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How public hospitals manage epidemic crises? Lessons from Iranian public hospitals

Ali Tahmasebi, Iravan Masoudi Asl, Aidin Aryankhesal, Soudabeh Vatankhah, Gholamreza Masoumi¹

Abstract:

BACKGROUND: The public hospital preparedness is essential for epidemic disaster like COVID-19 pandemic. This study was conducted to present a hospital management preparedness model of Iran's public hospitals for the epidemic.

MATERIALS AND METHODS: The method of this study was an exploratory sequential mix method study (qualitative–quantitative). In this study, qualitative and quantitative methods were used in four stages. (1) Interviews with hospital managers to identify hospital management experiences during the COVID-19 epidemic and categorize the results in themes and subthemes, (2) assessing the performance of public hospitals in managing the coronavirus epidemic in a quantitative method, (3) present the initial hospital management model for a public hospital in epidemic conditions using an expert panel, and (4) validation of the model using the Delphi method.

RESULTS: Experiences of hospital managers and specialists were categorized into eight themes: information gathering and environmental analysis, general and operational planning, provision of equipment and physical and financial resources, training and empowerment of human resources, a compilation of instructions and job descriptions, review and ensuring maximum readiness, monitoring and follow-up of service provision and existing problems, evaluation and feedback of performance problems and level of preparation and 51 sub-themes. The quantitative study indicated that all the investigated indicators had a significant decrease in the first month and an increase in the epidemic's continuation. The results were categorized in nine themes and 59 sub-themes, and finally, the model was validated in one round by the Delphi method.

CONCLUSION: In Iran, managers have valuable experiences in COVID-19 epidemic management, but these experiences are scattered and not organized. In this study, by a qualitative–quantitative, a model was presented that contains essential points obtained from the experience of hospital managers and experts in actual disaster conditions and is appropriate and fits hospital structure and infrastructure of the health system in Iran.

Keywords:

Covid-19, epidemic, hospital administration, public hospital

Introduction

Data and reports indicate that the scale of mortality and morbidity due to non-communicable diseases has been more prominent for many years than communicable diseases.^[1-5] Not only is the work of infectious diseases not finished yet,

but every few years, the world witnesses their emergence, reappearance, mutation, and global outbreaks.^[6] Epidemics and pandemics caused by infectious diseases still take a terrible toll every few years and bring costs to the health systems, significantly reducing organizations' capacity to provide services during an epidemic.^[6-9] Coronaviruses, including

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Department of Health Services Management, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran, ¹Department of Health in Disaster and Emergencies, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran

Address for correspondence:

Dr. Iravan Masoudi Asl, School of Health Management and Information Sciences, Shahid Yasami st, Valiasar st, Tehran, Iran. E-mail: masoudiaslirvan@gmail.com

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SARS, MERS, and COVID-19, are contagious types that have affected all parts of the world during the last two decades through epidemics and pandemics.^[10,11] The coronavirus epidemic has caused conditions such as rapid and uncontrollable spread, fear and panic among people and patients, insufficient hospital resources, and new conditions that have caused the management of hospitals to become unique, complex, and critical.^[12] In the ambiguous situation of the epidemic, hospitals' response and admission capacity can be limited. However, managing resources can improve hospitals' performance in this situation.^[13]

Working in a completely new situation, very different from the expected condition, fatigue caused by wearing personal protective equipment, fear of contracting a disease or transmitting the virus to others, high workload, and difficulty controlling relationships in stressful situations have complicated conditions for hospital management.^[14] These conditions can easily disrupt other hospital admissions unrelated to the epidemic and increase the complexity of hospital management. As a result, the continuation of the epidemic situation severely reduces hospital resources and the capacity to accept other patients, and thus the complex situation becomes more complicated.^[15-18] Assigning a working group to prepare hospital capacities by collecting data and estimating needs, training personnel, categorizing the severity of the disease and limiting direct contact with patients, predicting the current needs of the hospital, ensuring the commitment of the hospital management staff and other officials, encouraging effective leadership, disseminating knowledge from the experiences of hospital managers, protecting medical staff and organizing communication with the public, have been some of the hospital experiences during the COVID-19 epidemic.^[19,20] Cultural barriers, communication, financial, human, and political barriers make the management experiences of managers not well available to their peers to reduce errors in cases of re-exposure.^[21] On the other hand, their multiplicity of experiences and diversity can reduce their use in epidemic conditions in the future. Considering conditions of economic sanctions and other conditions surrounding Iran, the complexity of work increases in the conditions of an epidemic. Also, there is no preparedness model in Iran for epidemic crises and the foreign model is not suitable and fits the health system of Iran because of differences in structure and infrastructure. Therefore, the coronavirus epidemic in Iran has caused special conditions in managing various resources, supply of drugs and equipment, education and research in healthcare, management of corona and non-corona patients, financial management, and the management of hospitals. These conditions have created extensive experiences for managers, which can be valuable in an epidemic but these experiences

are scattered and not organized in a model. Therefore, this study designs a preparedness model for hospital crisis management during the epidemic by collecting and analyzing the experiences of managers and experts during the epidemic of the COVID-19 that is appropriate for the health system of Iran and also can be used in similar health systems in other countries.

Materials and Methods

This is applied research and the research method is qualitative-quantitative and has four phases.

1-Interview phase: In the first phase, the descriptive phenomenological method was used and the interview was conducted. In conducting the interviews, after coordinating with the interviewee, went to the workplace of each person at unbusy and pre-appointed time, interviewed individually, and during each interview, the sound was recorded and after each interview transcribed. Before the start of each interview, was talk about the study and it is important to participants. Then, the next interview was continued until the interviews reached saturation and no new code was specified based on Lisa M. Given study.^[22] The experiences of a public hospital in managing epidemic conditions were collected through interviews with hospital managers and policymakers. The sampling method was purposeful and the criterion for selecting people for the interview was to have knowledge and information and to be on the executive board of hospitals or medical university vice presidents during the COVID-19 epidemic or to have information on dealing with the COVID-19 epidemic despite not having a position on the executive board, such as infection control supervisors or emergency and ICU physicians. According to these criteria, 35 people participated in the interview. The primary tool was the interview guide, which included open questions. This tool was designated by research group in three questions about experiences, challenges, and problems of managing hospitals in COVID-19 epidemics. Also, extracted other questions from the interviews with initial interviews with three knowledgeable managers, and the questions of interview increased to six questions and questions about performance evaluation, suggestions, and other points added to questionnaire shown in Table 1. In order to analyze the data, thematic analysis was used, and the research team did data coding. To increase the rigor of the study results, four criteria proposed by Goba and Lincoln be used.^[23] The consent of participants and interviewees was got and the interview text was considered confidential.

2-Performance evaluation: In the second stage, the evaluation of Iran's public hospitals' performance in managing the COVID-19 epidemic was carried

Table 1: The interview questions

1	As a first question, please tell us about your experiences in the field of managing the epidemic of COVID-19 in your hospital?
2	In your opinion, what are the most important challenges and problems in Iran's public hospitals for the management of infectious disease epidemic crises—the case of COVID-19?
3	How do you evaluate the readiness of Iran's public hospitals to manage infectious disease epidemic crises—on a case-by-case basis, COVID-19?
4	On your opinion, what public hospitals should do to manage infectious disease epidemic crises—in every area?
5	What are your proposed solutions for proper management of infectious disease epidemic crises—in the case of COVID-19?
6	In the end, if you have any other opinion or topic in mind or you would like to say, please tell us?

out (comparison of hospital financial-functional indicators before and after the COVID-19 epidemic). The data were collected from HIS (hospital information system) of four hospitals affiliated with the Iran university of medical sciences by a form designated by researchers and analyzed by the time series method to evaluate the accuracy of interviews and use of mentioned codes in the model with Stata software. The confidentiality of data and information be considered.

3-Designing the initial model: In the third stage, for designing the initial model, the panel of the expert methods was used. In this panel, six hospital management experts from the Iran university of medical sciences and the ministry of health who have knowledge and experience in the management of COVID-19 epidemic of hospitals participated. According to the results obtained in the previous stages, the thematic analysis method was used and the consent of experts was got for panel participation.

4-Validation of the model: In the final stage, the validation of the model was done by the Delphi method. By using email, the questionnaire which has 12 dimensions and is based on Polit *et al.*^[24] tool sent to experts and they answered and back to the research team. Each dimension should gain more than a 70% score. In this phase, 15 experts from the field of health administration, health policy, and disaster in health participated. The selection criteria were having executive or scientific experience in hospital management, having a scientific article or book in the field, or having related academic education. The consent of participants and confidentiality of data and information are considered. Also, this study got ethics with a number of IR.IUMS.REC.1399.1100 from Iran University of medical sciences.

Results

Out of 35 participants in the stage of identifying the experiences of selected managers and decision makers in the study, 26 were men, and 9 were women. In terms of the job title, 21 people were from the executive board of

the studied hospitals, four people were knowledgeable and opinionated people who were not on the executive board of the hospitals but have worked in hospitals during the epidemic condition, and ten people were working in universities of medical sciences and the Ministry of Health and Medical Education (MOHME) in different areas of the health system. Regarding educational qualifications, 21 people had a specialized doctorate, six were general physicians and had master's degrees, and eight had bachelor's degrees. According to the interview questions, the research team extracted the quotes expressed in three areas of experiences, performance evaluation, and challenges and 51 sub-areas as the principles and components of hospital management preparedness for epidemic disaster shown in Table 2.

The results of evaluating the performance of the studied hospitals in managing the COVID-19 epidemic using selected indicators showed that all the indicators studied significantly decreased in the first month of the epidemic. However, they have increased in the epidemic's continuation. Table 3 shows the results of each indicator assessment separately.

For example, the trend of bed occupancy index changes is shown in the graph below. As the graph shows, the percentage of bed occupancy after the COVID-19 epidemics increased by 0.93% on average compared to before the COVID-19 epidemic, which was not statistically significant (P value = 0.101) [Figure 1].

The research team designed the initial table of content of the study with eight main themes, and 51 sub-themes. In the third phase, according to the opinion of the expert panels, which comprised four expert panels in person and two expert panels were held virtually, the nature of some of the identified sub-themes that seemed not to be included in any of the main themes, because of their similar nature, were included in another theme called leadership and macro-management. As a result, the number of key themes increased to nine. The expert panel removed several sub-themes due to their similarity with the existing themes, combined and integrated them, and added some.

According to the analysis of the indicators in the second stage of the study and comparing it with some interviews conducted in the first stage, some sub-themes were removed and confirmed. For example, the managers of the hospitals in several interviews had mentioned the decrease in the hospital's income, and by examining the specific income index, it was determined that maybe these views were true in the first few months of the epidemic. However, over time, the hospital's income has grown significantly. The same interpretation was made regarding

Table 2: Principles and components of hospital management preparedness for epidemic disaster quoted by interviewers

Experiences during COVID-19 epidemic	Performance evaluation during COVID-19 epidemic	Challenges during COVID-19 epidemic
<ul style="list-style-type: none"> - "separating infected patients' entrance to the hospital from other patients" - "separating infected patients' wards from other wards" - "training of physicians from non-infectious specialties about the epidemic disease" - "employing physicians from non-infectious specialty" - "training of non-specialist personnel about the epidemic disease" - "using workforce capacity of closed non-infectious wards " - "Rating of patients in the emergency ward" - "Rating of patients in in-patient wards" - "executing infectious patients triage and transferring them from the emergency ward to in-patient wards" - "providing electronic and communicational infrastructures to control the epidemic" - " providing virtual infrastructures to control the epidemic" - "trying to show evidence-based performance and identifying diseases' nature" - "activating disaster committee in the hospital " - "absorbing financial and equipment aid from other organizations" - "the careful separating of infectious and non-infectious waste and disinfection of wards" - "physical reinforcement of personnel" - "Mental and psychological reinforcement of personnel" - "providing a place for the rest of the personnel in the hospital" - "establishment of "your voice" system" - "establishment of a "follow-up" system" - "using electronic tools" - "designing a plan for financial and equipment allocation in epidemic condition" - "managing and coordinating the corpse of infectious patients with the relevant organization" - "identifying and using peer and supportive organization capacity" - "documentation of experiences and learning from the epidemic condition" - "consistent analysis of disease prevalence and burden of in-and outpatient" - " beneficiaries analyze in epidemics, in and out of hospital " - "designing treatment priority plan for admission of infections and non-infectious patients" - "planning for admission and treatment of delayed elective diseases" - "systematic planning based on evidence" - "having a maintenance plan for medical, mechanical, and electrical equipment for epidemic condition " - "revising in research scope and allocating some percent of research financial sources to epidemic studies to monitor epidemic diseases" - "holding epidemics disaster maneuvers " 	<ul style="list-style-type: none"> - "preparedness in providing medical devices and equipment" - "preparedness for employing specialized and non-specialized manpower " - "preparedness for providing physical space" - "performing based on accreditation indicators on the epidemic" 	<ul style="list-style-type: none"> - "identifying infectious disease nature" - "preparing and identifying demographic features of the population" - "lake of preparedness plan for the epidemic condition" - "supplying financial and equipment sources" - "shortage of resources" - "financial and welfare support" - "physiological management of personnel in an epidemic" - "scientific evidence and effective instructions" - "coordination of inter and out of the organization" - "psychological problems related to patient stigmatization" - "worrying and stress of patients" - "reduction of hospital revenue" - "insurance reimbursement delay" - "effective evaluation of systems and infrastructures"

the number of clinic visitors, the number of hospitalized patients, and the number of surgeries. The contradictory cases with quantitative data were discarded. Several cases in the interviews were confirmed in the quantitative data analysis as a sub-theme in the study. For example, the sub-theme of stratification of patients in the inpatient and emergency departments was included in the initial model concerning reducing the length of stay of patients in the hospital. It showed the positive effect of this measure

in reducing the average length of stay. The sub-themes added in the initial design of the model mostly referred to the post-crisis stage and the actions needed in this stage, because the CEOs were not discussed much at the time of the interview due to the involvement of hospitals with COVID-19 and the lack of prospects for the end of the disease. Finally, nine main themes and 59 sub-themes were identified in the final framework. Also, according to the opinion of the expert panels, which comprised four

Table 3: Evaluating the performance of the studied hospitals in managing the COVID-19 epidemic: trend change following the epidemic condition

Indicators	Trends	Regression coefficient	Standard deviation	T	Probability
Occupancy rate	baseline level	79.95	2.79	28.67	<0.001
	pre-epidemic trend	0.27	0.21	1.33	0.192
	slope change following the epidemic	-24.57	4.41	-5.57	<0.001
	trend change following the epidemic	0.93	0.55	1.69	0.101
	post-epidemic occurrence trend	1.20	0.50	2.42	0.021
Revenue of hospital	baseline level	75.08	5.14	14.62	<0.001
	pre-epidemic trend	0.81	0.38	2.13	0.041
	slope change following the epidemic	-29.92	8.15	-3.67	0.001
	trend change following the epidemic	3.06	1.01	3.02	0.005
	post-epidemic occurrence trend	3.86	0.92	4.22	<0.001
Number of surgeries	baseline level	1346.91	80.73	16.68	<0.001
	pre-epidemic trend	5.91	6.01	0.98	0.333
	slope change following the epidemic	-966.73	136.58	-7.08	<0.001
	trend change following the epidemic	47.02	16.24	2.89	0.007
	post-epidemic occurrence trend	52.93	15.07	3.51	0.001
Number of patients admitted to the emergency	baseline level	2283.37	134.93	16.92	<0.001
	pre-epidemic trend	1.35	9.67	0.14	0.890
	slope change following the epidemic	-624.10	173.95	-3.59	0.001
	trend change following the epidemic	1.97	25.28	0.08	0.938
	post-epidemic occurrence trend	3.32	21.45	0.15	0.878
Average of patient hospitalization day	baseline level	5.17	0.17	30.64	<0.001
	pre-epidemic trend	0.03	0.01	2.03	0.051
	slope change following the epidemic	-2.28	0.28	-8.19	0.000
	trend change following the epidemic	0.05	0.03	1.44	0.158
	post-epidemic occurrence trend	0.07	0.03	2.39	0.022
Number of in-patients	baseline level	1830.38	83.61	21.89	<0.001
	pre-epidemic trend	6.44	6.19	1.04	0.305
	slope change following the epidemic	-840.33	135.75	-6.19	<0.001
	trend change following the epidemic	42.66	16.59	2.57	0.015
	post-epidemic occurrence trend	49.10	15.14	3.24	0.003
Drug and medical equipment costs	baseline level	35.90	2.55	14.09	<0.001
	pre-epidemic trend	0.57	0.19	3.02	0.005
	slope change following the epidemic	-13.07	4.36	-3	0.005
	trend change following the epidemic	3.28	0.51	6.38	<0.001
	post-epidemic occurrence trend	3.86	0.48	8.04	<0.001
Number of clinics visits	baseline level	13183.44	983.06	13.41	<0.001
	pre-epidemic trend	171.29	72.98	2.35	0.025
	slope change following the epidemic	-11436.24	1631.04	-7.01	<0.001
	trend change following the epidemic	320.46	196.41	1.63	0.112
	post-epidemic occurrence trend	491.75	180.73	2.72	0.010
Number of Para-clinics delivered services	baseline level	148837.90	7060.78	21.08	<0.001
	pre-epidemic trend	36.98	521.73	0.07	0.944
	slope change following the epidemic	-49406.75	11361.06	-4.35	<0.001
	trend change following the epidemic	5599.96	1396.99	4.01	<0.001
	post-epidemic occurrence trend	5636.94	1270.56	4.44	<0.001

experts in person and two experts were held virtually, the initial framework was designated [Table 4], and in Figure 2 initial model was suggested.

The managerial preparedness model of public hospitals for epidemic disaster in nine key themes, including leadership and macro-management, information gathering and environmental analysis, planning and

overall and operational coordination, provision of equipment and physical, and financial resources, training and empowerment of human resources, compilation of instructions and description of tasks, review and assurance of maximum readiness, monitoring and follow-up of service provision and existing problems, evaluation and feedback of performance problems and level of preparation and 59 sub-themes were developed

Table 4: The initial framework of the hospital management preparedness model of Iran's public hospitals for epidemic disaster

Disaster stage	Implementation				Evaluation				
	Leadership and macro management	Information gathering and environmental analysis	Planning and overall operational coordination	Provision of equipment and physical financial resources	Training and empowerment of human resources	Compilation of instructions and description of tasks	Review and assurance of maximum readiness	Monitoring and follow-up of service provision and existing problems	Feedback on performance problems and level of preparation
Before epidemic disaster	<ul style="list-style-type: none"> - activating epidemic disaster committee in the hospital -contracting with peer and supportive organizations 	<ul style="list-style-type: none"> - preparing and identifying demographic features of the population -identifying peer and supportive organization capacity 	<ul style="list-style-type: none"> -designing of treatment priority plan for the admission of infectious patients -designing of treatment priority plan for admission of non-infectious patients 	<ul style="list-style-type: none"> -having a maintenance plan for mechanical, and electrical equipment for epidemic -having a maintenance plan for medical equipment for epidemic -designing a plan for financial and equipment allocation in epidemic condition -planning for providing isolated physical space -planning for employing specialized and non-specialized manpower 	<ul style="list-style-type: none"> -preparing and compiling educational programs for self-caring in crisis situations -training of physicians from non-infectious specialties about epidemic disease -training of non-specialist personnel about epidemic disease 	<ul style="list-style-type: none"> -identifying infectious disease nature 	<ul style="list-style-type: none"> holding epidemics disaster maneuvers every two months 	<ul style="list-style-type: none"> —providing electronic and communicational infrastructures to control the epidemic - providing virtual infrastructures to control the epidemic - Establishment of "follow-up" system -establishment home care unit to provide some services in home 	<ul style="list-style-type: none"> -evaluation of epidemic management based on accreditation indicators from the MOHME
During epidemic disaster	<ul style="list-style-type: none"> - absorbing financial and equipment aids from other organizations - getting the support of volunteers from other organizations to increase manpower capacity 	<ul style="list-style-type: none"> -consistent analysis of disease prevalence and burden of in and outpatients 	<ul style="list-style-type: none"> -executing infectious patients triage and transferring them from the emergency ward to in-patient wards -rating of patients in emergency and in-patient wards -Inter and intra organizational coordination with beneficiaries -the careful separating of infectious and non-infectious wastes and dis-infection of wards 	<ul style="list-style-type: none"> -separating infected patients' entrance to the hospital from other patients - separating infected patients' wards from other wards 	<ul style="list-style-type: none"> -virtual and face-to-face training of personnel about admission and treatment protocols for infectious patients -Using electronic tools in the education of clinical students - employing physicians from non-infectious specialty 	<ul style="list-style-type: none"> -using scientific evidence and effective instructions 	<ul style="list-style-type: none"> ----- 	<ul style="list-style-type: none"> -establishment of "your voice" system -managing psychological problems related to patient's stigmatization 	<ul style="list-style-type: none"> -documentation of actions in responding to the crisis in accordance with accreditation standards

Contd...

Table 4: Contd...

Disaster stage	Planning			Implementation		Evaluation			
	Leadership and macro management	Information gathering and environmental analysis	Planning and overall operational coordination	Provision of physical financial resources	Training and empowerment of human resources	Compilation of instructions and description of tasks	Review and assurance of maximum readiness	Monitoring and follow-up of service provision and existing problems	Evaluation and feedback on performance problems and level of preparation
After epidemic disaster	<p>-amendment of contracts with beneficiaries for a better corporation in the context of epidemic</p> <p>-experiences documentation and learning for occurred epidemics</p>	<p>-analysis of beneficiaries the epidemic</p>	<p>-Managing and coordinating of corpses of infectious patients with relevant organization</p>	<p>-management of hospital revenue</p> <p>-managing insurances reimbursement</p>	<p>-financial and welfare support</p> <p>-using manpower capacity of closed non-infectious wards</p> <p>-physical reinforcement of personnel</p> <p>-mental and psychological reinforcement of personnel</p> <p>-developing recovery programs to improve the physical and mental conditions of personnel</p> <p>-revision of the training programs of different personnel according to the functional weaknesses and strengths identified during the crisis</p>	<p>-updating and localization of treatment protocols collaboratively and by process owners</p> <p>-revising in research scope and allocating some percent of research financial sources to epidemic studies to monitor epidemic diseases</p>	<p>-revision of the method and content of preparation maneuvers programs</p>	<p>-managing Worrying and stress of patients</p>	<p>-providing revisory solutions to comply with accreditation criteria during a crisis</p> <p>-quantitative and qualitative assessment of services provided to patients to eliminate possible deficiencies</p>

to enter the Delphi technique stage. In the Delphi phase, the form was sent to 18 experts, and 15 experts answered. After performing the Delphi technique stage and analyzing the data, because of obtaining a score above 0.72 in all 12 dimensions of the Delphi questionnaire in the first round, Delphi was terminated, and the model was finalized.

Discussion

Due to the high rate of the spread of the virus during the epidemic, it may not be possible to conduct a quantitative study to formulate efficient management models; however, it is possible to collect experiences from the challenges, problems, and successful activities of hospital management during the epidemic through a qualitative study and use them to control similar

conditions in the future.^[25-27] Considering hospital managers' experiences and experts' views, the results were categorized into nine key themes, including 59 sub-themes. According to the literature on management and health management, the management activities of organizations can be summarized in three main areas: planning, implementation, and monitoring and evaluation.^[28,29] Therefore, the nine main areas extracted can be classified according to their relationship with these three critical areas. In this way, the three main areas of general and operational planning, information gathering and environmental analysis, leadership, and macro-management can be included in the planning phase of crisis management.^[28] Planning for uncertain future conditions requires organizing teams and resources and preparing employees to respond to the organization's needs.^[29] In term of planning, it means deciding how to do something.^[30] Although planning for crisis conditions differs from normal conditions, It is said that information gathering and environmental analysis, leadership and macro-management, and general and operational planning are close to the usual conditions. On the other hand, it is said that planning and activities related to it should be considered an essential factor in preparing hospitals for biological hazards.^[25] Obviously, planning is the core of the preparation of a hospital for epidemic conditions. According to experts' opinions on leadership and macro-management theme, unity of command and system integration plays an essential role in crisis preparation and management. Some items in this context have indicated the aspects of creating a crisis committee and effective communication with people and institutions outside the organization to absorb financial

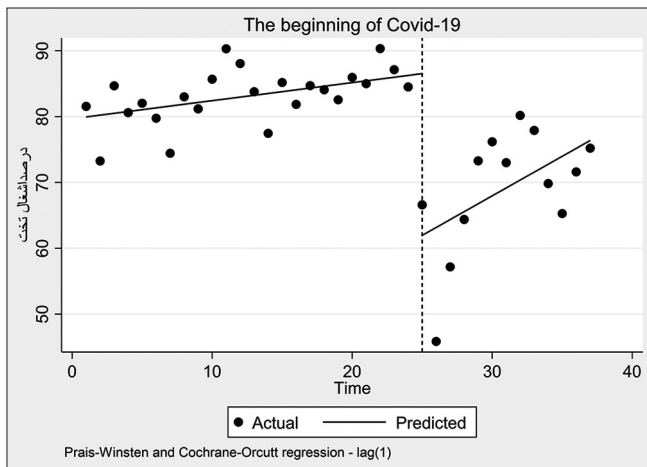


Figure 1: The trends of bed occupancy after the COVID-19 epidemic

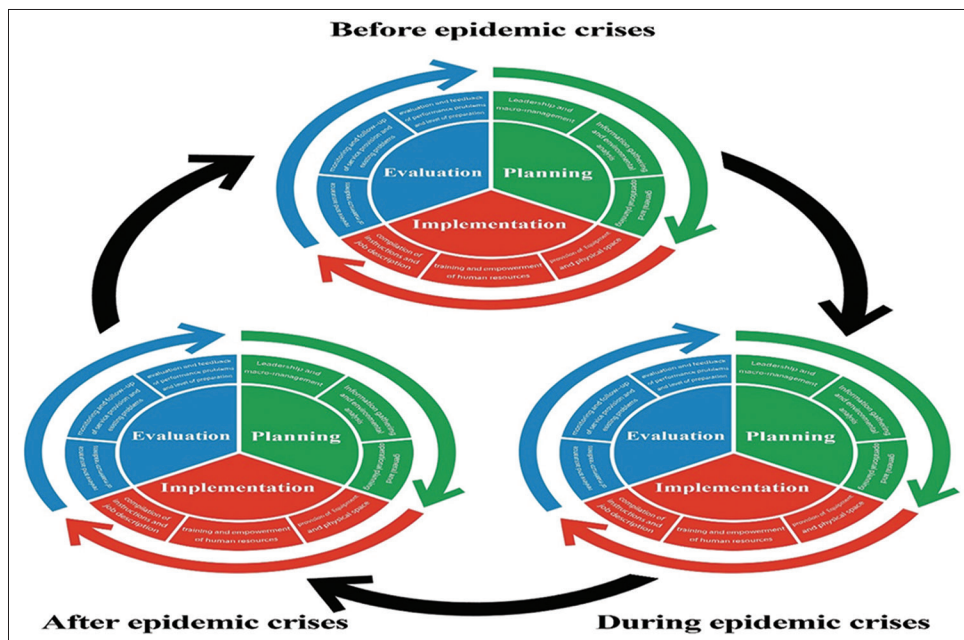


Figure 2: The initial model of hospital management preparedness model of Iran's public hospitals for epidemic disaster

and equipment support and human resources. In line with these issues, planning for challenges and managing workforce limitations, benefiting from the participation of volunteers, benefiting from financial aid and charity support, managing information on COVID-19, and learning from the previous stage of the crisis are considered some main aspects of crisis management in the coronavirus epidemic.^[31] To achieve this goal, the effect of the epidemic on non-epidemic patients admitted to the hospital, ensuring the commitment of the hospital management staff and hospital employees, motivating effectively to implement instructions, using all medical staff, organizing communication with the public, as well as the capacities to get help and the cooperation from other organizations should be taken into consideration.^[20,32] In addition, the concepts of planning for the organization through gathering environmental information, trying to understand processes and sorting them, as well as coordination within the hospital and coordination with organizations and people outside the hospital, are seen in the proposed models for managing health disasters.^[33-35] Therefore, it can be said that in this study hospital managers' experiences and expert opinions for planning are essential and significant although if there was a tool to assess the planning capacity of hospitals in COVID-19 epidemic, most of the public hospitals get a poor score.

Implementing planned processes is one of the fundamental principles in every organization.^[28,36] In the implementation phase and to organize and manage the implementation of processes during an epidemic disaster, three main areas of providing equipment and physical and financial resources, training and empowering human resources, and compiling guidelines and job descriptions are proposed from the analysis of managers' experiences and experts' opinions. In implementing crisis management in the hospital during a study, points such as the need to apply standard clinical guidelines, quick application of operational rules and regulations, paying attention to the involved personnel, increasing the capacity of the hospital to treat patients with COVID-19 and effectively manage their needs through the transfer and equipping of human and technological resources, ensuring that other non-COVID patients are not infected and ensuring that their essential needs are addressed through defining and re-applying roles and tasks, participating in creating effective clinical solutions and new methods according to pandemic conditions with the help of forming multidisciplinary teams and laboratory tools and technologies, creating supply chains through various agents to ensure the safety of the patient and to ensure to managing synergistically according to the factors involved in solving the epidemic problems should be considered.^[32] Also, in another research, things like building an isolation ward with a capacity of 40 beds, intensifying clinical monitoring as measuring oxygen levels and vital signs up to 6 times a day, and infection

control personnel and infectious disease physicians (this team, which meets daily comprised members of the infectious diseases and infection control department, the elderly department, supervisors and the hospital's CEO) for clinical decision-making daily were mentioned.^[37] These can be considered as a brief description of the importance of increasing the physical capacity of the hospital and the importance of the description of duties or instructions in epidemics. The possibility of the rapid spread of the disease during the epidemic, the increase in the number of critically ill patients, and the need for a quick response significantly reduce the response capacity of hospitals.^[14,17] On the other hand, the reduction of routine activities, regular hospital surgeries, and the increase in the number of patients with epidemic diseases significantly reduce the financial resources of hospitals and physicians and equipment capacity.^[16-18] Based on this, it can be said that in the implementation phase, providing financial resources for providing equipment and physical place, training and empowering human resources, describing the duties of the personnel, and developing executive and operational guidelines for hospital management is vital. Therefore, training, paying attention to standards and guidelines, increasing capacity, challenges and strategies of providing physical places, supplies, and protective equipment for personnel, designing referral centers for COVID-19, designing a patient transport protocol, benefiting from financial aid and charitable support, information management about COVID-19 have been areas of importance in health crisis management models, which confirms the importance of the mentioned cases.

Evaluation and making sure that non-COVID patients are not infected, monitoring and ensuring that the crucial needs of other patients are taken care of, monitoring roles and tasks and re-applying roles and tasks based on existing conditions, getting help from multidisciplinary teams for evaluation of the conditions and provision of effective clinical solutions, patient safety monitoring and general monitoring of management systems, the participation of various multidisciplinary groups to collect data and monitor the existing situation have been among the main fields in crisis management models in the health sector.^[19,32,38,39] Therefore, these cases will show the importance of ensuring maximum preparedness, monitoring services, problems, and evaluation of performance and level of preparation and feedback on problems in epidemic conditions. These were frequent areas of attention of managers and experts in the current study.

Limitation and recommendation

In this study, experts in the epidemic disaster were very limited and the time of interviewees was short but we tried to solve these limitations in some ways. The presented

model was designated for public hospitals. For future studies, a preparedness model for private hospitals, conducting a study in different study places such as other universities, and designating tools for assessing the preparedness level of public hospitals are suggested.

Conclusion

Due to the new nature of the COVID-19 virus, the possibility of similar epidemics in the future, and the scattered experiences of hospital managers in Iran, there is a need for a framework to manage epidemic disasters with maximum effectiveness and efficiency. In this study, a model with 59 sub-themes in nine main themes. These themes and specific measures in each theme increase the managerial preparedness of hospitals. This model can serve as a practical guide for managers and decision makers of the health system in the public hospital in Iran in accordance with the infrastructures and frameworks of the country's health system. Also, paying attention to the current model and its experiences can be helpful in hospitals in foreign countries similar to the Iranian public hospital structure.

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Ethical statement

This study has got ethics code with the number of IR.IUMS.REC.1399.1100 from Iran University of medical sciences.

Authors' contributions

Dr Masoudi asl and Mr Tahmasebi conducted a search on databases and found related articles. Dr aryankhesal conducted interviews and quantitative data and Ali Tahmasebi analyzed the data. All authors reviewed the results and Dr Vatankehah and Dr Masoumi wrote the main manuscript.

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Conflicts of interest

There are no conflicts of interest.

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