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Validation of Factors Affecting Disasters Risk Management in Iranian Hospitals

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Abstract

Background: In disasters, the hospitals' vulnerability depends on their shortcomings and weaknesses. Therefore, the investigation of possible hazards and vulnerabilities is necessary for effective risk management and planning.
Objectives: We aimed to assess the factors affecting risk management of accidents caused by disasters in Iranian hospitals.
Methods: In this research, the type of study was quantitative-qualitative. We used a semi-structured interview to identify the factors affecting the risk management of accidents caused by disasters in hospitals from experts and executors of disaster management systems. Then, we utilized a questionnaire that was confirmed by experts based on a five-point Likert scale, including 89 items in 4 dimensions and 20 areas. The construct validity of the questionnaire was done by exploratory and confirmatory factor analysis. Finally, the factors affecting the disaster risk management in hospitals were included in four dimensions of harm reduction, by five domains (planning, rules and regulations, technology and information, human resources, and participation), preparedness including six domains (planning, rules and regulations, technology and information, resource management, human resources, and community participation); the response including five domains (planning, technology and information, human resources and community, partnership, and operations), and recovery including four domains (planning, technology and information, human resources and community, and participation).
Results: The Kaiser-Meyer-Olkin (KMO) statistic was 0.963 and so, there was a high correlation between the scale items. There was a significant positive relationship between independents variables such as mitigation (0.74), response (0.70), preparedness (0.68), and recovery (0.63) and the dependent variable of accident risk management caused by disasters in hospitals. Also, the results of structural equations indicated the significant relationship between the independent and dependent variables.
Conclusions: The results showed that there was a good fit among the structural model, the experimental data, and expert opinions. The identified variables are suitable to be used in the form of a final model.

Keywords: Accident Risk Management, Disasters Risk Management, Disasters, Disasters; Hospitals

1. Background

The mortality rate due to natural disasters was reported 9503 people in 2017, while the number of victims was reported 68000 cases between 2007 and 2016 (1). According to the research center of the epidemiology of natural disasters, 2017 has been known as the second-costliest year due to natural disasters as well as losses incurred on the economy of the countries (2).

Iran because of special geographical situations is one of the most disaster- and hazard-prone countries in the world (3), where out of 40 known natural accidents, 31 cases can potentially occur in Iran (4). Iran is the fourth country in Asia and the sixth country in the world in terms of natural disasters (5). The term "disaster" in natural disasters is represented because of the inadequate preparedness of humans to face it (6).

Hospitals are the most critical components of disaster management in the health sector and unexpected events (7-9). Also, healthcare services in accidents and disasters are the main factor of human survival (10).

The hospital situations change completely during accidents and disasters (11). The weak performance of hospitals is not only due to natural hazards but also the destruction of some parts of the hospital building or inadequate human resources (12). Therefore, with the proper assessment of potential accidents (internal factors such as buildings, facilities, access to medications as well as external factors such as terrorism, natural disasters), hospitals can suitably be prepared to confront disasters (13). Hospitals should be encouraged to maintain their readiness to cope with critical situations during an unexpected event (14). The goal of preparation of hospitals is to provide emergency response systems, train staff, and purchase equipment and items required to take care of current patients, protect the personnel, and ultimately respond to the needs arisen by accidents and disasters (15). Evidence shows that there is a direct relationship between the readiness of hospitals as well as healthcare centers and the mortality rate due to accidents and disasters (16). Studies (2015) have developed several frameworks to reduce the risk of disasters including (17, 18).

In Iran, despite the importance of the concept of accident risk management caused by disasters and its widespread use at hospitals, few executive writings are available. To the best of our knowledge, there was not any study in this issue, the current study was used various materials by conducting a multi-stage, systematic and targeted study.

2. Objectives

We aimed to design a comprehensive model for the risk management of accidents and disasters in the hospital taking into account all the components and variables affecting it at both the national and international levels.

3. Methods

In this research, the type of study was quantitative-qualitative. The steps of methods were presented in the following:

A) Documentary and library method: A comprehensive literature review was used to achieve the theoretical framework, to clarify the effective factors, and to understand the research background.

B) Qualitative method: We used a semi-structured interview to identify the factors affecting the risk management of accidents caused by disasters in hospitals from experts and executors of disaster management systems such as the Emergency Department, Red Crescent and Ministry of Health. Then, the initial conceptual model was formulated, designed, and validated. The statistical population of the present study in this stage included all the experts and executors of the disaster risk management system. The sample was selected using a non-random purposeful sampling and snowball method, and the interviews continued until data saturation was achieved. Scott's method was used to content analysis. In this method, the stages involved authenticity, credibility, representative data, and meaningful data. We extracted data from texts in the specific issues and then considered as the content area. Then, the initial conceptual model was presented to 20 experts from relevant organizations including the National Disaster Management Organization, the Emergency Department, the Red Crescent, the Ministry of Health and Medical Education, and subordinate departments. Ultimately, after reaching the agreement, at least 80% of the initial conceptual model was introduced. The inclusion criteria were: being employed in the emergency department, disaster management department and the Red Crescent, specialized education, familiarity with the accident and disaster risk management and history of over 10 years of work experience in disaster management.

C) Quantitative method: The test of questionnaires and presentation of the statistical model of factors affecting disaster risk management in hospitals were performed using an exploratory factor analysis method by SPSS-20 software and confirmatory factor analysis method by Lisrel software.

In this step, the statistical population of the study consisted of all academic experts in the field of disaster risk management including experienced faculty members and experts in the research and education of this field, doctors or other specialists of accident management with operational experience, as well as the Red Crescent, governmental and non-governmental organizations.

Structural equation modeling is a technique for data analysis designed to evaluate the relationship between two types of variables: a) manifest variables: variables that can be directly measured and observed; b) Latent variables or those that are considered as theoretical constructs.

We utilized a questionnaire that was confirmed by experts based on a five-point Likert scale, including 89 items in 4 dimensions and 20 areas. The content validity of the questionnaire was 0.88 using the Content Validity Ratio (CVR) method. The CVR was an acceptable value. The factor analysis technique was used to estimate the validity, and the KMO statistic (0.963) showed that the correlation of the scale items was suitable for performing factor analysis.

Finally, the factors affecting the disaster risk management in hospitals were included in four dimensions of harm reduction, by 15 items (1 to 15) and five domains (planning, rules and regulations, technology and information, human resources, and participation), preparedness including 26 items (16 - 41) and six domains (planning, rules and regulations, technology and information, resource management, human resources, and community participation); the response including 36 items (42 - 74) and five domains (planning, technology and information, human resources and community, partnership, and operations), and recovery including 15 items (75 - 89) and four domains (planning, technology and information, human resources and community, and participation).

For the reliability of the researcher-made questionnaire, the selected items were analyzed, and the reliability was fair. The statistical techniques were used, including factor analysis for the validity assessment, the goodness of fit index for fitting the theoretical model of research, and Lisrel for modeling the structural equations and presentation of the final model. A P-value of less than 0.05 considered as statistical significance.

4. Results

According to the results, most participants were men (66%), aged 31 - 40 years old (48%), and had a professional Ph.D. (59%). Their field of study was medical (66%), and they worked in management positions (40%) for the emergency department (32%). Table 1 presents the factors affecting disaster risk management in hospitals regarding important management models. Table 2 shows the impact factor and *t*-value of factors affecting disaster and accident risk management in hospitals. The results of Table 2 indicated that all of the paths of the model were significant given the scale domains, with the values ranging from 12.43 to 26.59; In terms of dimensions, they vary from 31.30 to 57.45. Meanwhile, in studies that model the structural equation, the normal distribution of variables is examined by analyzing skewness and kurtosis indices. Bayern (2010) proposed a normal distribution from -2 to +2 for skewness. The skewness of all items was between -0.74 and -0.94.

Table 3 presents the fit indices of the confirmed model for disaster and accident risk management in hospitals. Table 3 showed the P-value in this model was less than 0.0001 ($P < 0.0001$) and so, the model' fitness was not proper.

The comparative indices of CFI and NFI were used to evaluate the acceptability of the model based on its comparison with the independence model, where values greater than 0.9, it is interpreted as acceptable values. In this model, the index mentioned above showed that the models' fitness was suitable.

The PNFI fit index shows whether the model economy has been met, where values greater than 0.5 are interpreted as acceptable values. In this model, this index showed that the fit of the model was appropriate.

RMSEA indicated whether the proposed model can be accepted. Rang of this index could be between zero and one, and the smaller value is more acceptable for a proposed model. In this model, the RMSEA value was 0.036 that indicating the appropriate fit of the model.

The presented indicators in Table 3 showed that the model of disaster and accident risk management in Iranian hospitals was confirmed.

5. Discussion

In the current study, there was a good fit between the model structured with experimental data and experts' opinions. With an emphasis on structural equations, a suitable model was developed for components affecting risk management of accidents caused by disasters in Iranian hospitals. The present study concluded that the proposed model of the researcher was complete fit since the comparative indices of CFI and NFI and the fit index of PNFI were acceptable. Also, the RMSEA value was 0.036, which represented the fit of the researcher's model. The results of the current study were consistent with the other studies (19-32).

In the current study, the most important areas of disaster and accident risk management in the hospital were as follows: the rules and regulations in mitigation dimension (0.89), technology and information in mitigation dimension (0.83), participation in mitigation dimension (0.81), resource management in the preparedness dimension (0.80), the planning in response dimension (0.78), technology and information in the response dimension (0.77), human resources and community in the response dimension (0.74), technology and information in the recovery dimension (0.72), planning in the preparedness dimension (0.70), operation in the response dimension (0.69), rules and regulations in the preparedness dimension (0.66), human resources in the preparedness dimension (0.65), human resources in mitigation dimension (0.63), planning in recovery dimension (0.62), community participation in the preparedness dimension (0.61), the planning in mitigation dimension (0.58), technology and information in the preparedness dimension (0.56), human resources and community in the recovery dimension (0.55), participation in the recovery dimension (0.54), participation in the dimension of response (0.50). The order of dimensions was presented as mitigation (0.74), response (0.70), preparedness (0.68) and recovery (0.63).

The results showed mitigation was one of the most important factors affecting the risk of accidents and disasters in the hospital. The factors affecting mitigation in hospitals included planning, rules and regulations, technology and information, and human resources. Proper rules and regulations must be put into practice to reduce harm and increase safety. Then, the rules are planned and implemented using the appropriate equipment, facilities, and technology, as well as trained human resources. In the situation, that hospital suffers from structural and safety problems, and inadequately ready for human resources to face disasters. The development of a single model to reduce damages can be helpful.

The second effective dimension of disaster risk man-

Table 1. Factors Affecting Disaster and Accident Risk Management in Hospitals

Models	Mitigation	Preparedness	Response	Recovery
1- Traditional model	*	*	*	*
2- Inferential-contradictory model	*	*	*	*
3- General model	*	*	*	
4- Binary model	*		*	
5- Iceberg	*	*	*	
6- Gartner model	*	*	*	
7- Australian development gate model	*	*	*	
8- Zimerman and Kavel model	*		*	
9- Wheel-shaped model	*	*	*	*
10- Kany model	*	*	*	*
11- Kimberly model	*	*	*	
12- Tuskaluza model	*	*	*	
13- Manitoba model	*	*		
14- Buss model	*	*		*
15- Ebrahim model	*			
16- Mo and Pataranakol model	*	*	*	
17- Mitraf and Pearson model		*	*	*
18- Lichat model			*	*
19- Gupta model			*	

Table 2. Impact Factor and t-Value of Factors Affecting Disaster and Accident Risk Management in Hospitals

Variable	Abbreviation	Impact Factor	Parameter Estimate	Significance Level	t-Value	Skewness
Mitigation (planning)	A1	0.927	0.584	0.000	20.15	0.44
Mitigation (rules and regulations)	A2	1.000	0.892		20.53	0.28
Mitigation (technology and information)	A3	0.917	0.832	0.000	22.79	0.31
Mitigation (human resource)	A4	0.960	0.633	0.000	21.99	- 0.49
Mitigation (participation)	A5	1.040	0.812	0.000	21.60	0.84
Preparedness (planning)	P1	0.974	0.707	0.000	19.92	- 0.16
Preparedness (resource management)	P2	0.978	0.800	0.000	18.02	0.12
Preparedness (human resource)	P3	0.937	0.654	0.000	20.57	- 0.27
Preparedness (community participation)	P4	0.953	0.619	0.000	24.17	0.41
Preparedness (rules and regulation)	P5	0.981	0.665	0.000	17.49	0.28
Preparedness (information and technology)	P6	0.982	0.565	0.000	18.83	0.39
Response (planning)	R1	0.653	0.781	0.000	18.87	0.46
Response (information and technology)	R2	0.706	0.773	0.000	16.84	- 0.28
Response (human source and community)	R3	1.399	0.742	0.000	14.25	- 0.63
Response (operation)	R4	1.034	0.691	0.000	12.43	- 0.74
Response (participation)	R5	0.917	0.500	0.000	19.74	0.86
Recovery (planning)	B1	0.958	0.629	0.000	26.59	- 0.47
Recovery (technology and information)	B2	1.274	0.727	0.000	24.13	0.39
Recovery (human source and community)	B3	1.100	0.552	0.000	23.37	- 0.69
Recovery (participation)	B4	1.335	0.546	0.000	17.14	0.73
Mitigation	A	1.285	0.745	0.000	31.30	
Preparedness	P	1.302	0.684	0.000	46.66	0.94
Response	R	1.000	0.700		57.45	- 0.36
Recovery	B	1.095	0.632	0.000	43.51	0.75

agement in the hospital is the response. The integration of accident risk management activities in hospitals with the technologies used to perform these activities, as well as trained human resources is one of the requirements to cope with accidents. Also, the high incidence of accidents, complex activities of hospitals, development of new tech-

Table 3. Fit Indices of the Confirmed Model for the Disaster and Accident Risk Management in Hospitals

Fitting Indices	Criterion	Obtained Values	Model Fit
Chi-square	The lower, the better	11256.745	-
Significance	Higher than 0.05	0.000	Inappropriate
Relative chi-square	Between 2 and 5	4.135	Appropriate
RMSEA	Lower than 0.08 and desirably lower than 0.05	0.036	Appropriate
CFI	Higher than 0.9	0.961	Appropriate
NFI	Higher than 0.9	0.924	Appropriate
PCFI	Higher than 0.6	0.636	Appropriate

nologies, and rapid changes of community needs of health care services, have forced existing hospitals to take advantage of the rapid flow of information, group decision-making using technology, all-inclusive coordination with other organizations, training human resources, attraction of public participation, and localization of accident risk models. Therefore, it is necessary to adopt policies and guidelines for the implementation of accident and disaster management plans in hospitals.

All healthcare centers need to prepare themselves to deal with accidents and disasters. Relying on health services from outside of the damaged area could increase the mortality rate and worsen the injuries of victims. This preparation requires a scientific process based on the proper models in the world.

5.1. Conclusion

The results showed that there was a good fit among the structural model, the experimental data, and expert opinions. The identified variables are suitable to be used in the form of a final model.

Footnotes

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