Research Paper: Assessing the Status of Yazd Province Medical Emergency and Accident Management Center in Terms of Necessary Standards for Air Emergencies

Hassan Jafari[1], Mohammad Ranjbar[1], Ali Reza Mozaffari[2], Ahmad Sadeghi[3], Saeed Fallah Aliabadi[4*]

1. Department of Health Care Management, Health Policy and Management Research Center, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
2. Department of Health Services Management, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
3. Department of Public Health, Esfarayen Faculty of Medical Sciences, Esfarayen, Iran.
4. Department of Health in Disaster and Emergencies, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

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ABSTRACT

Background: Air emergency medical services provide advanced medical care to patients and critically injured as soon as possible to reduce injuries and casualties. In this study, the status of the Medical Emergency and Accident Management Center in Yazd Province in terms of the necessary standards for air emergencies was investigated and compared with existing standards.

Materials and Methods: The present research was a cross-sectional descriptive study. Using a researcher-made checklist, the required data, such as human resource requirements, physical and environmental space, time, communication equipment, medical equipment, equipment for traffic detection and management, and equipment for technical and safety services, were collected by asking relevant officials and experts. Finally, data analysis was performed using tables and descriptive statistics.

Results: The study findings showed that in total, 2 items in the field of human resource requirements, 7 items in physical space and environmental requirements, 2 items regarding time requirements, 4 items regarding communication equipment requirements, 43 items regarding equipment and medicine requirements, including patient cabin equipment, emergency resuscitation kit and Cardiopulmonary Resuscitation (CPR), medicine and jump bag equipment, delivery set, triage bag, dressing equipment and technical and safety service equipment requirements were in accordance with the existing standards.

Conclusion: Based on the existing standards, the air emergency in Yazd Province in most areas was satisfactory. Because of the importance of the issue, authorities must take the necessary measures to address the deficiencies and limitations so that the emergency missions be carried out in the best conditions.

*** Corresponding author:**
Saeed Fallah Aliabadi, PhD.
Address: *Department of Health in Disaster and Emergencies, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.*
E-mail: *sd.fallah@gmail.com*

1. Introduction

An air emergency is an emergency notified to the air emergency base at the request of a land ambulance, dispatch center, and Emergency Operation System (EOC) [1]. An air ambulance is also a type of emergency vehicle used for immediate medical assistance when the ambulance cannot reach the patient due to low speed or far distance [1]. The emergency helicopter can travel the distance between two points directly and operate on a broader coverage area than a land ambulance. Because of several factors, such as the high frequency of accidents in Iran, the vast land of Iran, the diverse climate and the enormous inaccessible areas, nomadic life, and people's use of resorts, it is difficult to rapidly transfer some drugs, such as antidotes, and provide medical services in the shortest possible time in high-risk accidents. So one of the service packages of the Health Transformation Plan (HTP) was allocated to upgrade the country's air emergency to cover at least 70% of the country for accident management and providing emergency medical services to have more access to health services with higher quality [2].

The first modern air emergency service was recorded on August 14, 1950, during the Korean War, by a BELL 407 helicopter. At the time, more than 20000 wounded were transported to Aqaba and medical facilities. The basket transfer was done, i.e., no treatment was performed on the patient during the transfer, the mortality rate of wounded soldiers was reduced by 50%. In Iran, planes and helicopters were widely used to transport the wounded during the 8-year Iran-Iraq war. However, the use of these services in the civilian sector began in 2000 to establish an air ambulance base in cooperation with the Iran Helicopter Support and Renewal Company (IHSRC) and the Tehran Emergency Department [3]. Since 2000, the number of air emergency bases has gradually increased. After implementing the Health Transformation Plan in August 2014, the air emergency was introduced as the only service package of the Health Transformation Plan in the field of prehospital emergency [4]. The head of the air emergency department of Iran announced the opening of 33 air emergency bases in the country in recent years [5].

Today, one of the health issues in most countries is the proper and timely service to the affected people of the society due to diseases and unexpected accidents, especially catastrophic accidents [6]. Every organization desperately needs an evaluation system to know the desirability and quality of its activities, especially in complex and dynamic environments. Performance appraisal is a tool that can meet both the need of individuals to know their position and the need of the organization in recognizing the efficiency of its employees. Today, prehospital care is an essential and crucial component in treating emergency patients, and emergency medical services are an essential part of the health care system in most societies [7].

The medical emergency system is the front line of medical centers in dealing with the patients and the injured cases and the most important factor in reducing mortality rate because they must take measures to deal with these patients in accordance with international standard protocols. Studies also show that fast and standard quality emergency care services can reduce accident-related deaths by up to 30% and significantly prevent the complications of inappropriate actions and improper transfer of the injured cases that lead to disability. Equipment and supplies and knowledge and skills of human resources are two essential principles for implementing care. Deciding on the selection and initiation of initial measures is one of the critical tasks of emergency personnel. Thus, they must have sufficient knowledge, skills, and attitudes in applying skills and making immediate and correct decisions. Taking action requires complete and safe equipment that employees must be confident in operating, as the seconds and minutes may determine the distance between life and death [7].

Research in the early 1970s shows that surgery for severely injured patients is essential in the first hours after the injury. Emergency experts have described the concept as the golden time following an accident. Half of all deaths typically occur during this time. Air emergency medical services provide advanced medical care to patients and critically injured as soon as possible and thus reduce their hospital stay [2].

In different countries, to reduce the complications and deaths caused by these diseases and emergencies, a successful and efficient system called emergency medical services has been designed. The task of this system is to provide medical services at the patient's bedside and, if necessary his transfer to medical centers.

Unfortunately, in some cases, emergencies face difficulties in providing services to patients and injured people due to problems, such as the geographical conditions or large population and many vehicles in large and crowded cities, ambulances dispatch, or timely presence of emergency aid. Despite such problems, one of the necessary measures is to create and launch an air emergency, which can arrive as soon as possible, regardless of

road traffic and crowded population, in cases where the accident area does not have the necessary communication route to send an ambulance [8, 9].

Air emergency medical services provide advanced medical care to patients and critically injured as soon as possible, resulting in reducing hospital stay length [10]. The emergency medical system is recognized as an essential part of modern health systems. As an organization in health systems, it is responsible for providing care and prehospital care activities to patients and, if necessary, transporting them to the hospital. Therefore, the quality of emergency services play an essential role in health systems, and its ability to respond efficiently and promptly can significantly impact on saving patient's life and the health of the community [6].

The proper functioning of the emergency rescue system leads to the rapid and timely dispatch of an ambulance to the patient's bedside and prevention of death and disability. The success of this system depends on various factors, such as the ability of people, trained staff, their responsibility, equipment, coordination, and communication system [7].

An air ambulance has several advantages. The greatest benefits of using an air ambulance are reducing the time it takes for a patient to reach a medical center, reaching the patient's bedside sooner, accessing hard-to-reach places, overcoming traffic, using exceptional medical staff and special medical and support facilities, and assessing the accident site from the sky [11]. The land transfer of patients has many advantages. However, because of the limitations of land transfer of patients, especially when there is a considerable distance between the accident site and medical centers or the vital role of time in the treatment of the patient, rapid air transport of patients with intensive and effective care by an experienced and professional air medical team by plane is one of the important and determining factors in saving the lives of patients and injured cases. Therefore, to provide the best and most timely medical services to patients with serious problems, the benefits of the transfer, the risk factors, and the conditions and available facilities should be considered for deciding to transfer by air [1].

Alavi et al. [8] reported that because of the high cost of using a rescue helicopter, employing a suitable algorithm to select patients, using telemedicine, and providing standard equipment and drugs can help increase the efficiency of this type of ambulance. Tomazin et al. [12] noted that the outcome of severely injured patients could be time-dependent. Thus, Helicopter Medical Emergency Service (HEMS) can significantly shorten rescue missions, especially in mountainous areas. Accordingly, because of the importance of the issue, we assessed the situation of the Medical Emergency and Accident Management Center in Yazd Province, Iran, in terms of the necessary standards for air emergencies compared with existing standards.

2. Materials and Methods

The present cross-sectional descriptive study assessed the Air Emergency Unit supervised by the Medical Emergency and Accident Management Center and its various dimensions. These aspects included human resources, drug supply, physical and environmental space, time, technical and safety service equipment, communication equipment, and traffic detection and management equipment. Access to some studies was provided by searching studies and available resources on air emergency standards in Iran and other countries. By studying these sources, we selected those studies that matched with the native culture and the situation of Iran. Also, with the cooperation of the research team, a preliminary checklist with 7 dimensions and 78 items were prepared. To examine the validity of the checklist, the face validity and content validity were used qualitatively. To check the qualitative face validity of the checklist, it was provided to 10 experts in accident management, including professors who were experts in disaster health (5 people), medical emergencies (3 people), and health services management (2 people). They were asked to comment on the relevance and relation of the items, the ambiguity and misconceptions, and the difficulty of understanding the concepts. Necessary changes were made in the checklist after the review of the experts' comments. Regarding the validity of the qualitative content, the questions were given to 8 managers and 2 experts, and they were asked to review the questions in terms of grammar, use of appropriate and understandable words, placement of items in their proper place and proper scoring, and finally express their opinions in the form of comments. After reviewing their comments, the necessary changes were made to the questions. Finally, the designed tool with 7 domains and 73 items was approved and used to collect the required data.

The researcher for extractable data completed the checklist, and for other cases that required additional data and information, the officials and experts of the relevant units were asked. There was no need for sampling because we examined the various functional dimensions of the air emergency. After collecting the necessary data in terms of the current functional status of the air emer-

gency, the information was compared with the desired status or standards. Therefore, these data were analyzed using descriptive statistics and drawing related graphs using SPSS V. 19.

3. Results

The designed tool was examined with 7 domains and 73 items, and the obtained results showed that 58 items were matched with the standard criteria. In total, 2 items regarding human resources, 7 items regarding physical and environmental space, 2 items regarding time, 4 items regarding communication equipment, and 43 items regarding equipment and medicine, including patient cabin equipment, emergency resuscitation, and CPR kit, medicine, and jump bag equipment, delivery set, triage bag, dressing bag equipment and technical and safety service equipment requirements were in accordance with the existing standards. Table 1 presents the results of comparing different standards of Yazd Air Emergency with the current situation.

4. Discussion

This study aimed to evaluate the status of the Medical Emergency and Accident Management Center in Yazd Province, Iran, in terms of the necessary standards for air emergencies and compare it with the existing standards in 2017.

Our findings showed that 2 items regarding human resource, 7 items regarding physical and environmental space, 2 items regarding time, 4 items regarding communication equipment, and 43 items regarding equipment and medicine, including patient cabin equipment, emergency resuscitation, and PCR kit, medicine and jump bag equipment, delivery set, triage bag, dressing bag equipment and technical and safety service equipment requirements were in accordance with existing standards.

Human resource requirements

In the present study, human resource standards were examined, and except for cases 1 and 4 (absence of physician and operator), all other cases were in good condition. In 2013, Khankeh et al. studied prehospital services with an emphasis on traffic accidents in developed and developing countries. They showed that the system of providing prehospital services was influenced by several factors, such as human resources and its distribution, training, equipment, management, and organization. Paying attention to human resource variables, such as training, distribution, and organization can be useful in making prehospital services more effective. Conducting any interventions to increase the speed of service or reduce the response time, equipping ambulances and the required facilities, continuous training of ambulance staff, the use of highly specialized manpower, such as nurses, job satisfaction, and increased coordination with other departments can reduce the number of deaths and disability caused by traffic accidents [10], which is consistent with the results of the present study.

Physical and environmental space requirements

In the present study, the standards of physical and environmental space were examined. All the mentioned cases were in good condition. Firoozi Jahantegh and Ghaderi in 2018 assessed the location finding of air ambulances using the multi-criteria decision analysis approach using fuzzy network analysis process model and fuzzy DEMATEL technique combined with the geographic information system. This study showed that the number and coverage of air ambulance bases in cities and roads of Sistan and Baluchestan Province are not appropriate. Therefore, the obtained map from the fuzzy integration of information layers of the identified effective factors shows that the cities of Zabol and Iranshahr have the best status regarding the criteria for the establishment of air emergency bases in Sistan and Baluchestan Province [11]. This result is not consistent with the findings of the present study regarding physical and environmental requirements that included the existence of a mosaic map and numbering the helicopter operations area (150 km distance from flight radius) to establish a medical and air ambulance team, providing a suitable space for landing and determining a safe route for the medical team to enter.

Time requirements

In the present study, the time standards were examined. Except for case 3 (flight duration after the announcement of the mission), the rest of the items were in good condition. In 2012, Tomazin et al. assessed the factors affecting the activity and timing of helicopter emergency services in 4 Alpine countries. They noted that the outcome of severely injured patients could be dependent on the use of the HEMS, and it can significantly shorten rescue missions, especially in mountainous areas. The shortest activation time was about 3 minutes and the longest 17 minutes, the shortest average time was 10.4 minutes, and the longest was 45 minutes [12]. The findings of time requirements in the present study were as follows: less than 5 minutes for the helicopter to take off from the ground, less than 10 minutes for the transfer of the injured person from the scene of the accident to the medical centers, and within a maximum of 3 minutes of the flight time after the announcement of the mission.

Table 1. Comparison of different standards of Yazd Air Emergency with the current situation

Row	Physical and Environmental Space Requirements	Optimal Status (Standard)	Current Status	Compliance Status
1	Existence of a mosaic and numbered map of the helicopter operation area (150 km distance from flight radius) in the helicopter for the use of the flight team and the medical team to facilitate finding the location of the mission	√	√	Compliance
2	Air ambulance base with acceptable environmental space with a minimum area of 80 m for the deployment of medical team and flight team, preferably adjacent to each other or in two different spaces with a maximum distance of 200 m from each other for speed of operation and double coordination in mission deployment	√	√	Compliance
3	Writing the letter H in the middle of the area	√	√	Compliance
4	Provide suitable space for landing	√	√	Compliance
5	Determine the safe route to enter the medical team	√	√	Compliance
6	Asphalting	√	√	Compliance
7	Existence of an inflatable flag at the edge of the landing pad or a flag that indicates the direction of flow	√	√	Compliance

Row	Time Requirements	Optimal Status (Number of People) (Standard)	Current Status	Compliance Status
1	Time to take off the helicopter from the ground	Less than 5 min	Four minutes and 50 s	Compliance
2	The time needed to transfer the injured from the scene of the accident to medical centers	Less than 10 min	Nine minutes and 50 s	Compliance
3	Duration of flight after the announcement of the mission	Within a maximum of 3 min	Ten minutes	Non-compliance

Row	Communication Equipment Requirements	Optimal Status (Number of People) (Standard)	Current Status	Difference	Compliance Status
1	Helicopter radio network	1	1	0	Compliance
2	Helicopter GPS device	1	1	0	Compliance
3	Handheld wireless device	1	1	0	Compliance
4	Satellite phone	1	1	0	Compliance
5	Walkie Talkie	2	1	-1	Compliance
	Equipment and medicine requirements	Optimal status (number of people) (standard)	Current status	Difference	Compliance status

Row	List of Patient Cabin Equipment	Optimal Status (Minimum Number of People) (Standard)	Current Status	-1	Compliance Status
1	Stretcher (number)	1	0	0	Non-compliance
2	Backboard short and bed accessories, vest or KED “preferably KED” (set)	1	1	0	Compliance
3	Long backboard and accessories, preferably spider strap (set)	1	1	0	Compliance
4	Lt head immobilizer and accessories	1	1	0	Compliance
5	Scoop stretcher and accessories (set)	1	0	-1	Non-compliance
6	Traction splint (number)	1	0	-1	Non-compliance

Row	List of Patient Cabin Equipment	Optimal Status (Minimum Number of People) (Standard)	Current Status	-1	Compliance Status
7	Adhesive or inflatable or vacuum splint, preferably vacuum (set)	1	1	0	Compliance
8	Oxygen supply system	2	1	-1	Non-compliance
9	Portable electric suction (number)	1	1	0	Compliance
10	Pulse oximeter (number)	1	1	0	Compliance
11	Cardiac monitoring (device)	1	1	0	Compliance
12	AED or manual electroshock with AED mode, preferably manual electroshock with AED mode (device)	1	1	0	Compliance
13	Automatic ventilator (device)	1	1	0	Compliance

Row	List of Medical Jump Bag and CPR Equipment	Optimal Status (Number of People) (Standard)	Current Status	Difference	Compliance Status
1	Stethoscope (number)	1	1	0	Compliance
2	Barometer (number)	1	1	0	Compliance
3	Tourniquet (number)	1	1	0	Compliance
4	Scissors (number)	1	1	0	Compliance
5	Forceps (number)	1	1	0	Compliance
6	Thermometer (number)	1	1	0	Compliance
7	Examination flashlight (number)	1	1	0	Compliance
8	Glucometer and test strip and accessories (number)	1	1	0	Compliance
9	1 to 2-L portable aluminum or plastic oxygen capsule with accessories and a simple mask or nasal cannula (number)	1	1	0	Compliance
10	Glucometer test strip (pack)	1	1	0	Compliance
11	Epinephrine hydrochloride ampoule (1: 1000 or 1: 10000) (number)	10	10	0	Compliance
12	Atropine sulfate ampoule (0.5 mg/mL) (number)	5	5	0	Compliance
13	Dexamethasone ampoule (8 mg/2 mL) (number)	5	5	0	Compliance
14	Diazepam ampoule (10 mg/2 mL) (number)	5	5	0	Compliance
15	20% and 50% hypertonic dextrose (number)	Two from each	Two from each	0	Compliance
16	Electrode gel (number)	1	1	0	Compliance

Row	List of Medicine and Jump bag Equipment	Optimal Status (Number of People) (Standard)	Current Status	Difference	Compliance Status
1	20% and 50% hypertonic dextrose (number)	One from each	One from each	0	Compliance
2	Surgifix (roll)	1	1	0	Compliance
3	Stethoscope and barometer (device)	1	1	0	Compliance
4	Laryngoscope battery (number)	2	2	0	Compliance

Row	List of Delivery Set	Optimal Status (Number of People) (Standard)	Current Status	Difference	Compliance Status
1	Pipette filler (number)	1	1	0	Compliance
2	Sterile towel (number)	1	0	-1	Non-compliance
3	Surgical perforated drape (number)	1	1	0	Compliance
4	Sterile gloves (pair)	2	2	0	Compliance
5	Oxytocin ampoule with an expiration date of 2 years (number)	2	0	-2	Non-compliance

Row	List of Triage Bag	Optimal Status (Number of People) (Standard)	Current Status	Difference	Compliance Status
1	START triage card with a serial number according to instructions (number)	50	50	0	Compliance
2	Triage vest (number)	2	0	-2	Non-compliance
3	Magic light (number)	2	2	-2	Compliance

Row	List of Dressing Bag Accessories	Optimal Status (Minimum Number Needed) (Standard)	Current Status	Difference	Compliance Status
1	Bandages (roll)	10	10	0	Compliance
2	Sterile gas (number)	10	10	0	Compliance
3	Non-sterile gas (number)	20	20	0	Compliance
4	Leukoplast adhesive (tape)	1	1	0	Compliance

Row	Technical Service Equipment And General Safety	Minimum Required Number	Current Status	Difference	Compliance Status
1	Belt cutting scissors (number)	1	1	0	Compliance
2	Ring cutter (number)	1	1	0	Compliance
3	Large flashlight (number)	1	1	0	Compliance
4	Gloves (pair)	2	2	0	Compliance
5	Helmet (optional) (number)	2	0	-2	Non-compliance
6	Vest (number)	2	0	-2	Non-compliance
7	Radiator heater (number)	1	0	-1	Non-compliance

Row	Traffic detection and Management Equipment Requirements	Optimal Status (Number of People) (Standard)	Current Status	Difference	Compliance Status
1	Flashing light (optional) (number)	1	0	-1	Non-compliance
2	Hand-held stop sign with lights (number)	1	0	-1	Non-compliance

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Communication Equipment Requirements and Equipment and Medication Requirements

In the present study, the communication equipment standards were examined. All the mentioned cases were in good condition. Also, the standards of equipment and medicine were in good condition in most of the cited cases. In 2016, Taylor et al. evaluated the practical role of ICT tools in health care systems. They owed that the use of modern communication and information technologies in the health care system is of great importance. Collecting data from crisis areas using mobile technology is faster and more reliable. Every day, new generations of technologies and mobile communications with many different capabilities are developed. To introduce and familiarize relief workers with these new technologies, it seems necessary to hold training courses [13]. The communication equipment was at an excellent level, which confirms the results of the Taylor et al. study. In 2007, Hisamuddin et al. assessed factors affecting the improvement of prehospital emergency services in Malaysia and reported that the existence of care protocols, appropriate communication system, systematic management, training, and quality assurance policies are the essential areas for improving prehospital emergency services [14]. Similarly, we found a suitable communication system based on the existing standards, which confirms the study of Hisamuddin et al.

In 2008, Alavi et al. examined the standards of emergency helicopter service for transporting patients in urban areas. They showed that due to the high cost of using a rescue helicopter, employing a suitable algorithm to select patients, using telemedicine, and providing all standard equipment and drugs can help increase this type of ambulance [8]. In the present study, most required medications were provided in the air emergency of Yazd City, which is also consistent with the study of Alavi et al.

Technical and general safety equipment requirements and traffic detection and management equipment requirements

In the present study, the standards of general service and safety equipment were examined, and except for helmets, vests, radiators, other items were in good condition. Also, the standards of traffic detection and management equipment were not in the desired condition in all the mentioned cases (lack of flashing lights with a handheld stop sign). In 2002, Mahmoudi et al. assessed the status of management in the air rescue system and evaluated the views of senior managers in 10 areas of planning objectives for establishment, organization and management structure, human resource structure, communication and information, intra-departmental communication, coordination in the operation process, employment and training criteria, patient transfer criteria, safety equipment for patients and staff, credits and budgeting, and evaluation and quality management of the work.

Finally, some suggestions were made by the authors. The suggestions were the development of an organizational chart of air rescue system, development of patient transfer criteria and use of helicopters according to existing standards and scientific guidelines, development and communication of flight medical staff duties, the use of small, low-noise helicopters known as medical helicopters (such as the BK-115), the formation of a board of directors consisting of managers of organizations and hospitals involved in the air relief plan to further coordinate and evaluate performance [15]. In the present study, technical services and public safety equipment were at the desired level and consistent with the study of Mahmoudi et al.

5. Conclusion

This study was conducted to assess the status of the Medical Emergency and Accident Management Center in Yazd Province in terms of standards for air emergencies and compare it with existing standards in 2017. Air emergency measures in Yazd Province are satisfactory

in most dimensions based on current standards. However, due to the promotion and progress in the fields of medical sciences, including medical emergencies, the need of people for prehospital care has changed due to changing patterns of diseases and health needs, the advancement of knowledge, and health care. Therefore, improving the evaluation system, creating an approved organizational chart, leveling air emergency personnel, upgrading equipment, continuing training and changing training methods, improving communication systems, updating national and provincial standards, and changing its content and methods should be considered. The results of this study can provide information about the status of air and medical emergencies and centers of Yazd Province to the Vice-chancellor of the University and managers of medical centers. Thus, by recognizing the influential factors and existing conditions, they can take steps towards strategic care planning, budgeting, staff knowledge, equipment, and facilities and promote these vital measures.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences (Code: IR.SSU.SPH.REC.1397.116).

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Authors' contributions

Conceptualization, methodology, writing – original draft, and writing – review & editing, and supervision: Hasan Jafari; Data collection, data analysis and writing the manuscript draft: Mohammad Ranjbar, Alireza Mozaffari, Saeed Fallah Aliabadi, and Ahmad Sadeghi; All authors read and approved the final manuscript.

Conflict of interest

The authors declared no conflict of interest.

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