefore, the proper functioning of different parts of this system leads to rapid dispatch and timely emergency care, which can potentially prevent disability and death of the injured [14-16].

The results of various studies on the causes of delays in the pre-hospital emergency mission have pointed to things such as the number of ambulances, equipment, and emergency bases required according to population density. Monsef et al. (2011) stated that the average time for an ambulance to reach a patient's bedside in Gilan was 8 minutes for traffic accidents and 6 minutes for urban accidents [16]. Moradian et al. (2013), in their study aimed at investigating the response time to emergency cases and the causes of delays in the missions of 115 emergency center in Shiraz, stated that reducing the time requires the ability to accurately assess the number of ambulances, equipment, and emergency bases required, taking into account

the population density and people's demands in each urban area [17]. Soltani et al (2011) considered the time required for the presence of the emergency forces of Islam Shahr at the scene of the accident to be 5 minutes, and stated that the variable of the working day did not affect this time and the variable of the type of season had a positive effect [18]. To improve the provision of pre-hospital care, it is necessary to consider regular quality reviews, improvement of equipment, quality improvement of educational curriculum, and treatment protocols [19]. Khorasani-Zavareh et al. (2018) considered the way community members cooperate with the pre-hospital emergency and their involvement in the accident scene and the number and location of pre-hospital emergency facilities, the type and number of ambulances and manpower are among the most important factors in reaching the accident site and the transfer of victims has had an effect [20].

Regarding the challenge of various studies in this field, it should be said that various quantitative studies have examined the time to reach the scene of the accident. These studies play an effective role in determining the position of pre-hospital emergency systems regarding global standards, and various reasons have been stated and examined in this regard. However, few studies have addressed and examined this issue from the perspective of EMS staff who are directly involved in reaching the scene of the accident. In other words, it should be said that in addition to quantitative studies, to reveal as many dimensions of this issue as possible, it is necessary to address the experiences of the staff. Also, given that the qualitative study of this issue can be different under the environmental and structural conditions of different regions of Iran, this study was planned in this specific region with its specific geographical conditions and characteristics.

Considering the importance of the pre-hospital emergency center in providing vital and urgent services to the needy and paying attention to time management, which is one of the main elements of service delivery in these centers and high-quality care, the present study was therefore conducted to explain the factors affecting the arrival time of pre-hospital emergency workers to the accident scene in the emergency centers.

## Materials and Methods

This study was conducted in 2022 using a qualitative method and a conventional content analysis approach. Since the question of the present study was related to the experiences of prehospital emergency workers in the area of factors affecting the time to arrive at the scene of the accident, and due to the lack of sufficient studies in this area, the qualitative content analysis approach was used. Also, due to the lack of a specific model and theoretical structure in this area, conventional content analysis was used [21].

A purposive sample of prehospital emergency staff, communication center workers, and emergency center managers was selected. After obtaining a license from Shahrekord University of Medical Sciences and referring to the emergency management center of the city, we got access to the list of emergency workers at the level of Borujen city. Then, employees who met the entry criteria were selected from different bases in the city. The inclusion criteria were the ability to express experiences, the experience of providing care

at the scene of an accident, or the experience of being involved in the process of personnel arriving at the scene of an accident, having at least 6 months of work experience in the pre-hospital emergency work environment.

Participants entered the study individually and were interviewed. The interview analysis process was conducted simultaneously with the interview process. The analyzed results helped us to conduct sampling in the next steps. This process continued until data saturation was reached. To achieve maximum variation in the sample, participants were selected to ensure maximum diversity in age, educational level, number of years of service, and type of organizational position.

Data were collected through in-depth, face-to-face, semi-structured, individual interviews. The place and time of the interview were determined by the participant's choice and convenience. The interviews took place in the prehospital emergency department. Before conducting the interview, an interview protocol was designed. First, a list of general questions on the subject of the study was prepared. At the beginning of the study, while introducing oneself and stating the purpose of the study and obtaining informed written consent for conducting the study and recording the audio, demographic information of the subjects was obtained. First, the interview process began with open-ended questions (Please describe the process of your dispatch to the scene of the accident. Explain your daily work process.). Following the continuation of the study process and according to the participants' responses, the study continued by asking semi-open-ended questions (What factors are effective in the arrival of pre-hospital emergency personnel to the scene of the accident? What factors facilitate or hinder the arrival of the scene of the accident in terms of management? Describe your experiences in this field. What role does the pre-hospital emergency communication system play in the arrival of personnel to the scene of the accident? Describe your experiences in this field. To increase understanding and deepen the experiences expressed by the participants, probing questions (Please explain more, or what do you mean by this sentence? ") were used. All interviews were recorded in Persian using a voice recorder.

The study data were subjected to analysis by the methodology delineated by Graneheim and Lundman (2004), which entailed the following systematic steps: 1) verbatim transcription of the interviews followed by multiple thorough readings to achieve a holistic understanding of the transcripts, 2) segmentation of the text into condensed meaning units, 3) abstraction of these condensed meaning units and their subsequent designation as codes, 4) organization of the codes into subcategories and overarching categories based on comparative analysis of their similarities and distinctions, and 5) formulation of themes that encapsulate the latent content inherent in the text [21]. In line with the aforementioned procedural steps, the researcher conducted the interviews and engaged in multiple readings of the interview text to grasp its content comprehensively. Subsequently, the meaning units within the interview text were delineated, and coding was executed. The codes were then subjected to comparative analysis and classified based on their

similarities, differences, and thematic content. All interviews were conducted and analyzed by the researcher, with oversight provided by the research team.

Lincoln and Guba criteria were used to increase the methodological accuracy of the research [22]. In this research endeavor, to establish credibility, the transcribed interviews and the derived codes were submitted to the participants for their evaluation regarding the accuracy and comprehensibility of the content (member check). Furthermore, an effort was made to implement sampling that encompassed maximal diversity. To ensure dependability within this study, a research audit, which entails a comprehensive assessment of the data conducted by an external observer, was employed to bolster the stability of the research findings. The prolonged engagement of the researcher with the data, as well as the application of pre-determined solutions for the participants, were also integral to this process. To achieve confirmability in this investigation, all phases of research, including data collection, analysis, and the construction of subclasses and categories, were thoroughly documented to facilitate verification by external parties. In pursuit of transferability, an effort was made to incorporate a diverse array of perspectives and experiences from various participants regarding the same phenomenon while maximizing diversity in the sampling process. Additionally, transferability was further enhanced by presenting comprehensive and detailed findings supported by relevant quotations.

## Results

The interviews with the participants were conducted over 5 months. Seventeen interviews were conducted individually and face-to-face with 17 participants. Interviews continued until data saturation, with no new data or categories being obtained. Data saturation occurred after interview 15. Two more interviews were conducted to ensure data saturation. The average duration of each interview was 20 minutes. To manage the data, MAXQDA software version 10 was used. The characteristics of the participants are shown in Table 1.

**Table 1. A** summary of the participants' demographic characteristics**.**

| Number | Age (years) | Work experience (years) | Degree of education | Organizational position |
|---|---|---|---|---|
| 1 | 43 | 18 | MSc | Management |
| 2 | 42 | 18 | MSc | Management |
| 3 | 45 | 22 | BS | Management |
| 4 | 36 | 10 | BS | Clinical expert |
| 5 | 35 | 9 | BS | Clinical expert |
| 6 | 26 | 4 | BS | Clinical expert |
| 7 | 43 | 19 | BS | Management |
| 8 | 45 | 22 | BS | Management |
| 9 | 35 | 10 | BS | Clinical expert |
| 10 | 37 | 12 | BS | Clinical expert |
| 11 | 43 | 18 | BS | Clinical expert |
| 12 | 32 | 10 | BS | Clinical expert |
| 13 | 33 | 10 | BS | Clinical expert |
| 14 | 35 | 12 | BS | Clinical expert |
| 15 | 28 | 7 | BS | Clinical expert |
| 16 | 50 | 25 | BS | Clinical expert |
| 17 | 25 | 3 | BS | Clinical expert |

The results of the study include three categories (barriers to care, systemic barriers, and environmental barriers) and seventeen subcategories (human barriers, barriers related to inter-organizational inconsistency, inappropriate urban planning, unsafe care environment, deficiencies in facilities and equipment, insufficient specialized human resources, barriers related to the system). The categories and subcategories of the study are shown in Table 2.

**Table 2.** Category and subcategories and examples of the codes.

| Category | Sub-categories | Examples of the codes |
|---|---|---|
| Interfering factors in care | Human barriers | People's false requests and telephone harassment |
| | | It is time-consuming to justify the companions to provide a specific type of care |
| | | Involvement of other people on the scene in providing care |
| | Barriers related to inter-organizational inconsistency | Lack of uniform protocol for coordination between aid agencies |
| | | Lack of clarity in care management between different organizations |
| | | The lack of awareness of some of the personnel of the organizations regarding the provision of care |
| Environmental barriers | Inappropriate urban planning | Lack of awareness of drivers in dealing with emergency ambulance |
| | | Lack of clear addresses in some streets and alleys |
| | | Inability of some streets to pass emergency ambulance |
| | Unsafe care environment | Endangering the lives of personnel by the patient's companions |
| | | Unforeseen environmental hazards (debris, slippery road, fire) |
| Systemic barriers | Deficiencies in facilities and equipment | Lack of ambulance spare parts |
| | | Lack of GPS system in some areas |
| | | Disturbance in the client's mobile phone lines when making calls to dispatch |
| | Insufficient specialized human resources | Lack of specialized trained personnel |
| | | Inadequate driving skills of new personnel |
| | | Lack of awareness and sufficient experience of some personnel in providing service |
| | Barriers related to the system | Lack of dispatch system in some areas locally |
| | | Lack of familiarity of dispatch personnel with local places |
| | | Dispatch operator's lack of mastery of the local dialect of the clients |

**(A) Interfering factors in care**

This category refers to the factors that, due to human obstacles and the inconsistency between different participating organizations, disrupt the process of providing care at the scene and the time of providing care to patients and injured people is disrupted.

**1. Human barriers**

Pre-hospital emergency workers reported that obstacles created by other people can act as a barrier to care and delay the delivery of care. These barriers include telephone interruptions, which can waste time and disrupt the provision of care to people who need it. Issues such as a lack of awareness on the part of the person in need of care of the correct way to address them, and resistance on the part of the patient's companions and those present at the scene, can prolong the arrival of staff at the scene and also the provision of care.

"The wrong address of people makes us spend a lot of time finding the place of the accident, and we lose time..." (36 years old, Expert).

"Some telephone intruders cause the emergency line to be occupied, and the service to patients who need help is delayed" (43 years old, Management).

2. **Barriers related to inter-organizational inconsistency**

One of the things that can interfere with the delivery of care and prolong the time of delivery of care is the obstacles related to the inconsistency between the organizations involved in the delivery of care on the ground. The lack of the same protocol between the aid organizations, the lack of the same management between them, and the lack of knowledge in the field of patient care cause interference between these organizations and prolong the time of providing care.

"The other relief organizations on the scene were doing their own thing. I expected them to respect our opinion" (36 years old, Expert).

"Many times, the presence of different rescue services at the scene of an accident does not help us... because there is no uniform operating manual for them." (50 years old, Expert).

**(B) Environmental barriers**

This category refers to inappropriate urban design as a significant factor in the arrival of prehospital emergency services at the scene of an accident, and an unsafe environment for care, which prevents emergency services from calmly providing care and therefore prolongs the time it takes to provide care.

**1. Inappropriate urban planning**

The participants stated that the poor state of the roads and some streets makes it difficult for ambulances to move. The lack of awareness on the part of other drivers in the face of an ambulance on a call and heavy traffic, as well as the lack of clear street and alley addresses, also delays the arrival of paramedics.

"Sometimes we have to look for the address for a long time when we arrive at the scene. Sometimes some streets do not have specific addresses" (33 years old, Expert).

"There was an address where there was no car at all, and we had to go a long way and waste our time" (43 years old, Expert).

**2. Unsafe care environment**

Staff experience has shown that conditions such as an unsafe and difficult traffic environment for the ambulance to arrive at the scene and unforeseen risks caused by the environment or the nature of the incident can make the environment unsafe for service delivery and cause delays in service delivery.

"When we arrived at the scene of the accident, we were threatened by the companions of the patient, who were worried about the patient's life; this is not the way to work" (25 years old, Expert).

"Sometimes, when there is an accident, we are threatened by the risk of the car exploding, and in this situation, we cannot provide services quickly" (28 years old, Expert).

**(C) Systemic barriers**

This category refers to the three cases of people, management and facilities in health systems that cause time delays in providing care and arriving at the scene of an accident.

**1. Deficiencies in facilities and equipment**

Emergency personnel announced that the existence of some outdated facilities and ambulances, as well as the lack of spare parts, make it difficult to provide timely service. The low speed and sometimes intermittent nature of the Internet, the lack of a GPS to reach the scene of an accident, and the disruption of telephone lines are also among the problems that generally delay workers from reaching the scene of an accident on time and providing services.

"Some parts of ambulances are expensive or rare, which reduces the number of ambulances available and leads to a reduction in service and an increase in delivery time" (43 years old, Management).

"In some cases, internet failures cause problems in our systems and delay arrival at the scene" (42 years old, Management).

**2. Insufficient specialized human resources**

Another systemic obstacle that increases the time to reach the scene of an accident is the lack of specialized personnel to provide care. The lack of EMS personnel, the inexperience of new personnel

in driving and providing services to patients at the scene of an accident, and the fear of personnel about the speed of action in reaching the scene of an accident can delay the arrival of EMS personnel at the scene of an accident.

"In one scene, my new colleague, who was inexperienced in driving, delayed our arrival at the scene" (43 years old, Expert).

"Because I had an accident once and paid a lot of money for the ambulance repair, I try not to drive fast anymore. This delays our arrival at the scene of the accident" (37 years old, Expert).

**3. Barriers related to the system**

The pre-hospital emergency responders identified some barriers, such as the lack of a local dispatch system in some cities, the lack of familiarity of the central dispatchers with local locations and addresses in some cities, and the lack of mastery of the local dialect of the dispatchers. This can delay the arrival of pre-hospital emergency services at the scene of an accident.

"Some of the local addresses could not be identified by the Dispatching Expert, resulting in a delay in the dispatching of resources" (45 years old, Management).

"The Dispatch Expert's lack of control over the caller's location disrupts dispatching the closest resources to the scene" (37 years old, Expert).

## Discussion

The present study aimed to explain the factors that influence the arrival time of pre-hospital emergency services at the scene of an accident. The results showed that factors such as interfering factors in care, systemic barriers, and environmental barriers can affect the arrival time of prehospital paramedics at the scene of the accident.

Bidari et al, in a study designed to evaluate the performance of Tehran's prehospital emergency department in patients transferred to Hazrat Rasool Akram Hospital, found that the average arrival time of emergency services from the emergency department to the scene of the accident was 12 minutes. It also showed that to improve pre-hospital care, factors such as regular quality review, improvement of equipment, quality improvement of training curriculum, and treatment protocols need to be considered [19]. Moradian et al, in their study of the causes of delays in the response of Shiraz emergency center, found that attention and planning should be given to the number of ambulances and equipment according to the needs of each region [17]. Panahi et al. in the investigation of the performance of EMS rooms in the field of children in Tehran showed that, according to the type of disorders considered in children, the training of personnel in the field of internal problems and children should be given special attention. In addition, the average time to reach the accident site was reported as 15.1 minutes in this study [23]. Haghani and Sadeghi also stated that people who enter the profession of pre-hospital emergency do not have the necessary educational sufficiency corresponding to this profession, and the necessary attention should be paid in the process of special training

of students of this field [24]. Turner et al. also highlighted the deficiencies in training and experiential knowledge, as well as the inaccuracies in assessment and decision-making processes among pre-hospital emergency personnel [25]. Dianti et al. further underscored the imperative of focusing on the cognitive understanding and practical efficacy of EMS responders concerning issues pertinent to their profession [26].

According to the results of these studies, it should be said that the limitations in the knowledge and performance of prehospital emergency personnel were emphasized in these studies. In the current study, one of the barriers that caused the delay in arriving at the scene of the accident was the lack of knowledge and experience of the personnel. Lack of specialized knowledge, as well as factors of inexperience, cause a person to not be able to play their role well and quickly, and therefore delays in the provision of care occur.

To reduce these barriers, as suggested by these studies, it should be said that paying attention to the quality of education of prehospital emergency students, expanding and improving the status of in-service education in line with current evidence, as well as using a combination of experienced individuals in staff shifts, and also paying attention to the role of mentors at the beginning of the service of less experienced staff can play an effective role in addressing the educational and clinical experience deficiencies of staff.

In a qualitative study, Bayrami et al. identified factors such as individual characteristics of staff and staff dissatisfaction, structural challenges, lack of equipment and human resources, and socio-environmental and cultural challenges as challenges in prehospital emergency care [27]. Eri et al. delineated the obstacles associated with delivering services in the prehospital emergency department of Golestan province, categorizing these challenges into organizational, individual, and extra-organizational issues. The scholars elucidated that the organizational challenges predominantly pertain to domains such as management, human resources, and equipment, whereas the individual challenges are primarily related to the motivation of employees. Within the extra-organizational sphere, difficulties concerning public attitudes, as well as deficiencies in knowledge and collaboration with other organizations, have been documented [28].

When the results of these studies are examined and compared, it is clear that many of the factors identified as challenges to prehospital emergency care are, in fact, the same factors that affect the arrival of personnel at the scene of an accident. Organizational, managerial, and equipment factors, as well as people's knowledge and attitudes, which were identified as challenges, are factors that can affect the time it takes to reach the scene. To reduce these factors, various studies have pointed to issues such as expanding knowledge and improving the general public's attitude regarding the duties of EMS personnel. Upgrading the organization's facilities and equipment in line with global standards can be effective in addressing obstacles.

Bahrami et al. mentioned things like a lack of manpower and ambulance equipment that can reduce the effectiveness of the response [29]. Firozbakht et al. also suggested that we should improve the care they provide by enacting appropriate legislation to protect prehospital emergency personnel [30]. In their study, Motie et al. also introduced factors such as lack of manpower and lack of facilities as factors affecting the quality of care provided by them, in addition to stress in the staff [31].

According to the results of the mentioned studies, the factors related to manpower and equipment can affect the quality of care, in addition to the effect on the employees. In our study, these factors were expressed as time barriers to reach the scene of an accident.

One of the limitations of this study is the lack of generalizability of the results. This is a qualitative study and was conducted in a specific context, and as a result, the results cannot be generalized to other systems in other places.

## Conclusion

Participants' accounts of their experiences showed that several factors, including barriers to care, systemic barriers, and environmental barriers, can affect the arrival of EMS at the scene of an accident.

Given that many of the existing obstacles require interdisciplinary cooperation, it is recommended that senior managers and politicians take important steps by establishing joint working groups between the health system and other systems involved in this issue, as well as allocating appropriate budgets and planning for professional development and equipment upgrades.

It should be noted that, because of the importance of the time taken by employees to reach the scene of an accident, the performance of the emergency system should be monitored regularly by senior managers. This monitoring plays an effective role in identifying the factors and obstacles that effectively increase the time it takes for employees to reach the site of an accident. Many of the above cases require human resource management. Effective training while serving and providing sufficient force according to regional needs plays an effective role in improving the practice of EMS. Therefore, managers and planners of the EMS are advised to consider the necessary planning to attract sufficient forces to provide timely service to the patients. Also, with the necessary training, while serving to improve the quality of care provided at the accident scene, they must be guaranteed.

Regarding the study site, it should be said that due to the mountainous location and the impassability of some of the city's roads, the increase in the time it takes for personnel to reach the scene of the accident is justified. But even so, the necessary plans for access to hard-to-reach areas should be done by the urban management organization. Coordinating with city managers to improve the space and city addresses can reduce the time employees take to arrive at the scene of the accident. Therefore, city managers at the macro level are advised to plan and take necessary measures to remove urban obstacles and also ensure the

transparency of city-level addresses, which is an important obstacle in the timely arrival of emergency staff to the scene of the accident. It is also recommended to city managers that by considering special traffic lines for relief systems in the city and crowded places, they can remove many urban obstacles. Also, to match the aid delivery to the accident site by different organizations, it is recommended to develop the same aid protocols agreed upon by different aid organizations. In this regard, it is recommended that for the cooperation of different relief organizations, one organization should be in charge and be responsible, and have the role of guiding other organizations at the scene of the accident. Also, to remove the cultural barriers of the patients, which in many cases can prevent emergency services from taking timely action on the scene and also reaching the accident site, it is recommended to conduct public training through various media. Familiarizing the general public with the process of providing care as well as the process of sending to the place can help in removing many obstacles.

## Ethical considerations

Before conducting the study, the code of ethics (IR.SKUMS.REC.1401.104) was obtained from Shahrekord University of Medical Sciences. The ethical tenets of agency, autonomy, and confidentiality were meticulously evaluated throughout the research. Written informed consent was obtained before the interview was conducted, and consent was also obtained for audio recording during the interview. They were assured of the confidentiality of their information and of their right to withdraw from the study at any time.

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**Authors' contributions**

**Conflict of interest**

There was no conflict of interest in this research.

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