

ASSESSMENT OF HOSPITALS PREPAREDNESS IN ROAD TRAFFIC CRASHES WITH MASS CASUALTY: THE CASE OF IRAN

Shiva Yousefian¹, Sanaz Sohrabizadeh^{2, 3}, Meysam Safi-Keykaleh⁴, Zahra Eskandari⁵,
Farshad Faghisolouk⁶, Hamid Safarpour^{7, 8}

¹National Emergency Medical Organization, Ministry of Health & medical education, Tehran, Iran

²Air Quality and Climate Change Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

³Department of Health in Disasters and Emergencies, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran

⁴Nahavand School of Allied Medical Sciences, Hamadan University of Medical Sciences, Hamadan, Iran

⁵Department of Medical Emergencies, School of Nursing, Alborz University of Medical Sciences, Karaj, Iran

⁶Social Determinants of Health Research Center, Clinical Research Institute, Urmia University of Medical Sciences, Urmia, Iran

⁷Non-Communicable Diseases Research Center, Ilam University of Medical Sciences, Ilam, Iran

⁸Department of Nursing, School of Nursing and Midwifery, Ilam University of Medical Sciences, Ilam, Iran

Abstract

INTRODUCTION: Road traffic crashes (RTCs) annually cause about 1.35 million deaths and 20–50 million injuries. Hospitals have the main role in responding to road traffic injuries (RTIs) and decreasing the number of disabilities and deaths.

This study aimed to assess the preparedness of selected Iranian hospitals in responding to road traffic crashes with mass casualties.

MATERIAL AND METHODS: This cross-sectional study was carried out among 13 hospitals in four provinces including Tehran, Alborz, West Azerbaijan, and Hamedan in 2019. The valid and reliable questionnaire of hospital preparedness assessment in RTIs was used for data collection (Kappa coefficient = 0.89; CVR: 0.98; CVI: 0.97). Using SPSS 16, the level of hospital preparedness was categorized into three parts as weak (less than 34%), moderate (34–66%), and high (more than 66%).

RESULTS: Preparedness of the selected hospitals was at a moderate level (= 65.25%). Although the level of preparedness in the aspects of command and control (72.7%), safety and security (71.54%), infrastructure and medical equipment (74.12%), and coordination (71.15%) was satisfactory, hospitals were weak in the training and exercise aspect (48.46%). The level of access to specific equipment needed for responding to trauma injuries was high (79.56%).

CONCLUSIONS: Based on the findings, a response plan is required to make hospitals more prepared to respond to road traffic injuries. The plan may include training and development, as well as health facilities preparedness in terms of structure, equipment, and human resources. In addition, assessing the effectiveness of all response plans requires exercise and practice.

KEY WORDS: preparedness; mass casualty; road traffic injuries; prehospital; Iran

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ADDRESS FOR CORRESPONDENCE:

Hamid Safarpour, Department of Nursing, School of Nursing and Midwifery, Ilam University of Medical Sciences, Ilam, Iran
e-mail: h.safarpour@sbmu.ac.ir

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INTRODUCTION

According to the report of the World Health Organization (WHO) (2018), annually, road traffic crashes (RTCs) cause 1.35 million deaths and 20–50 million injuries [1]. RTCs are the most common cause of death in low and middle-income countries; as more than 90% of such deaths occur in these countries [1]. In Iran, the rate of RTCs is higher than the world average [2, 3]. The report of WHO 2017 indicated that 32.1 people per one hundred thousand died in traffic accidents in 2013, which is the highest in the Middle East region [4]. RTCs are one of the major risk factors and causes of disease and disability in Iran. The rates of disability and death due to RTCs are growing among adolescents and youngster [5]. Depending on the number of casualties and their severity, they may affect the resources of the health system such as staff and equipment and disrupt health programs [6, 7].

Hospitals, as the vital element of the health system and the most involved organization in responding to emergencies and disasters [8, 9] should provide effective and continuing services [10]. Hospitals are the most important places to respond to such incidents and emergencies that result in hospitals overcrowding and overload [11]. The preparedness of hospitals to provide proper responses is one of the main concerns of WHO [12–14]. Studies showed that hospitals are not fully prepared for dealing with disasters and the operational impairment of hospitals has been reported many times [15–17]. RTCs are one of the main public health concerns in Iran. Knowing about the preparedness level of hospitals with RTCs can help to better planning, preparedness, and response in the future. However, there are not enough studies about the level of hospital preparedness in RTCs with mass casualties.

Objectives

The present study was aimed to assess Iranian hospitals' preparedness in RTCs with mass casualties.

MATERIAL AND METHODS

Study design

This was a descriptive cross-sectional study.

Sampling method

The convenience sampling method was used in this study. Hospitals were selected from provinces with

a higher rate of RTCs based on the report of the Iranian Legal Medicine Organization (ILMO).

Setting

A cross-sectional study was conducted in 2019 in selected hospitals of four provinces of Iran including Tehran, Alborz, Hamedan, and West Azerbaijan. Finally, a total of 13 hospitals were studied.

Data collection

The data was collected by an assessment tool. The tool was made by the researchers previously in another study [18]. Its validity and reliability were evaluated and confirmed (Kappa coefficient = 0.89; CVR: 0.98; CVI: 0.97). Accordingly, the preparedness aspects assessed in this research include command and control; infrastructure and medical equipment; communication and information systems; surge capacity; triage and medical services; safety and security; human resources; coordination; training and exercise, and specific equipment needed for the treatment of RTCs including airway management, blood circulation, head trauma, spinal cord injury, and limbs, chest and abdomen injuries, burns and wounds. Based on the tool, the level of hospital preparedness was categorized into three parts weak (less than 34%), moderate (34–66%), and high (more than 66%).

Data analysis

The collected data were analyzed using SPSS statistical software 16. Descriptive statistics (frequency distribution and mean) were used for analysis. The obtained scores were calculated as percentages and considered the model of classifying hospitals' safety situation in Iran called Farsi Hospital Safety Index (FHSI). The hospital's preparedness situation in RTCs was classified into three levels: poor (> 34%), moderate (34–66%), and high (> 66%) [19].

RESULTS

The information of selected hospitals has been illustrated in Table 1. The average bed occupancy ratio in these hospitals was 84% (Tab. 1). Based on the findings, the total preparedness of the hospitals was at a moderate level (65.36%). A number of 7 hospitals had 66% preparedness and 6 hospitals had a moderate preparedness level with scores ranging between 34% and 66%.

Province	Hospital	Number of beds	Number of beds in emergency unit	Bed occupancy
Tehran	A	594	35	83%
	B	450	45	100%
	C	250	10	75%
Alborz	D	300	30	90%
	E	478	54	100%
	F	100	13	70%
West Azerbaijan	G	526	67	96%
	H	218	16	85%
	I	160	20	87%
Hamadan	J	160	12	76%
	K	160	20	75%
	L	96	12	67%
	M	400	40	86%

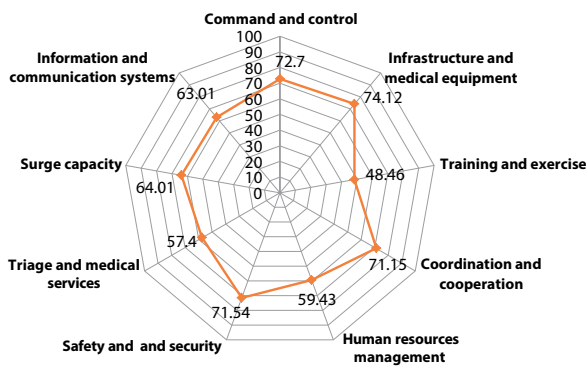


FIGURE 1. Preparedness of selected hospitals in the event of Road Traffic Injuries in terms of nine dimensions

The findings showed that all hospitals had a high level of preparedness in three dimensions of safety (71.54%), infrastructure, medical equipment and supplies (74.12%), as well as coordination (71.15%). The moderate level of preparedness was attributed to the aspects of training and practice, capacity building, communication and information, human resources management, and triage and medical services (Fig. 1).

The hospital M located in Hamedan had the highest level of preparedness (with the score of 82.9%). This hospital in all preparedness dimensions had a satisfactory situation. Hospital C in Tehran was at the lowest level of preparedness (with the score of 43%). The preparedness of this hospital in the

dimension of safety was acceptable, in the dimension of triage and training was weak, and in other dimensions at the average (Tab. 2).

The preparedness level of the selected hospitals in terms of equipment needed for the treatment of RTCs was satisfactory (with a score of 79.56%). Being a trauma center, hospital D had 100% of the equipment and supplies needed for the treatment of the injured. Hospital H located in West Azerbaijan Province, lacked some of the necessary equipment (with the score of 55.1%) and was scored at a moderate level. Major shortages were in the dimensions of head, neck and spinal cord and chest and abdominal injuries. In the studied hospitals, access to the equipment needed for the airway management system was optimum (scored 92.24%) and access to the equipment for the treatment of head and neck trauma, spinal cord, and abdominal and thoracic injuries (with the score of 68.64%) was the weakest (Tab. 3).

DISCUSSION

Based on the findings of this study, the overall preparedness level of selected hospitals in RTCs with mass casualties were in a moderate level. Given the average scores obtained in the hospitals studied, hospital preparedness was high in the dimensions of command and control, safety and security, coordination, infrastructure, as well as medical equipment and supplies. However, they had a poor function regarding training and practice. In other fields of assessment, the level of hospital preparedness was moderate. The studies on the preparedness of Iranian hospitals showed different results; poor [20–22], moderate [8, 9, 23–29] and high [11, 30–33].

Studies in other countries, especially in developed countries, show higher levels of preparedness of their hospitals compared to Iranian hospitals [29]. A study conducted in 27 European countries showed that 68% of hospitals were categorized as acceptable (66–100%). The highest level of preparedness was in England, Lithuania, and Luxembourg [34]. The reason for these differences might be the use of different methods of assessment, and different locations and times of study. Although there is an "All Hazard approach" to disaster response planning, some disasters, such as RTCs, require more attention than others, so having a proper assessment checklist provides a good opportunity to plan and respond effectively to the disasters [18].

Table 2. Preparedness of selected hospitals in Road Traffic Crashes in terms of studied dimensions

Hospitals Dimensions	Preparedness percentage													Mean of preparedness	Preparedness level
	A	B	C	D	E	F	G	H	I	J	K	L	M		
Command and control	72	72	39	77.7	72	61	62.9	74	70.3	83.3	88.8	77.7	94.4	72.7	High
Communication and information systems	50	75	38	81.2	75	75	62.5	75	54.1	50	61.1	50	72.2	63.01	Average
Surge capacity	83	67	50	83	29	58	77.7	41.6	38.8	70.8	83.3	66.6	83.3	64.01	Average
Triage and medical services	92	73	31	57	53	34	66.6	41	71.8	65.4	46.1	38.4	76.9	57.4	Average
Safety and security	70	80	80	90	70	60	60	40	50	90	80	80	80	71.54	High
Human resources management	61	83	39	83	50	55	66.6	33.3	40.7	83.3	72.2	33.3	72.2	59.43	Average
Coordination and cooperation	50	100	50	75	50	50	50	25	75	100	100	100	100	71.15	High
Training and exercise	30	40	30	50	20	30	50	30	60	90	100	20	80	48.46	Average
Infrastructure and medical equipment	75	92	58	88	76	83	85	63.3	73.3	65	72.5	45	87.5	74.12	High
Sum	67.9	75	43	76.2	55.1	55.7	69.8	51.2	59.6	77.5	78.2	56.4	82.7	65.25	Average

Table 3. Preparedness of selected hospitals in the event of Road Traffic Crashes in terms of special equipment needed for the treatment of the injured: 2019

Hospitals Dimensions	Preparedness percentage													Mean of preparedness	Preparedness level
	A	B	C	D	E	F	G	H	I	J	K	L	M		
Airway management	97	88.2	94.1	100	94.1	94.1	97	58.8	67.6	100	100	82.3	100	90.24	High
Circulation	78.6	89.3	75	100	100	82.1	96.4	64.3	75	100	92.8	96.4	100	88.45	High
Limbs trauma	35	100	100	100	95	90	100	50	50	100	80	85	85	82.3	High
Head, neck, and spinal cord trauma	57.1	100	64.2	100	64.2	64.2	100	42.8	57.1	100	21.4	21.4	100	68.64	High
Burns and wounds	50	100	50	100	83.3	83.3	100	66.6	66.6	100	75	75	100	80.75	High
Chest and abdominal trauma	85.7	100	14.3	100	85.7	78.5	100	42.8	57.1	78.5	42.8	28.5	78.5	68.64	High
Total	67.2	96.7	66.3	100	82	78.4	98.1	55.1	66.4	96.7	68.8	64.7	93.9	79.56	High

In the current study, the level of preparedness of hospitals in the command and control dimension was rated as satisfactory (72.70%), which is in line with the results of a 2012 study [35]. Although im-

portant steps have been taken to develop a response plan and to design an incident command system in the selected hospitals, there are still deficiencies in the communication, review and updating the plan,

the allocation of sufficient financial resources for the successful implementation of the plan as well as training the members of the incident command system. It has been addressed in other studies [22, 27, 36, 37]. In the dimension of command and control, the response plan, which is considered one of the most important issues [30], is one of the requirements of hospitals for efficient and effective response to emergencies and disasters [38–40]. Allocating sufficient resources to the treatment of mass casualty in hospitals is important for policy makers [41, 42], this program should be assessed and reviewed through planned exercises [40, 43]. Therefore, as a single plan cannot be useful for all hospitals in the country, each hospital should consider designing, implementing, and evaluating its response plan based on its own situation, including environmental conditions, and human resources [44].

Since in responding to mass casualty, the preparedness of communication system including human communication and staff recall is essential [45], this study addressed the communication systems, programs, and systems of alerts and calls and other related aspects. The results of this study showed that the level of hospital preparedness in this dimension is average (63.01%). In other studies, the preparedness of communication systems in the hospitals of Bushehr and Tehran was confirmed [25, 27, 46]. The highest level of preparedness of communication and information systems among the studied hospitals was at hospital D in Alborz province (81.25%). This level of preparedness in Alborz province centers was due to the December 2006 earthquake in which all hospitals were required to upgrade their communication and information systems.

Hospital authorities should plan and prepare alternative communication systems at the time of disasters and emergencies [22, 47]. Although, hospitals, especially in major cities, developed guidelines for alternative communication systems in emergencies, there are still shortcomings. Adequate resources, facilities, and equipment should be provided for better inter- and intraorganizational communication [22], surveillance system to mitigate the effects of disasters need to be addressed. Local governments play an important role in this system to effectively allocate resources [48].

According to the findings of this study, the coordination of selected hospitals with other hospitals and related organizations was in good condition. In most hospitals studied, co-operation agreements

have been considered. Although studies have not specifically assessed the status or absence of co-operation agreements, they have acknowledged its importance. Thus, the proper response at the time of disasters is considered to require cooperation agreements between the hospital and the pre-hospital emergency unit, fire department, Red Crescent, and the police [6]. The necessity of cooperation agreements has also been emphasized in the evaluation studies of hospitals outside Iran, as only 3% of hospitals in the study aimed at assessing the preparedness of 13 hospitals in Saudi Arabia lacked an agreement [7]. However, in one study in the United States, of the 45 hospitals studied, few hospitals had a cooperation agreement with a hospital (20%) or long-term care center (7%) [14].

In the present study, the preparedness of hospitals in the field of safety and security was assessed, and the results showed that the preparedness of selected hospitals was 71.54%, which is an acceptable condition, and higher than what other studies concluded [22, 25, 27, 49, 50]. The reason might be the more attention of authorities to developing security guidelines [22]. Hospital D in Alborz Province and Hospital J in West Azerbaijan Province have the highest score (90%). Being the province's trauma center and hospitals, more multi-trauma patients are referred to them. Sometimes, conflicts occur between patients, their families, and medical personnel, so authorities focused more on safety and security in recent years. Despite being acceptable, there are still access deficiencies with sufficiently trained security personnel and the need to take measures to control the congestion and traffic of vehicles around and within service centers.

Human resources play an important role in making the hospital prepared for responding to disasters. In the present study, the status of hospitals' preparedness in the dimension of human resources management was 59.43%, which is at the average level. The findings of this study are in line with studies conducted nationally and internationally. They all identified the failure of hospital staff training systems in the face of RTCs with mass casualty and the lack of sufficient financial support to training programs [7, 20, 36, 40, 50–55]. Based on the results of this study, despite having educational programs, the awareness of the personnel on disaster management is low, which has been emphasized in other studies [14, 22, 56]. Considering joint training programs and exercises with other hospitals

and organizations will improve staff preparedness for disasters [7, 22, 25, 50, 55, 57–63]. Moreover, stress management programs especially in surgical, emergency, and intensive care units are essential. The stress level increases by up to 45% in times of crisis [22, 46, 47, 64].

Surge capacity, which is defined as maximizing the ability to increase resources to address patients' needs in disasters [65], is one of the most important issues that should be addressed in hospital preparedness. In the present study, the preparedness of hospitals in the field of capacity building was estimated as 64.01% (at moderate level). Hospital E had the least preparedness score in capacity building due to the inappropriate increase of beds and the privatization of some wards. In addition, the head of the committee on disaster management had no relevant education and work experience. The committee has not prepared any plans for disaster management to be consulted by senior hospital officials. Although capacity making is important and hospitals are required to apply different methods of capacity building [53], there is no plan for capacity making in the face of RTCs with mass casualty. The performance of hospitals in calculating the maximum capacity for patients' admission suitable (such as beds, human resources and essential supplies, equipment and supplies) was not enough. Not having a detailed plan for the hospital's capacity building at the time of the accident has also been indicated in national and international studies. Hospitals fail to design and implement a systematic process for capacity building [14, 38, 42, 53, 65–67].

In terms of infrastructure and medical equipment, the preparedness of studied hospitals was rated as good with 74.12% score which was similar to the findings of other studies [14, 24, 46, 64]. One of the most important aspects of hospital preparedness is having the necessary infrastructure such as beds, a proper triage dimension, a proper parking lot and ambulance service, and various types of places for treating and caring the injured [67]. All these aspects were evaluated in the present study; the results showed that hospitals have different levels of preparedness with regard to this dimension. The reasons could be the difference of hospitals as being academic or non-academic, trauma center or general, specialized and public hospital [11, 37].

In the dimension of triage and medical services, the preparedness of the hospitals studied was at an average level of 57.4%. In order to triage the injured,

trained staff and triage facilities are required. Due to resource constraints and the increase of the number of patients in the event of disasters, the management of resources is important [45, 68]. In the present study, three sub-categories of triage, namely, adequate space for entry and exit for triage, triage guidelines for potentially contaminated chemicals (transported by road transport system), and protocol for black triage (deceased) identification processes were not satisfactory in the studied hospitals. Study of Elsid and Gstrom identified the necessity of skilled staff, adequate facilities, and for triage [45, 68]. In addition, the findings of the study showed that hospital triage at the time of accidents and disasters is not based on guidelines and standards, which has been emphasized in other studies [69, 70].

Among the studied dimensions, training received the lowest score (48.46%). Despite training and empowerment programs, maneuvers and exercises in the hospitals studied the training for responding to RTCs with mass casualty and the role and duties of staff in dealing with such accidents are not enough. Scheduled maneuvers and exercises [71] (at least twice a year) in collaboration with other involved organizations, as well as the development of quality improvement programs related to trauma are necessary.

The studied hospitals were in good condition in the dimension of specialized resources and equipment (with the score of 79.56%). Hospital D in Alborz province was the best in this dimension of assessment with a score of 100. This hospital is a trauma and training center. It specially trains emergency medicine specialists and has the equipment, expertise, and specialties needed for trauma management. The lowest score was for the dimension of equipment needed to manage cervical and spinal cord injury and abdominal and thoracic trauma (with the score of 68.64%). National studies are short of information on hospital equipment, but studies in China have acknowledged the inadequacy of equipment needed to respond to emergencies [72–74].

Limitations

One of the limitations of this study was the limited number of studied hospitals, but considering that all hospitals were affected by disasters, this study can be performed at any hospital. The tool items were rated in three categories as "Yes", "Somewhat" and "No" and thus there was no opportunity to ask

the participants about their experiences on how hospitals preparedness systems works. On the other hand, it was difficult to access information on the efficiency and effectiveness of the response plans, training programs, and communicates and coordinates in the form of inter-agency agreements.

CONCLUSIONS

Due to the high level of RTCs in Iran and the moderate level of hospital preparedness, promoting the quality of health care centers should be an essential strategy for managers and policymakers. Response plan for different hazards such as RTCs and training and updating programs enable hospitals to provide the highest quality of service and avoid confusion. It is recommended that general and non-traumatic hospitals be provided with the equipment needed to manage injuries so that they can reduce the burden of injured in trauma centers. Hospital preparedness can be achieved by practicing, exercising, and evaluating. In this regard, the use of national preparedness assessment checklists, such as the checklist used in this study and exercise assessment provide the opportunity to identify strengths and to improve work plans and processes. This information will help decision making and allocation of resources and equipment. Planning for the proper response to the human consequences of RTCs and to prevent mortality and disability is necessary in hospitals. The plan should be supported by detailed specific action plans regarding any possible hazards and resources of hospitals.

Authors' contribution

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

Conflict of interests

None.

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