

Research Paper:

Preparedness for Dealing with Disasters and Its Relationship with Information-Communication Systems in Hospitals of Tehran University of Medical Sciences



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ABSTRACT

Background & Aims of the Study: Hospital preparedness is essential in responding to disasters, and the role of communication and information systems as one of the main components of preparedness is essential. Therefore, this study was conducted to assess the preparedness of hospitals in the face of disasters and investigate the status of communication and information systems and the relationship between them.

Materials and Methods: This cross-sectional descriptive-analytical study was performed in 12 hospitals available at Tehran University of Medical Sciences in 2019. In order to collect information, direct observation, talking, and finally completing two checklists were used: 1) assessment of preparedness for emergencies and 2) evaluation of information and communication systems. Expert professors confirmed their validity and reliability during the test-retest method. SPSS v. 24 software, descriptive statistics, and Pearson correlation coefficient were used to analyze the data.

Results: The overall preparedness status for dealing with disasters and communication-information systems was assessed at a moderate level. Also, there was a statistically significant direct relationship between the scores of preparedness areas and the scores of communication-information systems of these hospitals ($P \leq 0/05$).

Conclusion: The moderate preparedness status of the hospitals in this study was not acceptable due to national and sometimes international expectations. Therefore, it is necessary to pay attention to the overall preparedness and strengthen the technical infrastructure of communication-information systems in a multi-layered way and develop the culture of using these systems in the face of unexpected events.

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1. Introduction

Disasters occur unexpectedly and sometimes inevitably and are beyond the capacity of adaptation of societies due to their wide-ranging impacts on material and human resources and disruption of the natural course of life. Such incidents can sometimes lead to disaster without national and international assistance [1]. These incidents are natural (such as floods, earthquakes, hurricanes, tsunamis, landslides, epidemics, etc.) and unnatural (such as fires, terrorist attacks, riots, etc.). On average, each year, equivalent to 3% of the GDP of accident-prone countries is spent on losses due to disasters [2]. Iran has also become one of the ten accident-prone countries for various reasons, in which out of 40 types of disasters, 31 different types have been observed [3]. Health centers, especially hospitals, are among the places that are at risk of serious accidents and injuries with a high rate of injuries and casualties [4]. Moreover, in the event of a disaster, hospitals are expected to be able to maintain physical, managerial, communications, information, equipment, human resources, and related processes and provide services [5].

Hospitals are an integral part of the disaster accountability system and play a key role in promoting preparedness programs, and there is a widespread expectation that hospitals will be prepared to deal with any accident [6]. Experience in other parts of the world has shown that hospitals with a preparedness program and have practiced these programs are less likely to be harmed in an accident [6-8]. Preparedness is the first stage of the disaster plan, which includes providing the necessary measures to implement the incidents plan, and its components include training, research, drilling and exercise, planning, management structure, management, and providing the necessary resources; the existence of a program alone cannot be fruitful, but the successful implementation of programs is decisive [8]. In addition to natural disasters, internal disasters, such as fires, building collapses, epidemics, and nosocomial infections have casualties and financial losses, and attention and preparedness are necessary [5, 9].

On the other hand, in the event of disasters, disruption of communication devices and systems is recognized as one of the main complications. Therefore, it is necessary to have the necessary preparations for dealing with and maintaining these systems, which play an influential role in the quality of accident response, sending reliable information, and establishing communication from the scene of the accident [10]. Therefore, in order to better pre-

pare for disasters, we should strengthen communication requirements and skills, including methods of communication and information exchange in critical situations, identification and application of particular and public communication, use of technology as a communication tool, promoting effective oral communication, upgrading of communication systems and equipment, and providing the necessary training to personnel on preparedness for emergencies and even repairing vital communication equipment by some personnel, storing some equipment in warehouses, and be prepared to communicate with people who are skilled in managing such incidents [10, 11]. Also, the current limited information and communication management systems in the event of disasters in the first place (to identify records and track people), the use of static communication, and the limitations of these traditional methods are understandable and lead to poor and low-quality services in critical situations.

The new information technologies have a high capacity to overcome the physical limitations of traditional and space-limited information-communication systems. In this regard, many wireless information systems, such as wireless communication networks, electronic tracking patient location systems, electronic patient care devices with compatibility with electronic health records, medical communication support systems, and information exchange systems with medical centers have been developed for use and can strengthen communication and information channels and increase the quality of hospital care in the event of disasters [12, 13].

It should be noted that the hospitals of Tehran University of Medical Sciences are generally located in the central, southern, and densely populated areas of the capital, and the volume of referrals to them will be significant at the time of the accident. On the other hand, due to the long history of Tehran University of Medical Sciences and its sub-hospitals and having facilities and specialized medical staff, it is observed that they are known as centers of different specialties in Iran and the destination of patients from all over the country. Also, some of these hospitals are known for medical tourism and are intended for patients from other countries due to the provision of special services. Therefore, due to the special conditions of Tehran, Tehran University of Medical Sciences, and affiliated hospitals, and the need to pay attention to the communication-information status of hospitals when facing disasters, this study aimed to assess the preparedness of hospitals in the face of disasters and the status of communication-information systems and the relationship between them.

2. Methods and Materials

This cross-sectional descriptive-analytical study was performed in 12 hospitals available and ready for co-operation among 16 active hospitals affiliated with the Tehran University of Medical Sciences in 2019. In order to collect information, two researcher-made checklists were used: 1) assessment of preparedness for disasters and, 2) evaluation of information and communication systems, the first checklist has 24 areas (including 43 separate questions) and the second checklist consisted of seven areas (including 28 separate questions). The status of each area of the two checklists was assessed with questions in the form of yes and no and the level of safety of each area was classified with a low/weak (score 1), moderate (score 2), and high (score 3) rating. Also, the scoring range was set to be 24-72 for the first checklist and 7-21 for the second checklist. Then, the scores of the preparedness and communication-information systems areas of each of the studied hospitals and their mean were placed in one of the quarters: poor, moderate, good, and excellent, and were evaluated as follows:

$(24 \leq \text{poor} \leq 36)$, $(36 < \text{Moderate} \leq 48)$, $(48 < \text{good} \leq 60)$, $(60 < \text{excellent} \leq 72)$ = quarters of preparedness areas for dealing with disasters

$(7 \leq \text{poor} \leq 10.5)$, $(10.5 < \text{Moderate} \leq 14)$, $(14 < \text{good} \leq 17.5)$, $(17.5 < \text{excellent} \leq 21)$ = quarters of communication-information systems areas

Content validity was used to determine the validity of the tools used. In this method, first, by reviewing the available texts and interviewing ten expert professors, the initial checklists were prepared, and in the second stage, by eliminating the defects and applying corrections, the prepared checklists were approved by the experts, and the validity of the content of the tools was obtained. Also, using the test-retest method, the members of the Crisis and Disaster Committee of the two studied hospitals (30 people in total) completed the checklists one month apart, with the relevant results for the first and second checklists were estimated to be $r=0.82$ and $r=0.87$, respectively.

In order to collect data, the researchers referred to these centers to submit a letter of recommendation and obtain the cooperation consent of the studied hospitals. The researcher and the questioner provided relevant explanations by referring to these centers. They completed the checklists through direct observation and interviews with different people as needed (hospital manager, nursing manager, secretary of the emergency committee, and

hospital staff), according to the internal rules of each hospital. After filling in the checklists, the data were entered into the analysis SPSS software v. 24, and the necessary analysis was performed. Descriptive statistics were presented with relevant tables and graphs, and in the analytical part of the study, the Pearson correlation coefficient was used to show any statistical relationship between areas.

3. Findings

General specifications of the studied hospitals

Among the studied hospitals, nine were specialized and sub-specialized, and three were general. The number of hospital beds varied, and specialized hospitals had few active beds. All hospitals had a comprehensive crisis management program, and the managers of most of the studied hospitals (67%) had passed crisis management preparedness courses. On the other hand, the secretary of the crisis committee of all the studied hospitals, except for two hospitals, had passed the preparedness courses in crises (84%). Only one hospital was certified as a safety-friendly hospital at the required level. The public relations manager of five hospitals had passed the crisis preparedness courses (42%), and the information systems of most of the studied hospitals were accountable to the critical conditions (67%), and a replacement for these systems was provided in the critical conditions (75%).

Status of preparedness for disasters and communication-information systems

The overall status of areas of preparedness for dealing with disasters and communication-information systems in the studied hospitals was evaluated as moderate level, also only 16% of the studied hospitals (2 hospitals) in each of the areas of preparedness for dealing with disasters and communication-information systems were in excellent condition (Table 1). Also, a statistically significant direct relationship was observed between the scores of preparedness for dealing with disasters and the scores of communication-information systems of these hospitals ($P \leq 0.05$).

The status of preparedness for dealing with disasters in each of the studied hospitals is provided in Table 2. According to the findings, the highest frequency percentage of safety among the areas belonged to the training and drilling area, and the lowest frequency percentage of safety belonged to the area of the epidemiological care system.

Table 1. Overall status of preparedness for dealing with disasters and communication-information systems of the studied hospitals

Hospitals	Preparedness Score	Status	Communication-Information Systems Score	status
Imam Khomeini Complex	38	Moderate	17	Good
Medical Center	30	Weak	10	Weak
Baharlou	52	Good	10	Weak
Ziaeyan	64	Excellent	15	Good
Farabi	35	Weak	15	Good
Rouzbeh	34	Weak	14	Moderate
Sina	62	Excellent	18	Excellent
Amir Alam	56	Good	18	Excellent
Mohebe yas	60	Good	12	Moderate
Arash	30	Weak	9	Weak
Bahrami	50	Good	14	Moderate
Razi	44	Moderate	15	Good
Overall mean	46.25	Moderate	13.91	Moderate

Also, among the various communication-information systems of the studied hospitals, the highest frequency percentage belonged to the areas of voltage safety, the safety of telephone equipment, and site safety, and the lowest frequency percentage was observed in the area of antenna safety (Table 3).

4. Discussion

This study found that general hospitals have gained more scores than specialized hospitals. The specialization of hospitals may have been effective in requiring managers to take the necessary measures, followed by the expansion of communication systems and more exchange of communications between different groups. On the other hand, the small size and the low number of active beds in specialized hospitals may cause the managers of these hospitals to make a calculation error in simplifying the management of disasters that require a change of approach.

According to the findings, the overall status of preparedness areas for dealing with disasters (with a score of 46.25) was assessed at a moderate level. Having a comprehensive disaster management plan (67% of hospitals) during the crisis management courses by most managers and secretaries of the Crisis and Disaster Committee (84% of hospitals)

played a role in increasing scores. These results were similar to Balay et al.'s studies in hospitals in Saudi Arabia [14], Beyramijam et al. [15] in hospitals of Tehran University of Medical Sciences, Daneshmandi et al. [16], Hosseini Shokouh et al. [17] in hospitals affiliated with the Iran University of Medical Sciences, and Amiri et al. [18] in the hospitals of Semnan province. Also, the mean of preparedness of the hospitals in Iran in a meta-analysis study was assessed at a moderate level by Baziar et al. [19]. However, the results of other studies, including a study in hospitals in eight cities in Japan in 2013 [20], were considered favorable, and the existence of better infrastructure due to the high incidence of accidents in this country may have led to the necessary measures. Also, Mehri et al. in Ardabil hospitals [21], Zaboli et al. [22] in Tehran hospitals, and Ezzati et al. [23] in Kermanshah hospitals showed a favorable preparedness in the studied hospitals. The results of studies by Hekmatkhah et al. [24] in Urmia hospitals, Ojaghi et al. [9] in Kermanshah University of Medical Sciences, and Mohabbati [25] in Zabol hospitals, showed a poor status in the face of disasters. It is necessary to explain that the preparedness of hospitals varies according to the management measures and facilities specific to each hospital, and the results obtained in different studies depend on the study environment. In one city, two studies were performed in different hospitals and had the opposite results.

Table 2. Status of preparedness for dealing with disasters areas in each of the studied hospitals

Preparedness Areas	Hospitals	Studied Hospitals					
	Imam Khomeini Complex	Medical Center	Baharlou	Ziaeyan	Farabi	Rouzbbeh	
Safety of answers program in essential sections	Moderate	Moderate	Moderate	High	Moderate	Moderate	
Operational program activation process safety	Moderate	High	Moderate	High	Moderate	Moderate	
Safety of executive measures	Low	High	Moderate	High	Moderate	Low	
Safety of funds needed for the crisis	Low	Moderate	Moderate	Moderate	Low	Low	
Safety of the expanded usable space	Moderate	Low	Moderate	High	Low	Low	
Safety of the patients' reception in the emergency room	Moderate	Moderate	High	High	Low	Low	
Safety of the essential service expansion	Low	Moderate	Moderate	High	Low	Moderate	
Safety of the patients' records protection	Moderate	High	Moderate	High	Low	Low	
Safety of the inspection of sites and equipment	Low	Moderate	High	High	Low	High	
Safety of the epidemiological care system	Low	Moderate	Moderate	High	Low	Low	
Corpse safety and forensics	Low	Low	Moderate	High	Moderate	Low	
Safety of the triage, resuscitation, stabilization, and treatment	High	Moderate	Moderate	High	Low	Low	
Safety of the transportation and support services	Moderate	Moderate	High	High	Moderate	Moderate	
Safety of food ration in an emergency	Low	Moderate	Moderate	High	Moderate	Low	
Safety of the description of duties of support staff	Low	Moderate	High	High	Low	Low	
Safety of well-being ensures for support staff	Moderate	Low	Moderate	High	Moderate	Low	
Safety of coordination with local crisis management	Moderate	High	Moderate	High	Low	Low	
Safety of patient information registration process	Moderate	Moderate	Moderate	High	Moderate	Low	
Safety of patient referral and admission system	Moderate	Low	Moderate	High	Low	Low	
Safety of emergency response process in shifts	Moderate	Moderate	Moderate	High	Low	Moderate	
Safety of patient evacuation process	Moderate	Moderate	Moderate	Low	Moderate	Low	
Safety of emergency exit doors	Low	Moderate	High	High	Moderate	High	
Safety training and drilling preparation	Moderate	Moderate	High	High	High	High	

Preparedness Areas	Hospitals	Studied Hospitals				
	Sina	Amir Alam	Mohebe yas	Arash	Bahrami	Razi
Safety of answers program in essential sections	High	Moderate	Moderate	High	Moderate	Moderate
Operational program activation process safety	High	Moderate	High	High	High	Moderate
Safety of executive measures	Moderate	Moderate	High	High	Low	Low
Safety of funds needed for the crisis	Low	Moderate	Moderate	Moderate	Moderate	Low

Preparedness Areas	Hospitals	Studied Hospitals				
	Sina	Amir Alam	Mohebe yas	Arash	Bahrami	Razi
Safety of the expanded usable space	Moderate	Moderate	High	Low	Low	Low
Safety of the patients' reception in the emergency room	Moderate	High	High	High	High	Moderate
Safety of the essential service expansion	Low	Moderate	High	Moderate	Low	Low
Safety of the patients' records protection	Moderate	Moderate	Moderate	Moderate	High	High
Safety of the inspection of sites and equipment	Moderate	High	High	Moderate	High	High
Safety of the epidemiological care system	Low	Moderate	High	Low	Low	Low
Corse safety and forensics	Moderate	Moderate	High	Low	Low	Low
Safety of the triage, resuscitation, stabilization, and treatment	High	High	High	Moderate	Moderate	High
Safety of the transportation and support services	High	High	High	Moderate	Moderate	High
Safety of food ration in an emergency	Moderate	High	Moderate	Moderate	Moderate	Moderate
Safety of the description of duties of support staff	Low	Moderate	Moderate	Moderate	High	Low
Safety of well-being ensures for support staff	Moderate	Moderate	Moderate	Low	Low	Low
Safety of coordination with local crisis management	Moderate	High	High	Moderate	Moderate	High
Safety of patient information registration process	Moderate	Moderate	High	High	High	High
Safety of patient referral and admission system	Moderate	High	High	Moderate	High	Low
Safety of emergency response process in shifts	Moderate	High	High	High	High	Moderate
Safety of patient evacuation process	Moderate	High	Low	Moderate	Moderate	Low
Safety of emergency exit doors	Moderate	Moderate	High	High	High	High
Safety training and drilling preparation	Moderate	High	High	Moderate	High	High

Also, according to the findings, the general status of information-communication systems (with a score of 13.91) was at a moderate level, which is similar to the studies of Baziar et al. [19], Vali et al. [3], Daneshmandi et al. [16] and Beyramijam et al. [15] who reported the communication status of hospitals [(57%), (49%), (52.2%) and (52.14%), respectively] at a moderate level. Also, in a study in Virginia, hospitals were not prepared to deal with mass incidents in terms of communication [26]. Zaboli also showed that the status of information and communication systems in hospitals with a mean score of 1.83 was unfavorable [22].

The statistically significant and positive relationship between disaster preparedness and the status of communication and information systems of hospitals shows the great importance of communication and information systems in improving the overall preparedness of hospitals. This finding was in line with the study findings of Zaboli et al.. They considered the weakness of communication systems as one of the most important problems of hospitals in the face of disasters [22]. Vali

et al. also considered defects in the hospital communication systems as an important factor in reducing the preparedness of the studied hospitals in Tabriz to deal with disasters [3]. Similarly, Klein et al. considered communication and information issues as one of the problems in preparing for disasters in four North American hospitals [27]. Adbert et al. also noted that information-communication systems are a key component of disaster accountability and health care professionals need to be aware that poor communication will lead to ineffective accountability [28]. After an initial assessment of ten hospitals in Taiwan to assess disaster preparedness, Tzung et al. concluded that communication networks had been set up in all hospitals. However, none had good communication with the news media, leading to weak preparedness for disasters [29].

Telephone equipment, cables, and overcrowding of hospital telephone lines have been problematic, especially in the event of disasters, which was also assessed at poor to moderate levels (42%) in this study; other studies have recommended strengthening the infrastructure and

Table 3. Status of studied hospitals in hospital communication-information systems

Systems	Hospitals	Studied hospitals				
		Imam Khomeini Complex	Medical Center	Baharlou	Ziaeyan	Farabi
Antenna safety		Weak	Moderate	Weak	Moderate	Moderate
Voltage safety		High	Moderate	Weak	High	Moderate
Safety of alternative communication systems		High	Moderate	Weak	Moderate	Moderate
Safety of telephone equipment and cables		High	Moderate	Weak	Moderate	Moderate
External telecommunication system safety		High	High	Moderate	Moderate	High
Site location safety		Moderate	Moderate	Moderate	High	High
safety of internal communication and information system		High	Moderate	Moderate	High	Moderate

Systems	Hospitals	Studied hospitals						
		Rouzbah	Sina	Amir Alam	Mohebe yas	Arash	Bahrami	Razi
Antenna safety		Weak	High	Moderate	Moderate	High	Moderate	Moderate
Voltage safety		High	High	Moderate	Moderate	Moderate	High	High
Safety of alternative communication systems		Moderate	High	High	Moderate	High	Moderate	High
Safety of telephone equipment and cables		High	High	High	Moderate	High	Moderate	High
External telecommunication system safety		Moderate	High	High	High	Moderate	Moderate	High
Site location safety		Moderate	High	High	Moderate	High	Moderate	High
safety of internal communication and information system		Moderate	High	Moderate	High	Moderate	Moderate	Moderate

limiting call time to reduce the effects of this problem [30]. Also, training people, strengthening communication skills, and creating a culture to use public communication facilities inside and outside the organization in case of disasters effectively reduce the relevant complications [28]. At the same time, the status of hospitals in this study was moderate in internal communication (58%). In addition to requiring the mentioned measures, hospitals must be prepared and strengthen external telecommunication systems in order to inform better and establish fast and accurate communication with the mass media [31]. In this regard, the status of hospitals was moderate (50%) and only the public relations officials of the five hospitals in this study (42%) had passed the preparation courses in critical situations, and this status needs to be corrected. On the other hand, hospitals accepting outpatients (three of the hospitals in this study) needed relevant translators and pre-defined instructions

for managing this group of patients in critical situations [10]. Therefore, considering the importance of the issue, the support and commitment of the management in relation to the establishment of communication-information systems are very important and decisive. Also, implementing appropriate quality plans and models is effective in better preparation. In this study, only one hospital had obtained the certification of safety-friendly hospital standards at the required level, and the relevant authorities can take steps in this direction.

Regular follow-up of issues raised in the Crisis and Disasters Committee in obtaining the support of relevant officials and provide the necessary funding to strengthen communication and information equipment, especially in areas of infrastructure that need funding, such as voltage boost, site security, antennas (that the hospitals in this study were in poor to Moderate condition) and other

essential equipment will have positive results [10]. Also, determining the closest place in terms of communication and the safest physical location in proportion to the capacity and workload of the hospital as a hospital accident operations room helps manage the effectiveness of incidents. Due to the possibility of disruption in the current systems in crisis, appropriate and efficient alternatives should be provided in case of failure or disruption, and the status of the studied hospitals was unfavorable in this regard (34%).

5. Conclusion

Moderate preparedness status is not acceptable for hospitals affiliated with the Tehran University of Medical Sciences that have clients from all over the country and sometimes abroad. Therefore, the commitment and determination of managers and staff to strengthen the technical infrastructure of communication and information systems and develop a culture of using these systems by providing training and holding relevant workshops is necessary and determining the multi-layered communication platform between hospitals and crisis operations guidance center preferably with the ability to record communication-information data is of great importance.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of the Vice-Chancellor for Research of the Tehran University of Medical Sciences (26036).

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Conflict of interest

The authors declared no conflict of interest.

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