



## Risk Assessment of Crisis Management in Response to Natural Disasters with an Emphasis on Earthquakes

Seyed Mojtaba Hosseini <sup>a</sup>, Fatemeh Dirakvand <sup>a\*</sup>, Omidreza Safarian <sup>a</sup>, Ali Ayoubian <sup>a</sup>

<sup>a</sup> Department of Health Services Management, Tehran North Branch, Islamic Azad University, Tehran, Iran.

Received 24 June 2018; Accepted 10 February 2019

### Abstract

The aim of this study was to explain the risks of the crisis management process in responding to natural disasters with the focus on earthquakes. This quantitative, descriptive, analytic study was conducted in Doroud City, Lorestan province, Iran in 2017. The society of the research comprises all members of the Doroud Crisis Management team, out of which 140 people were selected by stratified random sampling. In order to collect data, self-made questionnaires comprising 40 questions and 6 domains (structural, therapeutic, help and rescue, safety, hygiene, logistics) and based on the Likert Five Option Spectrum (extremely low=1, extremely high=5) were used. To ensure the validity of the questionnaires, they were assessed and verified by experts in the field. To assess the reliability, however, the Cronbach's Alpha Coefficient of 0.89 was applied. The data was analyzed by mean, standard deviation, and Independent T-test and variance analysis using SPSS21. The findings showed that safety with a mean and standard deviation of  $4.91 \pm 0.68$  was the highest and structure with a mean and standard deviation of  $2.03 \pm 0.64$  was the lowest domains under the assessment of crisis management. Also, training courses in therapeutic and hygiene domains, and work experience in therapeutic, help and rescue, security, logistics domains made a considerable difference ( $p=0.05$ ). From the perspective of the sample under study, the domains of therapeutic and hygiene have the highest importance factor, logistics was allocated the lowest priority. Applying the proper assessment of different risk frameworks, the researchers reviewed each domain proportionate to the probability of an earthquake in the study area. This way by identifying the potential hazards and risks in view of important and effective domains, the dangers could be prioritized and management programs could be implemented.

*Keywords:* Risk Management; Crisis Management; Response Stage; Natural Disasters; Earthquake; Doroud City.

### 1. Introduction

Traditionally, looks at incidents and crises have been directed at their causes and intensities. In spite of the rising number of these disasters, attention is seldom paid to the number of casualties [1]. A crisis is a phenomenon that comes into existence by the functions of either humans or nature and affects the lives of people for a short period of time [2]. In cases where local administrations are not sufficiently prepared to face such sudden events, mortalities, injuries, property loss, and a reduction in hygiene levels can occur [1]. It is in man's best interest in facing crises to plan beforehand and apply during the incidents to de-escalate the resultant effects [3]. Crisis management, on the other hand, is a systematic effort of all members together with beneficiaries outside the organizations to prevent a crisis from taking place or to reduce the effects of an event once it has already happened [4].

Some experts and scientists in social sciences believe that crises indicate the inability of systems to continue existing in their current forms. The emergence of such a phenomenon in each and every environment shows the defects of some

\* Corresponding author: [dirakvand1396@yahoo.com](mailto:dirakvand1396@yahoo.com)

 <http://dx.doi.org/10.28991/cej-2019-03091281>

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parts and systems and is bound to be reviewed in order to resume operations [5]. In general, crises are categorized into distinct groups as those of human origin and those of a natural origin [6]. The knowledge of crisis management is said to be the series of actions taken before, during, and after a crisis in order to reduce the effects and damage caused by the incident [7].

Earthquakes will not be considered as a different natural incident. Just like other natural disasters, they may cause a chain of other undesirable incidents, such as ground propulsion, land splitting, flood, fire, explosion, water contamination, etc. [8]. Furthermore, earthquakes result in physical, human, social, financial, and economic losses together with outbreaks of contagious diseases, inflation, famine, and problems in the tourism and aviation industries in the area [9].

According to global statistics, Iran is among the top 10 countries with the highest disaster rates. Based on statistics from the Earthquake Engineering Research Institute, some 83% of the population in Iran reside in areas with a medium-high or high risk of earthquake. During the past 90 years, up to 90 significant earthquakes have occurred, 18 of which have had magnitudes of 7-8 Richter. To be more specific, on average, there has been a serious earthquake every three years for the past 30 years [10].

Crises resulting from an earthquake can be broken down into 3 main stages: A. crises prior to earthquakes, B. crises emerging during earthquakes, and C. crises after the earthquake [9]. One of the most-dealt-with matters in society is environmental crisis. Risk management, one of the most important topics in crisis management, is of utmost importance when it comes to planning and correct decision-making in the face of such crises [11]. Crisis risk management can be categorized based on the two main factors of contingency and vulnerability. According to the UNDP (2002), risk is defined as "the probability of a crisis occurrence and, as a result, loss of life, health, and property in an incident in a specific time and place." There are three things to consider when facing risks: the intensity and magnitude, the contingency, and the importance of the risk for the target society (vulnerability) [12].

Risk assessment process refers to an organized and systematic method for identifying and estimating risks for ranking decisions made so as to reduce risk to an acceptable level. This process is carried out using different methods with a range of qualitative and quantitative approaches [13]. Risk assessment is an important tool in the management field to reduce the risk of projects and achieve sustainable development, and is currently considered in planning and policy making of most countries worldwide. This technique has a high potential for analyzing potential malfunctions and the resulting effects to the extent that it is used to prevent accidents in high-risk industries such as the aerospace industry and nuclear plants [14].

## 2. Literature Review

Modiri (2015) stated that crisis management planning in the urban ruling of today's mega-cities, considering the Passive Defense Principles, is of the most necessary requirements in city planning that could reduce losses resulting from crises and natural disasters [15]. Abdi (2016) attributed the efficiency of crisis management to direct cooperation and coordination in intra-organizational relations and pointed out that, in spite of different disasters that have happened in the past and the probability of such events happening in the future, no intra-organizational relations analysis has been applied to enhance cooperation and coordination in crisis management, urban planning, and management [16].

Asgari (2016) acknowledged that a high level of preparation and empowering human resources is a key requirement of crisis management [17]. Studying history, partial position, and at-hand local and national data, Fotouhi (2013) discovered 31 hazards in Qayen City and assessed the risk of each hazard based on the two factors of contingency and vulnerability [18]. Sayedin (2016) stated that crises can be viewed from 2 different aspects: the personal, team, and social view; the psychological, geographical, and organizational view; and. Finally, the study of crisis management is conducted through the six factors of flexibility, inclusion, trust, risk perception, impartiality, and compatibility [19].

Avvenuti (2016) articulated that the responding components following a crisis emergence aim at saving the lives and property of people, providing partial welfare for the damaged, and preventing expansion of the losses. They include saving and helping, hygiene, treatment, safety, transportation, burial, fast informing, and warning. This is very important so that in the confrontation phase, the most crucial response components are known and prioritized to make the response faster, more accurate, and suitable to the events, thereby preventing a local crisis from becoming a national one [20].

Itria (2017) pointed to the importance of editing a codified plan for preparation before an accident as one of the main tasks of treatment center administrators in force-majeure. Doctors as well as nurses, as crucial elements of hospitals, have a determining role in planning and maintaining readiness [21]. Since earthquake is one of the natural disasters in Iran, and the most important factors in reducing such risk is the earthquake preparedness to deal with this phenomenon on the one hand, and there is also no tool to assess this preparedness, on the other hand, it is necessary to carry out risk assessment studies. Considering the foregoing, and since preparation for dealing with a disaster requires a predetermined planning based on the above and the fact that advance preparation is essential when facing an earthquake (for which a comprehensive agenda is needed), the current study has put forward for discussion the assessment of risk management

in the response stage to natural disasters with the focus on earthquakes.

### 3. Materials and Methods

The present study is a quantitative, descriptive, analytic type of research. The society of the research comprised the member organizations of the Crisis Management Team of Doroud City, Lorestan, Iran selected by stratified random sampling. The organizations included hospitals, healthcare centers, Red Crescent, housing foundation, police force, electricity and gas administrations, fire administration, telecommunications center, water and sewage administration, governor, agriculture administration, industry, and commercial affairs, out of which 140 people were asked to complete the questionnaires based on this Equation 1:

$$n = \frac{z^2 \cdot (1-\alpha)^2 \cdot P \cdot (1-p)}{d^2} \tag{1}$$

The criteria for entering the study were holding an educational certificate higher than B.A or B.S, working on the crisis management team of member organizations, and interest in taking part in the study. Self-made questionnaires were used to collect data. The questionnaire consists of 40 questions and 6 domains of structure (N=10), treatment (N= 6), rescue and relief (N= 6), security (N= 6), health (N=6), and support (N=6) designed based on the Likert Five Option Spectrum (extremely low=1 to extremely high=5). To ensure the validity of the questionnaires, they were assessed and verified by experts in the field. The questionnaire was then provided to 10% of the subjects (N=14) who answered the questions with two-week interval and Cronbach's alpha, and the reliability coefficient of 0.89 was later obtained. The data is shown in Table 1.

**Table 1. Questionnaire Cronbach's Alpha Coefficients of Domains**

	Title	Cronbach's Alpha Coefficient
Questionnaires	Structure	0.85
	Therapeutic	0.74
Components	Help and rescue	0.82
	Safety	0.88
	Hygiene	0.72
	Logistics	0.89

The researcher referred to the organizations in question after obtaining necessary permissions. The questionnaires were then provided to the respondents in person and then collected after explaining the goals of the study. The questionnaires were distributed among the participants by the researcher and collected after they were completed. The data was analyzed by the mean, standard deviation, Independent T-test, and variance analysis using SPSS21. The subjects were assured that their information would remain confidential and that data was only used in this study.

### 3. Results and Discussion

Based on the collected demographic data, 75% of participants were male, 51% were between the ages of 31 to 40, 66% held a B.A. or B.S. degree, 60% had 10 to 20 years of work experience, and 68% had participated in crisis educational courses. After calculating the average score of each of the 6 domains according to Table (2), the findings showed that safety with a mean and standard deviation of 4.91±0.68 and structure with a mean and standard deviation of 2.03±0.64 were the highest and lowest domains in risk assessment of crisis management, respectively.

**Table 2. Mean and standard deviation of domains under risk assessment of crisis management**

Domain	Total Average
Structure	0.64±2.03
Therapeutic	0.84±3.11
Help and Rescue	0.79±2.93
Safety	0.68±4.91
Hygiene	0.77±1.78
Logistics	0.75±1.45

To determine the relevancy between the different domains of the study, a statistical test was conducted. After running a one-way ANOVA test on the average scores of the domains and some of the demographic information, the results (shown in Table 3) showed that training courses in the therapeutic, safety, and hygiene domains and work experience in the structure, therapeutic, help and rescue, and safety domains have made a meaningful difference (p=0.05).

**Table 3. Domains (p-value) according to demographic information**

Demographic information	Structure	Therapeutic	Help and Rescue	Safety	Hygiene	Logistics
Gender	0.73	0.51	0.90	0.70	0.62	0.20
Educational Certificate	0.21	0.83	0.65	0.71	0.18	0.34
Training Course	0.29	0.01	0.47	0.03	0.01	0.54
Work Experience	0.01	0.03	0.04	0.04	0.36	0.02

The results shown in Table 4 proved that, from the perspective of the society under study, the greatest importance was allocated to the therapeutic domain followed by hygiene, while logistics was given the lowest priority among the 6 domains.

**Table 4. Importance and priority of each domain in risk assessment of crisis management**

Domain	Importance Factor				Average
	Extremely High		High		
	Number	%	Number	%	
Structure	34	24.2	14	10	3.21±0.90
Therapeutic	18	12.8	87	62.1	3.79±1.01
Help and Rescue	52	37.1	12	8.5	2.91±0.84
Safety	41	29.2	35	25	2.83±0.97
Hygiene	40	28.5	58	41.4	3.65±0.89
Logistics	56	40	29	20.7	2.45±0.63

The risk of crisis management process in Doroud City, Lorestan Province was assessed using self-made questionnaires based on the 6 domains of structure, therapeutic, help and rescue, safety, hygiene, and logistics. The results showed that the domains' order of importance is as follows: therapeutic, hygiene, structure, help and rescue, safety, and logistics. The method of planning for environmental hazards in Iran must be determined so as to enable firm decision-making when crises such as earthquakes must be faced. Risk management is one of the most important discussions in crisis management that was considered in the present study. Bearing in mind that the degree of risk for each area is the contingency of occurrence multiplied by vulnerability and the earthquake history, Doroud City was chosen.

The effects of supervening incidents like earthquakes on the health of a damaged society are of the most important negative consequences of such events. Since Iran is among the top 10 countries for natural disasters, the necessity of paying more attention to methods of reducing the negative effects of accidents is felt more than ever. Commanding and controlling the operations to help the damaged, recall personnel, transport crews and their lodgment in the area, change personnel shifts, provide water and food, enhance the inventory of medicine and equipment, establish a command center for controlling services, establish medical teams, form a center to which the injured can be transported, establish healthcare centers, take care of the injured and the dead, forge collaboration among healthcare personnel, provide human resources, supply medicine and food to centers and medical teams, coordinate visits to affected people by healthcare personnel, provide water treatment, proper disposal of wastes, give special care to the old and the disabled, assess healthcare centers, change medical teams in turns, and provide psychological healthcare are all services to be provided to an affected society in order to reduce risks and improve conditions for the short-term.

The findings of the present study are compatible with those of Avventi (2017) regarding the importance and priority of treatment actions taken when facing natural disasters [20].

Adini (2016) said that inter-sectoral planning and cooperation's should be taken into account in order to deal with natural disasters. Medical organizations critically need to take into account leadership, coordination, and decision-making, flexibility, expert teams, and multilateral relations so as to show urgent response to natural disasters, which is consistent with the current study [22]. Gunvor (2018) states that a large number of people are affected by natural disasters annually. Strengthening flexibility, communication, and education is also one of the most important aspects of disaster preparedness. A good solution to the crisis is also to raise public awareness and attitudes by organizations involved, which is consistent with the current study [23].

Abbasi (2018) stated that natural disasters are threatening for humans, the environment, and living organisms and quick action is needed to reduce the subsequent risks. Changing the crisis structure, making formal and informal inter-organizational coordination is important in the event of disasters. Healthcare organizations are among the most important health organizations in case of disasters that need to coordinate with other organizations to respond quickly to crises [24]. Gossip (2017) evaluated healthcare organizations in the event of disasters and states that quick actions on the part of health organizations can have long-term effects on the severity of the disasters. These actions include planning, implementation, and evaluation. Creating a culture of learning, education, participation, dissemination of learning, facilitating interorganizational learning, standardized assessment reports, increased commitment to the recovery process, having local leaders, and encouraging joint decisions were among the solutions to the natural disasters in the present study [25].

#### 4. Conclusion

Traditionally in most countries, organizations like the Civil Defense Organization or even the armed forces take responsibility for crisis management. The findings of studies conducted in countries like Bangladesh, the Solomon Islands, and India showed that personal training and asking citizens to plan their society may have significant results in alleviating the damage to the lives and property of the people. In recent years, all macro-planning in the world, especially by international bodies, has been developed for the benefit of using the society in order to strengthen crisis management. The lack of proper and transparent rules and instructions increases the vulnerability and spoils the capacities of communities.

A number of factors play a significant role in the crisis management process, including having a group-work spirit, overcoming fear, being expertise-centered, having a spirit of sacrifice, avoiding the spread of rumors, and inclining toward new technologies. Awareness of the risk assessment results in crisis management, accessibility to the mechanisms of intra-organizational collaboration, and enhancing the rate and accuracy of responding in emergencies may diminish the vulnerability of a society in the face of a crisis. It is hoped that the vulnerability of the area will be reduced to the lowest grade possible by the authorities taking the proper measures based on the domains under study. Moreover, with risk assessment, the operations necessary to prevent possible losses to public and private places will be done prior, during, and after a crisis.

#### 5. Conflict interest

The authors declare no conflict of interest.

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