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Evaluation of Crisis Management Based on the Seven Principles of Resilience Engineering in Selected Hospitals Affiliated to Yazd University of Medical Sciences in 2021

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Original Article

Abstract

INTRODUCTION: The use of resilience engineering principles is a commonly used method for the assessment of crisis management in hospitals as a part of the health system. The present study aimed to evaluate crisis management based on the seven principles of resilience engineering in selected hospitals affiliated to Yazd University of Medical Sciences in 2021.

METHODS: In this study, a crisis management evaluation questionnaire based on the seven principles of resilience engineering in hospitals was used. The reliability and validity of this questionnaire were confirmed by Azadian et al. in a previous study. The required data were collected from administrative and clinical managers and nurses. The mean score of the seven principles was obtained, making it possible to compare crisis management in all three selected hospitals (Shahid Sadoughi, Afshar, and Shahid Rahnamoun) in Yazd.

FINDINGS: The mean score of resilience engineering principles was determined, and the overall crisis management score of each hospital was determined. The mean scores of crisis management were calculated at 136.53, 135.23, and 132.07 out of a total score of 220 in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals. Nonetheless, the mean score in flexibility and preparedness components in some hospitals was below 0.6 of the total score.

CONCLUSION: The situation of crisis management in all three hospitals was evaluated to be at a good level. However, some corrective measures were required to be implemented in some components to improve crisis management in all three hospitals. It is necessary to take appropriate measures to enhance the preparedness of the three hospitals in different aspects of crisis management, especially flexibility, to arrive at a more favorable level.

Keywords: Assessment; Crisis Management; Hospital; Resilience Engineering; Seven Principles.

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Introduction

Since the beginning of life on earth, natural disasters have caused huge losses of life and the economy. According to statistics, Iran is the 10th disaster-prone country in the world and the 4th in Asia. About 77% of the 300 cities that include the most populated components of our country are located on earthquake faults and 35% of cities are exposed to floods and storms (1). Natural or manmade disasters and their destructive effects disrupt normal social functioning and result in unmet healthcare needs (2). Hospitals, as the most essential part of the health system, are of special importance in the crisis response phase.

The main goal of hospitals is to prevent the negative outcomes of treatment that occur to patients during the provision of health care. Disaster-caused disruptions in hospital treatment

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services and their long-term effects create an urgent need for medical care and public health in the post-disaster era. Damage to the health sector can lead to devastating secondary consequences (3-5). Hospitals make use of crisis management awareness to deal with the crisis (3). Crisis management is the science and art of integrated, comprehensive, and coordinated planning, organization, guidance, and leadership which tries to control the risks caused by various crises based on different stages of the crisis by drawing on available resources (6).

In crisis management, potential risks and available resources are evaluated, and an effort is made to strike a balance between existing resources and potential risks to control the crisis using available resources (7). Crisis management puts an emphasis on the necessity of regular prediction and preparedness to face those internal and external issues that seriously threaten the reputation, profitability, or life of an organization. Crisis management is essential for the prevention of crisis escalation and relationship destruction, as well as the protection of organizations against threats and disastrous events (8).

There are two general views on crisis management: traditional and modern. In the traditional view, crisis managers strive to limit the damage caused by a catastrophic breakdown; nonetheless, in the new approach, they prepare themselves to prevent or effectively deal with the crisis (9). The present study was conducted based on the tenets of the new perspective. One of the new approaches in the latter perspective is the evaluation of crisis management using the seven principles of resilience engineering, which was regarded as our evaluation criteria due to its novelty and efficiency (9& 13).

One of the characteristics of resilience engineering is how to minimize the damages caused by the crisis and how people learn from the events and adapt themselves to the environment. In fact, this model is used to bounce back to the initial state after an unprecedented event. Azadian et al. designed a questionnaire to evaluate crisis management using the principles of resilience engineering and identified seven components of top management commitment, error culture, learning culture, awareness, preparedness, flexibility, and transparency to evaluate crisis management (10&11). Nasrollahpour et al. pointed out that although public hospitals in Iran benefit from some strengths and opportunities in crisis and disaster management, they are presented with numerous challenges and threats. Therefore, there is an urgent need to evaluate them and implement appropriate intervention programs (12).

Hatam Abadi et al. reported that the occurrence of unexpected events leads to serious problems, the response to which requires planning for an emergency situation, which in turn needs an assessment of vulnerability to crises-that is to say, crisis management (13 and 14). According to the aforementioned issues and the lack of crisis management evaluation in selected hospitals, there is a need to carry out an evaluation based on a new approach, such as resilience engineering. In light of the aforementioned issues, the present study aimed to evaluate crisis management using the seven principles of resilience engineering in selected hospitals affiliated to Shahid Sadoughi University of Medical Sciences in Yazd, Iran, in 2021.

Methods

This descriptive cross-sectional study was conducted in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals in Yazd in 2021. The study population included all nursing personnel and managers of three hospitals affiliated to Shahid Sadoughi University of Medical Sciences, Yazd. We selected these hospitals since they are all government hospitals and among the selected hospitals in Yazd. The criteria for participant selection were having more information about the topics and questions mentioned in the questionnaire, as well as a more accurate judgment about the crisis in the hospital. The nurses and managers are more qualified in this regard, as demonstrated by Azadian et al. (10 & 15).

The nursing department encompassed all the personnel of the nursing unit, including nurses, head nurses, and hospital supervisors. The department of administrators included the hospital manager, supervisors, and experts in education and health, the chairman and members of the crisis committee, and the matron (manager of the nursing department). The research tool was the crisis management evaluation questionnaire based on the seven principles of resilience engineering in hospitals, which was developed by Azadian et al.

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Table 1. Situation of each component

Very weak	weak	Average	Good	Very good
(0-20)	(20-40)	(40-60)	(60-80)	(80-100)

in 2015. This 44-item questionnaire contains seven components: 1) top management commitment (nine questions); (2) error culture (six questions); (3) learning culture (four questions); (4) awareness (fifteen questions); (5) preparedness (three questions); (6) flexibility (five questions); and (7) transparency (two questions).

The scoring scale in this questionnaire was based on a five-point Likert scale from very low (1) to very high (5). To calculate the score of each component, the mean of the total scores assigned by people was calculated and interpreted based on the total score of that component, as illustrated in Table 1. Moreover, the validity and reliability of the questionnaire were confirmed in a previous study entitled Determining the validity and reliability of the crisis management evaluation questionnaire based on the weekly principles of resilience engineering in hospitals (10). In order to calculate the variance and other values needed to determine the sample size, the questionnaire was distributed among 20 employees of the three hospitals. Thereafter, the sample size was calculated at 200 cases, considering the confidence level of 95%, the power of 80%, and the standard deviation of 7.65 for the awareness score as the highest standard deviation and the standard error of 2 points.

The managers were selected via the census method, and stratified random sampling was used to select nurses. They were initially separated based on their unit; subsequently, according to the number of nurses in each unit, the needed participants were selected by simple random sampling. The logic behind the use of census and stratified random methods was the small number of managers and a large number of personnel in the nursing department. To collect data, the questionnaires were administered online via a link sent to the target sample, and finally, the data were entered into SPSS software (version 25), and its normality was checked using the Kolmogorov-Smirnov. Following that, the data were presented as mean and median. If the data fit the normal distribution, a one-way ANOVA test was used, and if the data were not normal, the Kruskal-Wallis test was used to compare the means in the three groups (three hospitals). In interpreting the results of each component, in order to assess the condition of each hospital in each component, as well as the general situation in all components, the mean score of each component was calculated based on 100% of the total score, using the proportional method, and based on the following spectrum, the general condition of that component was specified.

After determining the score of each of the seven components of resilience engineering, the mean of all seven components (the mean score of crisis management) was obtained for each hospital, providing the possibility of comparison. This comparison was made in SPSS software (version 25) using one-way ANOVA and descriptive statistics. The inclusion criteria entailed a willingness to participate in the research and a minimum of one year of work experience. On the other hand, the exclusion criterion was incomplete questionnaires. Before the commencement of the study, the participants were informed about the topic and the method of conducting the study, as well as the confidentiality of their responses. This research project was approved by the ethics committee (IR.SSU.SPH.REC.1400.034).

Findings

The findings of this study demonstrated the mean scores of each of the seven components of resilience engineering in crisis management in each hospital. These findings provide information about the strengths and weaknesses of each hospital in every component (Table 2).

Top management commitment

Out of the total 45 scores obtained in this component, the mean top management commitment scores were calculated at 28.39, 28.17, and 27.76 in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals, respectively.

Error culture

Out of the total 30 scores in this component, the mean scores of error culture were 18.31, 17.85, and 17.76 in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals, respectively.

Learning culture

Out of the total 20 scores in this component, the mean scores of learning culture were 12.60, 12.52, and 12.92 in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals, respectively.

Table 2. Mean of each component in all three selected hospitals

Component	Hospital	n	Mean	Variance	Error
Top manager commitment	Sadoughi	112	28.3929	4.77674	0.45136
	Rahnamoun	63	28.1746	6.58086	0.82911
	Afshar	26	27.7692	5.36886	0.05292
	Total	201	28.2438	5.45301	0.38463
Error culture	Sadoughi	112	18.3125	2.52209	0.23831
	Rahnamoun	63	17.8571	4.94765	0.62335
	Afshar	26	17.7692	3.37411	0.66172
	Total	201	18.0995	3.54965	0.25037
Learning culture	Sadoughi	112	12.6071	1.80768	0.17081
	Rahnamoun	62	12.5238	2.87288	0.36195
	Afshar	26	12.9231	2.57563	0.50512
	Total	200	12.6219	2.28393	0.16110
Transparency	Sadoughi	112	6.3125	0.97751	0.09237
	Rahnamoun	63	6.4127	1.32756	.16726٠
	Afshar	26	6.3462	1.35476	0.26569
	Total	201	6.3483	1.14373	0.08067
Preparedness	Sadoughi	112	9.7232	1.33024	0.12570
	Rahnamoun	63	9.8413	2.04944	0.12570
	Afshar	26	8.7692	1.79572	0.35217
	Total	201	9.6368	1.67405	0.11808
Awareness	Sadoughi	112	46.9554	6.44084	0.60860
	Rahnamoun	63	45.6190	10.81133	1.36210
	Afshar	26	45.8077	8.16343	1.60098
	Total	201	46.3881	8.24613	0.58164
Flexibility	Sadoughi	112	14.2321	2.71128	0.25619
	Rahnamoun	63	14.8095	3.88486	0.48945
	Afshar	26	12.6923	2.81097	0.55128
	Total	201	14.2139	3.18732	0.22482
Crisis management	Sadoughi	112	136.5357	16.61104	56960
	Rahnamoun	62	135.2381	29.86891	3.76313
	Afshar	26	132.0769	23.07713	4.52580
	Total	200	135.5522	22.32529	1.57470

Transparency

Out of 10 scores related to this component, the mean scores of transparency in Shahid Sadoughi, Shahid Rahnemoun, and Afshar hospitals were 6.31, 6.41, and 6.34, respectively.

Preparedness

Out of the 15 scores in the mentioned component, the mean scores of preparedness in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals were 9.72, 9.84, and 8.76, respectively.

Awareness

Out of 75 scores in this component, the mean awareness scores in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals were 46.95, 45.61, and 45.80, respectively.

Flexibility

Out of the total 25 scores of this section, the mean flexibility scores in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals were 14.21, 14.80, and 2.69, respectively.

The mean score of crisis management: the mean score of all seven components was obtained from the total of the mentioned component. The total score of the questionnaire was 220. The mean scores of all seven components were 136.53, 135.23, and 132.07 in Shahid Sadoughi, Shahid Rahnamoun, and Afshar hospitals, respectively. The highest mean in all seven components (crisis management score) pertained to Shahid Sadoughi Hospital, followed by Rahnamoun Hospital, while the lowest mean score was related to Afshar Hospital (Table 2).

Table 3. Equality of means in all three selected hospitals

		Sum of Squares	df	Mean Square	F	Sig.
Top manager commitment	Between Groups	8.646	2	4.323	0.144	.866
	Within Groups	5938.409	198	29.992		
	Total	5947.055	200			
Error culture	Between Groups	11.618	2	5.809	0.459	0.633
	Within Groups	2508.392	198	12.669		
	Total	2520.010	200		0.284	
Learning culture	Between Groups	2.989	2	1.494		0.753
	Within Groups	1040.275	198	5.254		
	Total	1043.264	200			
Transparency	Between Groups	0.405	2	0.0202	0.153	k0.858
	Within Groups	261.217	198	1.319		
	Total	261.622	200			
Preparedness	Between Groups	23.040	2	11.520	4.244	0.016
	Within Groups	537.448	198	2.714		
	Total	560.488	200			
Awareness	Between Groups	82.059	2	41.029	0.601	0.549
	Within Groups	13517.672	198	68.271		
	Total	13599.731	200			
Flexibility	Between Groups	82.584	2	41.292	4.194	0.016
	Within Groups	1949.217	198	9.845		
	Total	2031.801	200			
Total	Between Groups	428.570	2	214.285	0.427	0.653
	Within Groups	99255.132	198	214.285		
	Total	99683.701	200			

Examining the equality of means in all three hospitals using the ANOVA test

This test was performed to compare the obtained means in order to compare the similarity of all components of the crisis in all three selected hospitals. This test assessed the equality of means in all three groups (three hospitals), and if the means were not equal, the source of the difference was determined, and the hospital that differed from the rest was identified (Table 3)

Top management commitment

In this component, since the p-value for the t-test for equality of means was 0.866, which was higher than the confidence level of the test (0.05), no significant difference was observed between the means. Accordingly, in terms of top management commitment, all three hospitals were similar.

Error culture

In this component, the p-value for the t-test for equality of means was 0.633, which was higher than the confidence level of the test. Consequently, there was no significant difference among the three hospitals regarding error culture.

Learning culture

In this component, the p-value for the t-test for equality of means was calculated at 0.753, which was also higher than the confidence level of the test. Accordingly, the three hospitals did not significantly differ in this component.

Transparency

In this component, there was a marked difference between the obtained p-value and the confidence level of the test (0.858 is much higher than 0.05), signifying that there was no significant difference among the three hospitals in this component.

Preparedness

In this component, the p-value of 0.016 was obtained, which was lower than the confidence level of the test, indicating a significant difference

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among the three selected hospitals, and after examining the mean preparedness scores of three hospitals, this difference was attributed to the low mean preparedness in Afshar Hospital.

Awareness

In this component, the p-value was 0.549, which is higher than the confidence level of the test. Accordingly, in terms of awareness, no significant difference was observed among the three selected hospitals.

Flexibility

In this component, the p-value was obtained at 0.016, which was lower than the confidence level of the test; accordingly, in terms of flexibility, the three hospitals were significantly different, and this difference was due to the low mean score of flexibility in Afshar Hospital.

Discussion and Conclusion

The present study aimed to assess crisis management based on the seven principles of resilience engineering in hospitals affiliated to Yazd University of Medical Sciences. As evidenced by the obtained results, there was a significant difference among the mean scores of the three selected hospitals in the two components of preparedness and flexibility. The hospitals that are the source of differences in these two components should make great efforts to improve their situation. If the situation of these hospitals does not improve, they will suffer irreparable damage in the event of crises and disasters.

In the methods section, we stated that if the score of each component is equal to or more than 60% of the total score of that component, that component is in good condition. In this way, by calculating all the ratios, it was determined that in all three hospitals, all the components of resilience engineering were at a good level, except for the components of preparedness in Afshar Hospital, error culture in Rahnamoun and Afshar hospitals, as well as flexibility in all three hospitals. The results demonstrated that in these components, these hospitals are not at an optimal level and should take corrective measures. Moreover, they are in an alarming situation in the components which obtained scores less or close to half of the total score, and these components need appropriate programs to be improved.

The mean scores in each component in the three hospitals were very close in some cases; nonetheless, it does not imply the absence of any difference. This finding can be ascribed to the regional uniformity of the selected hospitals-that is to say, the hospitals in the same region and affiliated to the same medical university have similar access to resources. As a result, the outputs can also be very similar; nonetheless, other factors can also influence this issue. In the evaluation of the crisis management in the three selected hospitals, it was expected that Shahid Rahnamoun Hospital, which has a newer physical construction and more modern facilities than the other two hospitals, would get better results; however, in the component of preparedness, it was found that this hospital has the same performance as the other two hospitals.

Shahid Sadoughi Hospital had a higher mean score in a total of seven components than other selected hospitals, which shows the superiority of this hospital over the other ones. Nevertheless, it does not mean the superiority of this hospital in all components, and even in some components, it had a lower mean score, signifying that the hospitals have different strengths and weaknesses. One of the limitations of this research is the limited generalizability of the results since the mere use of nurses and managers cannot provide a thorough understanding of crisis situations in hospitals. In their study, Ghasemi et al. evaluated crisis management in incidents and illustrated that higher scientific levels, more updated information, and the use of new methods in operations would result in more efficient crisis management.

However, this study reported that Shahid Rahnamoun Hospital, despite the use of modern operating methods and equipment, did not have a higher crisis management mean score than other selected hospitals (16). Robbins stated that managers at every organizational level need human skills. In this study, senior managers who had a high level of commitment had a greater chance of success in dealing with incidents, indicating the necessity of communication skills (17). In their study in Cuba, Devos et al. indicated that following the guidelines had a significant impact on the detection of incidents (18).

Andreae et al., in their research entitled debriefing observations on healthcare simulation to prepare for the COVID-19 pandemic, showed that the use of predetermined scenarios and maneuvers, as well as system integration, can be effective in disaster management (19). Miller-

Hooks et al. referred to the effectiveness of formalized collaboration strategies through which patients can be transferred and resources, including staff, equipment and supplies, can be shared across hospitals in response to a disaster incident involving mass casualties and area-wide damage. The inflicted damages can influence the infrastructure of the hospital, thereby affecting the capacity and the provided services. This study also investigated the effectiveness of the equipment in the event of incidents (20).

Seyedin et al., in their research, evaluated the earthquake vulnerability of general hospitals in Tehran University from structural, non-structural, and management vulnerability aspects by visiting and observing the hospital, as well as interviewing technical experts in the hospital. In the stated study, in order to evaluate crisis management, various principles were used and the questionnaire was completed by those who were more familiar with the subject (21). In agreement with the results of the present study, Yaqoubi et al. reported that the preparedness of Iranian hospitals in the face of the crisis was at an average level (22).

Ali Akbari et al., in their research entitled Crisis teamwork competence: a qualitative content analysis study from the perspective of emergency nurses, indicated that nurses should be fully familiar with the limits and description of their duties and those of other members of the crisis team, know the hierarchy of management in response to the crisis, and be able to maintain the unity of command in order to perform effectively as a team in response to a crisis (23).

Based on the analysis performed in each component, it was concluded that the performance of all three hospitals was at a good level, and there was also a slight difference between the performance of the three hospitals. Nonetheless, all three hospitals need corrective measures to improve their condition. It is recommended to develop programs to prepare for crises, especially in the component of flexibility. Moreover, it is essential to perform a re-evaluation after the implementation of these programs. Therefore, there is a need for more measures to deal with the crisis in order to improve crisis management in hospitals. Future studies in this field should focus on examining the factors in order to promote and improve the situation of crisis management. Moreover, they should use strategic plans and enhance capabilities to be more prepared in the face of crises. Employees play a significant role in the success of hospitals; therefore, their skills against accidents and disasters need to be strengthened.

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Conflict of Interests

The authors declare that they have no conflict of interest.

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