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Assessment of a Military Hospital's Disaster Preparedness Using a Health Incident Command System

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Abstract

Background: A hospital emergency incident command system is one of the most reliable and popular organizational methods for disaster and emergency management.
Objectives: The aim of the present study was to assess the level of disaster preparedness in the emergency department and other selected units of a military hospital in Tehran.
Methods: This cross-sectional study was conducted in 2013 and involved 97 medical staff members from various departments: emergency, management, discharge and transport, camp (security and staff), information and communication technology, training, reception, and human resources. Three instruments were used for data collection: a self-reported questionnaire, unit evaluation checklist, and maneuver evaluation checklist.
Results: The overall mean score for the maneuver checklist was 55.5%. The mean ($\pm$ standard deviation) score for the questionnaire was 42.02 ± 8.62. The unit evaluation checklist had a score of 165 from a total of 244 possible points and a mean percentage of 67.62%. After conducting the maneuver, the hospital staff was reported to have weak performance in evaluating and prioritizing patients for quick release and tracking their conditions.
Conclusions: The present study shows that the selected hospital had a moderate level of preparedness, which is in line with the previous studies. It is recommended that future studies evaluate the effect of education on the disaster preparedness of hospital units.

Keywords: Hospital, Disaster, Emergency Responders, HICS

1. Background

Disasters are inevitable in both developed and developing countries and have various consequences for both the public and the government, such as social, economic, and human health problems, both for public and government (1). Unexpected catastrophes happen in all parts of the world, including Iran. According to the Center for Research on the Epidemiology of Disasters, 1,376,263 individuals in Iran were affected by natural disasters from 1980 to 2010, indicating that Iran is disaster prone (2).

Disasters are characterized as low-probability, high-impact events. In some countries, an event might turn into a disaster, while in others, it remains only an incident.

Disasters create higher demand for health care (3); therefore, preparedness is essential in the industry. Technological advances and the manufacturing of destructive weapons have contributed dramatically to the large number of disaster victims worldwide. Health services provided specifically to respond to natural disasters are the major cause of human survival during disasters, and many people injured during disasters visit hospitals to benefit from their services (4). Hospitals, which are the healthcare main organizations involved in disaster response, require specific programs to deal with such situations (5). United States government agencies have reported that a lack of disaster preparedness in hospitals costs the U.S. healthcare system $280 million each year (6). The present study was aimed at developing a disaster management plan for hospitals to quickly provide on-time health care and decrease mortality and complications related to disasters (7).

Incident command systems (ICS) are a standardized planning approach for effective emergency response to save affected populations (8). Hospital emergency incident command systems (HICS), in particular, are among the most reliable and popular systems in disaster and emergency management (9). HICSs provide organizational charts with specific roles and individual job descriptions during crises. Moreover, HICS have been customized for virtually all types of crises (10). ICSs were first proposed in the United States in 1970, and HEICS versions were revised in 1992 and 1998. The term HEICS was changed to HICS

in the fourth edition in 2006. The fifth edition addressed planning, modern threats, technology and regional coordination. It has been previously examined in many countries, including the United States, Taiwan, Turkey, Puerto Rico, Columbia, and Japan (11).

One study conducted in the northern Iran reported a moderate level of disaster preparedness (12). A study by Djalali and colleagues observed intermediate or fair performance by 23 Iranian hospitals during 2008 - 2009 (13). Mahdaviazad and Abdolahifar conducted research at 24 hospitals in Shiraz, Iran, and reported an average preparedness score of 59.5%, indicating an intermediate level. Interestingly, in their study, teaching hospitals scored higher than private hospitals (14).

It is recommended that a HICS be implemented in all phases of hospital emergency management, including mitigation, preparedness, response, and recovery (15). Application of HICS is a promising area, and further research could increase our understanding of them (16). Military hospitals should be ready to act effectively in disasters, and to achieve this ability, a HICS was applied to assess preparedness at a selected military hospital.

2. Objectives

This study was conducted to assess the level of disaster preparedness in the emergency department and other selected sections of one military hospital in Tehran, Iran. Military hospitals are the primary organizations leading disaster responses. Therefore, we selected to study a large military hospital in Tehran, Iran, over the year 2013.

3. Methods

A cross-sectional study was conducted in 2013. The study population was selected from among hospital staff in various units of a military hospital: 1) emergency, 2) management, 3) discharge and transport, 4) camp (security and transportation), 5) information and communication technology, 6) training, 7) logistics, 8) reception, and 9) human resources. In this study, three data-collection instruments were used: a unit evaluation checklist, self-reported questionnaire, and maneuver checklist. These instruments were adopted from the study by Binesh (17).

3.1. Self-Reported Questionnaire

The self-reported questionnaire was comprised of two subsections. The first subsection included demographic questions (12 items), covering respondents' age, gender, marital status, education level, job, previous experience in crisis care, and HICS training. The second section addressed participants' knowledge, attitude toward job tasks, experience in disasters, and hospital preparedness (22 items). Questions also assessed the probability of disasters, hospital planning, job description hierarchies, identify the chief and replace, crisis preparedness level, and responsibilities during crises.

Content validity and face validity were reviewed by a panel of experts experienced in the fields of health, disaster, hospital management, and related areas. Reliability was assessed by test-retest of 15 individuals at an 11-day interval ($r = 0.98$).

3.2. Unit Evaluation Checklist

The unit evaluation checklist was used to assess the disaster preparedness levels of nine hospital units. The validity and reliability of the checklist had been evaluated in the Binesh Study (17). Face and content validity were confirmed by five experts, and their proposed revisions were made. The reliability of checklist was established by a Kappa test (0.8).

The checklist included 244 questions relevant to various hospital units: emergency (24 items), personnel emergency training (16 items), reception (24 items), discharge and transport (31 items), security and transportation (32 items), communication (16 items), training (17 items), logistic (28 items), human resource (21 items), and management (22 items). The items used a 5-point Likert scale ranging from 1 to 5. Participants' scores were converted into percentages and categorized into 3 groups: weak (0% - 50%), moderate (50% - 75%), and favorable (75% - 100%).

Participants' job positions were determined by the HICS. Following the census sampling method, the questionnaires were distributed and subsequently self-administered by participants.

3.3. Maneuver Checklist

The maneuver checklist had 10 items covering various areas of performance. The validity and reliability of the measure were confirmed in the Binesh Study (17). Forward and backward translation were performed to ensure the conceptual and linguistic equivalence of the checklist. The intraclass correlation between the evaluators' scores was 0.83.

Ninety-seven participants from staff members in the hospital units were randomly selected. Participants provided written informed consent. Demographic and general information were collected through a self-report questionnaire by a census and purposeful sampling. The ethical approval for the research was granted by the medical committee of Baqiyatallah University of Medical Sciences.

The unit evaluation checklist was completed by a researcher with assistance. Staff members and equipment in

the nine units were observed. The expert panel had previous assessed the task guidelines for the hospital units using a terrorist explosion scenario, which was classified as a first-level disaster resulting in forty patients with injuries including burns and bone fractures. The maneuver was operationalized and applied in December 2013 to test the scenario.

After conducting four meetings to coordinate the unit staff, the demonstration maneuver was conducted, followed by the real maneuver a week later. The maneuver was administered with moderate intensity to avoid affecting hospital personnel's performance of patient care. This simulated, operational maneuver was performed to evaluate the hospital's level of preparedness, especially the emergency unit's response to the admission of many admissions patients with injuries.

The medical history, including symptoms and complaints, was also completed for each hypothetical patient. The researchers observed the maneuver without interfering and rated the performances, aiming to find weaknesses. The maneuver checklist was completed by five evaluators, and the mean score was calculated.

Data were analyzed using SPSS software (version 15) to perform t tests, Pearson's correlations, and one-way analysis of variance (ANOVA) to detect differences. The HICS protocol was presented to hospital managers.

Table 1. Demographic Characteristics of Participants

Variable	No. (%)
Sex	
Female	40 (2.41)
Male	57 (8.58)
Total	97 (100)
Marital status	
Married	74 (3.76)
Single	23 (7.23)
Total	97 (100)
Education	
Diploma	17 (5.17)
Bachelor	61 (9.62)
Master and higher	17 (5.17)
No response	2 (12.)
Total	97 (100)
Occupation	
Medical doctor	12 (12.4)
Nurse or paramedic	32 (33)
Other employee	53 (54.6)
Total	97 (100)

4. Results

Participants had a mean age of 34.6 $\pm$ 6.7); 58.8% were male, and 41.2% females. As well, 76.3% were married, and 23.7% were single. Approximately 63% had undergraduate certificates (N = 97). Table 1 presents participants' demographic information.

Of the participants, 43.3% had experience in disasters. Regarding knowledge, 37.1% knew about HICS, while 60.8% did not. The hospital's disaster plan was known by 80.4% of participants, while 52.2% knew their disaster task explanation. Finally, 65 (67%) participants had previous training in disaster care.

The security, transportation, and communication units had the highest scores for preparedness, while the training unit had the lowest score. The emergency unit had a preparedness score of 68.4% and a performance score of 68.8% (mid-level). The unit evaluation checklist score for all hospital units was 165 from a possible total of 244, with a mean percentage score of 67.62%.

Other units scored as follows: discharge and transport (64.5%), management (68.2%), human resources (61.9%), logistics (67.9%), and admissions (62.5%).

For the score calculated for 5 maneuver evaluators, the overall mean was 55.5%. The hospital was 60% successful at conducting planning for disaster management. The hospital delivered the following scores for performance during the maneuver: priority of assessment and quick discharge of patients: 40%; meetings after maneuver and report presentation: 60%; patient follow-up: 40%; ambulance preparedness: 40%; staff call communication by incoming calls, staffing, and schedule: 60%; establishing aid camps: 80%; and medicine and other services: (60%).

A significant association was found hospital preparedness level and occupation type (P = 0.005). One-way ANOVA showed a significant difference between occupation and hospital preparedness (P = 0.005). Post-hoc Tukey's test indicated that the observed difference was related to the scores of non-medical staff (P = 0.05). The ANOVA results are shown in Table 3.

5. Discussion

We assessed the disaster preparedness level of a military hospital and found that the selected hospital has a moderate level of preparedness, which supports previous studies conducted in Iran (14, 18, 19). For instance, a recent review by Rahmati-Najarkolaei and Yaghoubi re-

Table 2. Results for the 9 Hospital Units' Evaluation Checklist

Unit Name	Number of Questions	Score	Range	%	Preparedness Level
1. Emergency unit	38	28	0 - 38	68.4	Moderate
2. Personnel performance in emergency unit	16	13	16 - 0	68.8	Moderate
3. Communication	16	12	16 - 0	75	Good
4. Discharge and transport	31	20	31 - 0	64.5	Moderate
5. Management	22	15	22 - 0	68.2	Moderate
6. Human force	21	13	21 - 0	61.9	Moderate
7. Security and transportation	32	24	32 - 0	75	Good
8. Training	16	5	16 - 0	31.3	Weak
9. Logistics	28	19	28 - 0	67.9	Moderate
10.Reception	24	16	24 - 0	62.5	Moderate
Total (9 units)	244	165	244 - 0	67.62	Moderate

Table 3. Comparative Mean of Disaster Preparedness by Occupation Type (N = 97)

Occupation	N	Mean	SD	ANOVA
Physician	11	2.44	58.10	F = 5.69, Df = 68, *P = 0.0005
Nurse and or other related position	24	55.46	09.9	
Non-medical staff	36	36.38	60.8	
Total	70	03.42	10.10	

Abbreviation: SD, Standard deviation.

ported moderate levels of disaster preparedness in Iran (20).

A study by Van Remmen in Holland showed that 74% of general hospitals were not ready to handle disasters (21), while a study conducted in Los Angeles found that the area had insufficient preparedness despite sufficient facilities (22). Treat and colleagues reported that hospitals were not ready in terms of knowledge, security, communication, or care (23). In contrast to the present findings, a study in Japan detected favorable hospital preparedness for earthquakes (24). These differences might be due to hospitals' geographic location, views, instruments, and facilities. In countries prone to natural disasters, hospitals tend to be more prepared. Yarmohammadian and colleagues identified barriers to HEICS in Iranian hospitals: internal barriers associated with healthcare service and external barriers associated with factors other than healthcare service (25).

The majority of participants agreed that they were involved in disasters, displaying a sense of responsibility for their tasks. Participants perceived their performance ability in disasters as moderate, indicating the need to boost their self-efficacy.

The security and transportation unit gained the highest score, whereas the training unit gained the lowest. The high score for security and transportation unit is possibly due to the nature of the military hospital. Thus, education programs seem necessary. Health care providers should be ready more about program, educational materials, educators and facilities.

Moreover, the results indicated that there was not a significant relationship between the hospital's preparedness and participants' demographic characteristics, including gender, marital status, work experience, education level, and recognition of HICS. However, there was a significant relationship between hospital preparedness and occupation type. Among occupations, nurses and paramedics had the highest score averages, possibly due to the nature of their jobs and their greater involvement in disasters. Compared to physicians and other hospital staff members, nurses play the most important role in crises; therefore, they need more preparation for disasters.

Among healthcare workers, nurses have the most significant role and greatest potential to control disasters in the workplace and society (26). In a research, being responsible was the best predictor of absenteeism in disasters (27). According to the World Health Organization (WHO),

nurses should be the target group for disaster involvement and management (28), although other healthcare workers should be involved in disaster response along with nurses.

Disasters occur in Iran, so hospitals should be ready to respond effectively. Reception and emergency units were reported to have moderate preparedness levels, indicating that these two vital units require much greater attention. It is suggested that the effect of training on hospitals' overall disaster preparedness score should be evaluated. Therefore, developing a disaster management protocol should be a top priority for developing countries, including Iran. Furthermore, to become a more developed nation, Iran should have standardized disaster management plans based on HICS for its hospitals.

5.1. Limitations

This cross-sectional study was conducted in a military hospital. Therefore, its generalizability to other hospitals and populations is limited, and more such research is needed in military hospitals. Despite the importance of triage in hospitals, it was not considered in the current study because the emergency department was new. It is recommended that future studies consider triage and add it to the HICS.

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Footnotes

Authors' Contribution: Alireza Moeeni served as the main investigator, designed the study, collected the data, and performed analysis; Fatemeh Rahmati Najarkolaei supervised the study; Esmail Heidaranlu was the study advisor, while Abbas Ebadi was the statistical advisor.

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