Factors affecting simulators of the hospital emergency department during emergencies and disasters in Iran: a qualitative study

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Abstract: **Objective:** The simulation strategy is so important for appropriate responses and preparedness of hospital emergency department staff in emergencies to strengthen team building and care focused on the interdisciplinary community. Therefore, this study aimed to identify the factors affecting the hospital emergency department's simulators during emergencies and disasters.

Methods: This conventional content analysis study was conducted in 2021. Participants were selected from Iranian experts using purposeful and snowball sampling methods. Data were collected using semi-structured interviews and were analyzed by the content analysis.

Results: Analysis of the data results through semi-structured interviews showed 4 main categories and 11 sub-categories including management and leadership (the structure, casualty management, command, interactions and coordination, communications and information, as well as human resources), and increasing the capacity (resources (physical resources, and financial resources)), modern technology approaches (information technology), laws and policies (policies, guidelines, and rules).

Conclusion: The simulation technology use can be effective in preparing the hospital emergency department in the event of disasters, strengthening management and leadership, proper planning, appropriate organizational culture, organizational learning, interactions and coordination, casualty management, as well as providing resources, equipment, items, processes, and instructions. So, the use of these new technological training is recommended to improve responses in times of emergencies and disasters.

Keywords: Emergency Medicine; Disasters; Hospitals; Iran; Qualitative Research; Simulation Training

1. Introduction

Emergencies and disasters are seen in any society and are considered a factor beyond human beings' control and usually lead to various deaths and injuries. As a developing country, Iran is considered one of the most prone geographical areas to emergencies and disasters (1). In different parts of the country, all kinds of natural disasters, such as floods, earthquakes, landslides, avalanches, and unforeseen disasters such as fires, traffic emergencies and plane crashes, etc., are always occurring (2). Given this diverse set of disasters, addressing the crisis issue and preparing the health and treatment group to provide crisis care in this country is of great importance (3).

Therefore, hospitals, as fixed and specialized centers for providing medical services, with their facilities and experienced personnel, are considered as one of the important components of the disaster response process, whose mission is to maintain the health of the injured, provided that they are ready to provide services in times of crises (4). As reported in the United States (5), hospital emergency department visits increased by approximately 20% between 1995 and 2005. Meanwhile, the hospital emergency department staff is a large group of the medical team and one of the first to face the injured after the emergencies and disasters. Therefore, they should be able to manage the situation using their skills and speed of action to prevent problems and complications in the hospital emergency department (6-8). A 2011 study conducted by Taboada et al. has found that modeling and simulation are useful tools in many areas of operational health care management. Emergency departments are the most dynamic and complex areas in hospitals (9). According to the findings of the study of Faraji et al., the use of simulation methods in triage training increases the readiness of the hospital emergency department staff to perform disaster triage (10, 11). The results of Hutchinson and others' study in 2011, titled "Investigating the Effect of Simulation of Emergencies and Disasters on Medical Staff", have shown simulation training, of which triage is an important part, is an effec-

tive educational program on medical emergencies to prepare staff to deal with emergencies and disasters (12). Simulation allows skills to be acquired by hospital emergency department staff through repeated practices and risk-free emergency management. Because disasters are inherently unpredictable, the opportunity to practice such an event in a simulated environment is ideal for the initial encounter with a mass casualty. A combination of new technology, including the use of simulators and virtual reality, aims to create a realistic and chaotic environment to help staff of the hospital emergency department gain skills while providing clinical care during disasters (13, 14). Therefore, this study aimed to identify the factors affecting the simulation of the hospital emergency department at the time of emergencies and disasters.

2. Methods

2.1. Research design

The descriptive qualitative research design has been used, which is one of the most feasible ways to explore a society's socio-cultural beliefs and values (15). Figure 1depicts the research and data analysis processes.

2.2. Ethical considerations

This study was approved by the Institutional Review Board and the school of Health Management and Information Sciences of Iran University of Medical Sciences with the code of ethics IR.IUMS.REC.1400.633. Participants were informed about voluntary participation in the study and that they could withdraw from it at any time. Informed consent was obtained from all of them.

2.3. Participants

The participants consisted of 31 specialists in the field of simulation, artificial intelligence, and medical informatics, specialists in the field of emergencies and disasters, and head nurses of hospital emergency departments. They had to have experienced in a disaster situation to be included in this study. As this study aimed to identify factors influencing the design of a hospital emergency department simulation model in disasters and emergencies, specialists in artificial intelligence, and medical informatics were also selected as non-clinician participants. The participants also had to be familiar with the triage and patient prioritization in the health care system. The purposeful and snowball sampling methods were used to select the participants.

2.4. Data Collection

Face to face and semi-structured interviews lasting between 30 and 75 min were conducted by the first author in the workplaces of and at convenient times for the participants from October to December 2021. An interview guide was developed based on the study purpose, related literature, and the research team's experiences. The researcher piloted the in-

terview questions during the first two interviews with a triage nurse and an emergency medical technician. There were no modifications made to the interview guide and questions. Since there were no changes in the interview questions, the data collected in the pilot interviews were used in data analysis. At the beginning of the interview sessions, the interviewer explained the aim of the study; then participants were asked to describe one of their triage experiences. Subsequently, the interviewer asked them the following questions: 1) Did you experience any challenges in patient prioritization at the time of triage? 2) What were your challenges? As the topic was explored, the questions progressed from general to specific to generate details. The major explorative questions of the interview were: 3) Did you face any type of challenges when triaging victims in disasters? 4) What criteria should be used for victims in disaster triage? 5) Did you have any experience during disasters? 6) What criteria should we consider to design a simulator? Probing questions were also asked to ensure the interviewer understood the participant's responses and to provide an opportunity to obtain in-depth information. After 24–25 interviews, no new code was generated from interview data. However, five more interviews were performed to ensure data saturation and capture data run-off.

2.5. Data Analysis

Data were analyzed using 'content analysis' suggested by the Graneheim & Lundman proposed method (16). First, interviews were recorded, then anonymously transcribed verbatim, and reviewed several times to allow the first author to reach an overall understanding. All personal identifiers were transformed to a de-identified study number in the study files to preserve the participants' privacy. Second, sentences or phrases providing information about the ethical principles of patient prioritization in the triage were selected as semantic units condensed, abstracted, and coded. Thereafter, the codes were sorted into categories and subcategories based on constant comparison of their similarities and differences and consensus discussion. The authors checked the separate coding sheets categories for their further comments and then collaboratively interpreted and integrated. Finally, codes, categories, and subcategories were developed.

2.6. Trustworthiness

Graneheim & Lundman proposed the credibility, dependability, and transferability of the data to ensure the trustworthiness of results in the content analysis studies (16). Data confirmability and credibility were enhanced by maximum sampling variation, and prolonged engagement with data. Furthermore, the research team members talked over the results to agree on the codes, categories, and subcategories. Peer checking was performed by two other researchers who were not members of the research team to enhance the dependability of the results. In addition, to increase the transferability of the results, the researchers tried to provide a clear

Table 1 The demographic profile of the interviewees

NO.	Age	Gender	Education	Work experience (years)	Interview duration (Minutes)
1	36	Male	MS of Nursing	11	30
2	37	female	BS of Nursing	17	30
3	38	female	BS of Nursing	15	35
4	39	female	MS of Nursing	13	40
5	34	female	BS of Nursing	14	35
6	42	female	BS of Nursing	25	30
7	36	female	BS of Nursing	18	40
8	37	female	MS of Nursing	16	20
9	42	female	PHD of Nursing	18	35
10	39	Male	MS of Nursing	14	30
11	48	Male	MS of Nursing	22	35
12	35	female	MS of Nursing	10	20
13	48	female	PHD of Nursing	20	45
14	37	female	MS of Nursing	8	25
15	52	female	PHD of Health Emergency and Disasters	25	40
16	48	Male	Emergency Medicine	20	20
17	56	Male	Emergency Medicine	26	20
18	43	female	PHD of Health Emergency and Disasters	23	60
19	54	Male	PHD of Health Emergency and Disasters	25	60
20	53	Male	Emergency Medicine	18	50
21	44	Male	PhD in Artificial Intelligence	14	45
22	35	Male	PhD in Informatics	4	35
23	54	Male	PhD in Informatics	23	45
24	46	Male	PhD in Artificial Intelligence	12	50
25	53	Male	PhD in Artificial Intelligence	10	40
26	49	Male	PhD in Artificial Intelligence	17	45
27	42	Male	PhD in Artificial Intelligence	10	20
28	48	female	PhD in Informatics	15	35
29	54	Male	PhD in Medical Education	21	50
30	47	Male	PhD in Management and Information	14	45
31	41	Male	PhD in Medical Education	8	20

and distinct description of sampling, data collection, data analysis, and reporting of the results.

3. Results

To gather the data in this study, 31 interviews were conducted with 15 male participants and 16 female ones, with the median age of 40 years. The participants' job experience ranged from 8 to 25 years with median of 15 years. Eleven participants were specialists in artificial intelligence and medical informatics, 14 in health, and 6 in emergencies and disasters (Table 1).

Analysis of the data obtained from the semi-structured interviews showed 4 main categories and 11 subcategories, including management and leadership (structure, casualty management, command, interactions and coordina-

tion, communications and information, and human resources), increasing the capacity (resources (supply and distribution of equipment, physical resources, and financial resources), modern technology approaches (information technology (the role of information systems, and their implementation)), laws and policies (policies, guidelines, and rules) Details are reported in appendix 1.

3.1. Management and leadership

The management and leadership category had 6 subcategories, including the structure, casualty management, command, interactions and coordination, communications and information, and human resources. The subcategories were divided into several themes, including the structure (the location and emergency physical space), casualty management (casualty prioritization, treatment measures, and

on-scene management (in-hospital incidents)), command (the incident command chain), interactions, and coordination (intra-organizational, and extra-organizational interactions), communications and information (quick alert, staff, casualties and companions), as well as manpower (training infrastructures, learning and practicing, and empowerment).

3.1.1. Structure

According to the participants' statements, the support of managers, how they treat, their very good support for hospital grading based on the type of risks and the hospital location are important because drawing a risk map (identification of hazards) before any event is a must for a hospital. Also, access to the hospital as a medical center in case of emergencies and disasters should be easy from four directions. In contrast, access to the surrounding streets, ambulance routes, and a space for the helicopter should also be considered. "The hospital location is important for the arrival of mass casualties. If a hospital is within a traffic plan area, there are restrictions on entry, and casualties who come in their cars cannot access the hospital. So, you have to consider this in simulating a hospital." (P12) In the opinion of most of the participants, emergency interior management should be planned in advance because of some limitations of the emergency department. Therefore, having a coherent and predetermined plan to coordinate other departments to accept the injured, quickly assigning emergency patients, increasing hospital resources according to the available ones, floating the hospital emergency department, and providing medical services according to the type and severity of disasters as well as the number of the injured can be good answers in times of emergencies and disasters.

"If all the actions necessary at the time of disasters, including job descriptions and equipment provided in the emergency department, are planned in advance, and everyone knows what to do in the event of disasters, we will have fewer problems. Everything must be planned in advance. For example, admission and discharge, the laboratory, CT, and sonography should be active in the emergency department within 24 hours." (P18)

3.1.2. Casualty management

Based on the participants' beliefs, the management of the injured requires more experience, skills, creativity, condition assessment, and speed of action, which are strengthened in the staff of the hospital emergency department through training classes, remote maneuvers, and operational plans. They have also said the standard triage system is usually not applicable in emergencies and disasters because there is not enough space in the emergency room due to the congestion to screen the injured as standard.

"In the event of an emergency or a disaster when the hospital emergency department encounters many casualties, elective surgeries should be canceled, and casualties who do not have an acute problem should be immediately assigned.

Disasters are usually unpredictable. In a few hours, we do not know how many casualties the emergency will face." (P17)

"The hospital is still unprepared for a possible crisis or traffic accidents considering its proximity to the roads. If there is a fire in a mosque or a gas station near the exit and entrance of the city or a large car accident, we do not have the facilities and preparedness appropriate to the accident. Let alone the earthquake, for which we must be responsible for the whole city." (P19)

As said by some participants, the provision of medical services to the injured should be made according to the treatment protocol. The presence of hospitals providing treatment measures with advanced equipment can lead to continued services.

"In disaster management, when casualties are prioritized, it becomes clear who needs immediate medical attention and who does not. So, it is very important to prioritize the injured from the moment they enter the hospital emergency room." (P22)

3.1.3. Command

According to all the participants' statements, the command system is a system for command, control, and coordination in the face of emergencies and disasters, which provides the conditions to optimize the protection of the injured in the worst situations. Therefore, in case of emergencies and disasters, having an incident command chart and each person's job description can facilitate emergencies. "A person who is the commander and manager of a crisis has very important tasks to do in the event of an accident, and they have to manage everyone to do their job well. In the time of accidents, because of the congestion in the hospital emergency room, there is a lot of noise, and this is the commander who should have good management at this time." (P28)

3.1.4. Interactions and coordination

Based on most of the participants' opinions, interactions and coordination with internal and external organizations can help the hospital in different ways. External institutions such as certain other hospitals, police, etc. have memorandums of understanding with the hospital, greatly increasing the hospital synergy and resilience.

"Coordination of the emergency department with other departments inside and outside the organization is very important. In fact, this interaction creates teamwork in the hospital, and creating empathy and cooperation within the organization can be appropriate to provide the desired services." (P21)

3.1.5. Communications

As stated by most participants about communication and information systems, every person in times of crisis should know who to contact, from whom to receive information, to whom to give their information, and be aware of the

quick alert system. In the communication and information system, the person is responsible for maintaining the safety of the injured, increasing the confidence and self-esteem of the emergency department staff, strengthening the morale of the staff and companions of the injured, and reassuring them about the recovery of the injured.

"It's very important to whom the information is given. The accuracy of the information, and its non-contradiction is also important." (P3) "Nurses are exposed to severe stress caused by emergencies and disasters, leading to mental disorders in them. In addition to personal issues, these disorders have adverse effects on their activities. In fact, I can say for sure that nurses are the hidden victims of disasters and accidents." (P9)

3.1.6. Human resources
Most of the participants considered factors such as sufficient staff, competence, skills, commitment, and active participation of the personnel effective in the hospital emergency department at the time of disasters. The workload in the emergency department of hospitals is high in the event of disasters. Many interviewees believed the number of employees and their workload could affect their participation and commitment in the event of disasters.

"Early on, a small number of staff participated in disaster-related training courses, but now, all hospital emergency department staff are fully acquainted with all the necessary skills, including life-saving ones, casualty prioritization, and infectious triage." (P4)

Most of the participants emphasized holding practical and remote maneuvers and courses on revealing weaknesses, practicing with the help of modern technology, practicing as work teams, and using simulators in training staff of the hospital emergency department.

"One of the weaknesses can be the lack of knowledge and awareness of employees about the program as well as operational and remote exercises. The level of their knowledge about the development of maneuvers and simulation programs is very low." (P20)

As stated by most of the participants, managers have an important role in introducing the program to their employees and attracting their cooperation. Managers familiar with the program themselves try to encourage employees' participation in the planning process. "The level of employees' participation in the previous remote maneuver was very low, but with the development of the simulated remote and operational program according to the possible scenario, the level of staff participation and skills has increased to perform interventions despite the limitations in the time of emergencies and disasters." (P29)

In some of the participants' opinion, online training, which is a kind of simulated education, is an effective educational experience and can help the competence and performance of the hospital emergency department staff.

"Simulated education is very rare. Most of us use traditional training, but if simulation training is designed for emergency department staff, it can be very useful and add to their experience and expertise." (P31)

"Using simulation-based training is a creative method which can motivate emergency department staff." (P16)

" Simulated technologies can be incorporated not only in hospitals but also in universities and student courses." (P18)

3.2. Increasing the capacity
Increasing the capacity had two subcategories, including physical resources (the chain of equipment supply and distribution) and financial resources (budget allocation).

3.2.1. Resources
Based on most of the participants' beliefs, the forecasts related to medical equipment, pharmaceuticals, and water and electricity systems in case of disasters are very important because, without any of these factors, the hospital will not be able to provide services. According to most participants' opinions, the hospital should define and provide an additional capacity for the required items while anticipating the necessary capacity and resources in an accident. Additional capacities include increasing the capacity of staff, pharmaceutical items, consumable and non-consumable equipment and supplies, a physical space, and a support system (water, electricity). As capacities increase, the response system will be faster.

"For example, the hospital announced the emergency pharmacy had to have a depot of equipment and medicine items for the next 8 months. Well, these medications need a place to be stored. Some medicines should be stored in the refrigerator. It can be said that this is almost impossible." (P19)

"During disasters, health resources, facilities, supplies, equipment, and human resources are imperative for an active healthcare center. Emergency departments must increase the effect of disasters on their health resources.")P27)

"We must be careful if an accident occurs. We should use items and equipment in the emergency department in such a way that we do not run out of them and have to procure them from somewhere else." (P2)

"When assessing our triage impact, we should look if the patient benefits from our provided services, and interventions or not." (P7)

"Lack of equipment, staff, etc. is one of the main challenges in times of emergencies and disasters, which must be identified by operational maneuvers to identify these deficiencies and plan for them." (P24)

Most participants state that hospitals need a coherent plan to communicate with their suppliers to provide medicine and equipment and prevent shortages. Establishing strong and stable relationships with several suppliers can prevent monopoly and dependence on a particular supplier.

"The exclusivity of services is effective in hospital resilience. For example, they say that only I have this piece, such as

specific dialysis or angiography equipment." (P25)

"If all the equipment is not available in other departments, it must be in the emergency department, which is the first place involved in emergencies and disasters because the type and severity of the injured who comes to the emergency department are not known." (P30)

"I believe planning for disasters, and preparedness strategies can address health resource deficits, and increase ED resilience." (P20)

3.2.2. Financial resources

Many of the participants considered the financial resources inappropriate and not in line with the plan implementation, and they also considered the solution to set more realistic goals and prioritize them.

"I think if we make the goals more realistic and write down the priorities in the plans, we can properly manage the financial resources." (P14)

"Disasters are opportunities for policy changes and learning by hospital staff. However, hospitals must make their own decisions regarding finance constraints of disaster recovery." (P2)

Most participants considered allocating financial budgets and items such as sufficient financial resources for pharmaceutical items effective in the success of a hospital. One of the effective factors in implementing the response process in emergencies and disasters in hospitals is allocating appropriate financial credits according to the plan. Most participants considered it necessary to provide sufficient resources to implement disaster response programs.

"We need financial resources, energy and time to do a lot of things. If they are not entered into the system, the system working at its full capacity will collapse." (P12)

3.3. Modern technology approaches

The category of modern technology approaches with the subcategory of information technology included the Role of information systems and their implementation.

3.3.1. Information technology

Most participants emphasized scenario time, technology fear, increased workload, limited time for learning, limited time for planning, and not having enough staff.

"Using simulation programs is time-consuming and costly. Because the hospital emergency department is a crowded space, fewer people are willing to participate." (P17)

"Lack of digital equipment and underdeveloped technological infrastructures can reduce people's motivation. In addition, most countries in the world use these new information systems to advance education." (P10)

"Technology infrastructures require special attention of managers about financial issues which must be planned in this regard"(P5)

As stated by most participants, fear of technology can be due to a lack of experience and sufficient training in this field.

Concerning time for planning and learning, it can also be said that employees, because they do not have experience in scenario writing, will have to spend a lot of time writing scenarios. This factor causes the simulation for learning, and being acquainted with the simulation program standards will be time-consuming.

"Doing scenario writing exercises, forming a group, and participating in writing as an important part of training and supervision while working with the simulator can enhance employees' work experience and skills." (P26)

"Information technology tools and knowledge management approaches through scenarios for transferring knowledge will be very effective in the teaching-learning process in the field of disasters." (P9)

In the opinion of some participants, the use of simulation will be effective in training emergency department staff who do not have the opportunity to attend educational classes. Of course, it is necessary to identify suitable simulations and assist the emergency department staff in performing the simulations. Employees' participation in performing simulation as a pilot to identify errors is another method for learning simulation.

"In designing a simulator, you should prioritize employees' participation and interest so that they are motivated to work with this software. The simulation software does not hang too much so that employees get tired and do not follow it. So, it should be simple and understandable." (P15)

"Technology also plays an important role in teaching core clinical skills in simulation centers, which the faculty should consider." (P13)

3.4. Laws and policies

The category of laws and policies included the subcategories of policymaking (planning requirements, macro strategic plans, and development of protocols and processes) and instructions and rules (taking advantage of laws).

3.4.1. Policymaking

Most of the participants, interviewees in the field of process management, considered factors such as creating a work process management system, improving work processes, and evaluating programs effective in the success of strategic planning. Many interviewees believed a large number of work processes in hospitals created obstacles to the strategic planning process.

"Unlike other organizations where there is one process, there are many work processes in the hospital, which make the strategic planning process difficult." (P5)

"According to various laws and regulations, disaster response policies cannot be objectively implemented in practice because the government and health care providers are obliged to ensure the sustainability and availability of standards for health care workers working in medical centers." (P1)

According to some participants' statements, hospital planning should be a general goal in the hospital strategic plan,

and managers, and staff should give serious promotion consideration. Also, systematic and regular monitoring and evaluation of the strategic plan lead to timely identification of plan problems and the implementation of corrective measures if necessary.

"Program monitoring needs to be more coherent. If people know they are being monitored, they will be much more regular. If this monitoring does not exist, every hospital unit should definitely hold meetings to review the progress of its program." (P7)

Most of the participants stated that the development of hospital preparedness and contingency programs would make hospitals more resilient in disasters.

"The support of managers to run and implement programs is very important. These programs are only documented after they are written, but their implementation is not done to identify strengths and weaknesses, and that is why we will be in trouble in the time of crises." (P11)

3.4.2. Instructions and rules

Based on most of the participants' beliefs, standard rules on simulation should be developed for hospital emergency department staff so that they are familiar with these rules. Applying a new educational method for practical and skill training of employees also plays an important role. Although there are guidelines for diagnosis, treatment, and care, these rules may not be applied in emergencies for various reasons.

"Incorporating simulation programs into training programs is very good for staff because they do not have much time to attend educational classes." (P23)

"The simulation program should be designed based on the interest and participation of employees and the relevant standards as well as rules should be told to them in advance so that they do not get confused." (P7)

4. Discussion

This study aimed to identify and determine the factors affecting the simulation of the hospital emergency department at the time of emergencies and disasters. Based on the findings of the present study, management and leadership are one of the effective components in simulating the emergency department of a hospital during emergencies and disasters. The success of hospitals in times of disasters depends to a large extent on the staff and their consistent efforts to achieve organizational goals. Previous research also considered the role of motivated, committed, and active employees in developing and implementing operational plans and simulated maneuvers (17). Therefore, organizations should emphasize on strengthening the management system of employees, developing their capabilities, and satisfying them (18). Managers must be able to well convey organizational goals to employees and encourage them to provide services in the event of emergencies and disasters to respond appropriately. Staff participation in developing hospital preparation programs plays an important role in their cooperation in the imple-

mentation of these programs (19). Also, if the decisions are not made with the participation of the medical staff, it can affect the management of the injured. As a result, the provision of care services will be difficult in the application of knowledge and skills and the implementation of scientific principles because staff in the hospital emergency department, as a vital members of the medical team, must have the minimum qualifications to play a role in response to crises (20). In a study conducted by Slepski et al., it was found that despite equipping the hospital and its units with basic tools against emergencies and disasters, continuous training of staff in the form of workshops, maneuvers, etc., as well as strengthening their morale for reaching the highest level of preparation and their effective and comprehensive participation could be placed at the top of plans of the hospital crisis committee (7, 21, 22). Interactions and coordination in management and many educational laws, programs and regulations, development of rules on management, including crisis management, how to work as a team, how to communicate with various organizations, institutions and certain hospitals are among the things which need interactions and coordination (23, 24). These studies are in line with the present research in terms of management in the hospital emergency department and their results. Another result of the present study is the increase in capacities. In a study conducted by Kalali et al., it was found that the hospital preparedness program for disasters would not be well implemented without providing the required resources. Previous studies also considered the need to provide human, physical, information, and financial resources for the development, implementation, and evaluation of programs (17, 18, 25). In a study conducted by Mossadegh Rad et al., it was stated that managers had to develop realistic programs using information from the internal and external environments of the hospital. They had to consider budgets for the development and implementation of operational plans and simulated maneuvers, establishing necessary structures in the organization, and providing the necessary resources to employees so that the program could be well implemented to achieve good results. Therefore, managers should consider the development of organizational resources in the program's specific goals of increasing the hospital capacity. According to internal strengths and external opportunities, they should develop and implement appropriate measures to achieve these goals (26). These studies are consistent with the present research in terms of increasing the physical, human resources, and hospital capacities and their results.

Another finding of the present research is the category of technology in the health system. In their study, Furberg et al. showed simulation training could increase learning and performance (27). Findings from Tadrisi and others' study showed training in both lecturing and simulation software enhanced the learning of medical staff (27). The findings of Rankin et al. showed that effective training could help the professional competence and performance of the

treatment staff (28). A study by Al-Ghareeb et al. found simulation-based training helped identify the risks associated with preparing health care workers and emergency departments for epidemics. This approach can also assess and maintain preparedness for emerging infectious diseases in the future (29, 30). The complex nature of the emergency department makes simulation a convenient and widely used technique. Simulation can provide valuable insights for hospital managers to improve emergency department efficiency (31). These studies are consistent with the present research both in terms of the education type and the simulated method, as well as in terms of their results.

Another finding of the present study is the category of rules, regulations, and instructions, which are the most important way to stabilize and strengthen the readiness of hospitals. In these first centers, injured people go to in case of emergencies and disasters and are among the basic and important centers. Therefore, identifying and eliminating defects, re-evaluating the readiness status, and performing the preparation maneuver will be effective. Presenting rules and guidelines can ensure staff is acquainted with the real situation, effectively understand critical and emergencies, reconcile cross-sectorial commitments and efforts and link different hospital units to prepare medical centers better. The use of simulation-based training instructions to educate hospital emergency department staff increases their preparedness for disasters and emergencies (32, 33). Development of the system of work process management, process improvement, and regular and continuous evaluation of hospital processes lead to the success of strategic plans. However, many departments and work processes, together with systematic evaluation problems in hospitals, create obstacles to the macro planning process. Previous studies showed the large number and complexity of hospital work processes, poor coordination between different departments and units of the hospital, and the lack of clear mechanisms for monitoring and evaluating strategic plans were among the challenges of the strategic planning process in hospitals (30, 34, 35). Hospital processes need to be upgraded to provide quality, safe and effective services to patients. Therefore, hospital process management should be one of the most important goals in the macro strategic plans of hospitals. Regular determination and monitoring of key performance indicators play an important role in the success of programs (36, 37). These studies are consistent with and confirm the present study both in terms of the use of guidelines, rules and regulations, and the development of macro strategic plans and their results.

5. Limitations

Although this is a qualitative study based on the experiences of Iranian experts, the results can be generalized to similar cultural contexts. As it is well known, the research is based on analysis and inference, and it is not have statistical-probabilistic generalizability (38).

6. Conclusion

The results showed the factors effective in simulating the emergency department in the emergencies and disasters included strengthening management and leadership, proper planning, appropriate organizational culture, organizational learning, and proper management of staff, patients, resources, and processes which led to the successful formulation and implementation of macro strategic plans in hospitals. Managers should use the model appropriate to the structure and culture of hospitals to prepare staff for disasters, be actively involved in planning to be able to provide the necessary resources, manage and lead the strategy implementation process, supply and store equipment, and items, and use the most of the hospital capacity. In order to deal with crises, the formation of a crisis committee, the existence of an educational incident command system in a practical way, and holding training courses and maneuvers will be effective. Receiving in-service training based on simulated educational scenarios is effective for nurses' preparedness in the triage of disasters and medical emergencies. It will improve the hospital readiness in this field in the event of emergencies and disasters.

Therefore, considering these cases, managers are suggested to support simulated programs to make a significant contribution to educational advancement and reduction in problems. At the same time, this method should be used as a modern teaching strategy in education.

7. Declarations

References

1. Mirzaei S, Tafti AAD, Mohammadinia L, Nasiriani K, Rahaei Z, Falahzadeh H, et al. Operational strategies for establishing disaster-resilient schools: a qualitative study. Adv J Emerg Med. 2020;4(2):e23.

2. Ranaei Kordshouli H. A framework for the formulation of disaster management strategic plans at national and regional levels. Disaster Prev Manag Know. 2015;5(1):30-42.

3. Yousefli M, Asefzadeh S, PartoviShayan Z. Evaluation of emergency wards readiness for responding to disasters and emergencies at hospitals of Qazvin University of Medical Sciences according to world health organization model 2012. J Resc Relief. 2014;6(2):21-31. [Persian]

4. Daniel M, Park S, Seifert CM, Chandanabhumma PP, Fetters MD, Wilson E, et al. Understanding diagnostic processes in emergency departments: a mixed methods case study protocol. BMJ open. 2021;11(9):e044194.

5. Nawar EW, Niska RW, Xu J. National Hospital Ambulatory Medical Care Survey: 2005 emergency department summary. Adv Data. 2007;(386):1-32.

6. Ghaedi H, Nasiripour A, Tabibi SJ. Hospital preparedness in radiation crisis in selected countries and developing a conceptual model for Iran. Iran South Med J 2018, 21(5): 393-408. [Persian]

7. Moslehi S, Masoumi G, Barghi-Shirazi F. Benefits of simulation-based education in hospital emergency departments: A systematic review. J Educ Health Promot. 2022;11:40.

8. Yousefi K, Larijani HA, Golitaleb M, Sahebi A. Knowledge, attitude and performance associated with disaster preparedness in Iranian nurses: a systematic review and meta-analysis. Adv J Emerg Med. 2019;3(4):e42.

9. Taboada M, Cabrera E, Iglesias ML, Epelde F, Luque E. An Agent-Based Decision Support System for Hospitals Emergency Departments. Procedia Comput Sci. 2011;4:1870-9.

10. Faraji A, Khankeh H, Hosseini M, Abdi K, Rezasoltani P. Effect of simulated training course on preparedness of nurses to do pre-hospital triage. J Health Promot Manag. 2013;2(4):24-9.

11. Delshad V, Shirazi FB. The effectiveness of participation-based education on nurse performance in hospital Triage at disaster. Med Sci. 2019;23(97):404-9.

12. Hutchinson SW, Haynes S, Parker P, Dennis B, McLIN C, Welldaregay W. Implementing a multidisciplinary disaster simulation for undergraduate nursing students. Nurs Educ Perspect. 2011;32(4):240-3.

13. Kaplan BG, Connor A, Ferranti EP, Holmes L, Spencer L. Use of an emergency preparedness disaster simulation with undergraduate nursing students. Public Health Nurs. 2012;29(1):44-51.

14. Morrison AM, Catanzaro AM. High-fidelity simulation and emergency preparedness. Public Health Nurs. 2010;27(2):164-73.

15. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res. 2005;15(9):1277-88.

16. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse Educ Today. 2004;24(2):105-12.

17. Mosadeghrad AM, Ebneshahidi A, Abdolmohammadi N. The impact of strategic planning on hospital efficiency: A case study. Health Based Res. 2018;4(3):317-34. [Persian]

18. Mosadeghrad AM, Ebneshahidi A, Abdolmohammadi A. The impact of strategic planning on job satisfaction among hospital staff: a case study. Health Based Res. 2017;3(2):99-114. [Persian]

19. Etemadian M, Mosadeghrad AM, Mohaghegh Dolatabadi MR, Dehnavi H. The challenges of public private partnership in hospital operations: A case study. Payesh. 2019;18(2):127-48. [Persian]

20. Al-Ghareeb AZ, Cooper SJ. Barriers and enablers to the use of high-fidelity patient simulation manikins in nurse education: an integrative review. Nurse Educ Today. 2016;36:281-6.

21. Slepski LA. Emergency preparedness and professional competency among health care providers during hurricanes Katrina and Rita: pilot study results. Disaster Manag Response. 2007;5(4):99-110.

22. Hasan MK, Younos TB, Farid ZI. Nurses' knowledge, skills and preparedness for disaster management of a Megapolis: Implications for nursing disaster education. Nurse Educ Today. 2021;107:105122.

23. Fox-Young S, Brady S, Brealey W, Cooper S, McKenna L, Hall H, et al. The perspectives of Australian midwifery academics on barriers and enablers for simulation in midwifery education in Australia: A focus group study. Midwifery. 2012;28(4):495-501.

24. Seyedin H, Rostamian M, Barghi Shirazi F, Adibi Larijani H. Challenges of Providing Health Care in Complex Emergencies: A Systematic Review. Disaster Med Public Health Prep. 2021; Online ahead of print.

25. Kalali NS, Anvari MRA, Pourezzat AA, Dastjerdi DK. Why does strategic plans implementation fail? A study in the health service sector of Iran. Afr J Bus Manag. 2011;5(23):9831-7.

26. Mosadeghrad AM, Isfahani P. The challenges of strategic planning in Tehran province hospitals. Manag Strat Health Sys. 2018;3(3):184-200. [Persian]

27. Furberg R, Kizakevich P, Marcozzi D, Hubal R, Grantlin S, Holloway J, et al. Analysis of interdisciplinary, simulation-based triage training for disaster preparedness and response. Prehosp Disaster Med. 2007;22(S1):S5-6.

28. Rankin JA, Then KL, Atack L. Can emergency nurses' triage skills be improved by online learning? Results of an experiment. J Emerg Nurs. 2013;39(1):20-6.

29. Balmaks R, Grāmatniece A, Vilde A, Ļuļļa M, Dumpis U, Gross IT, et al. A Simulation-Based Failure Mode Analysis of SARS-CoV-2 Infection Control and Prevention in

Emergency Departments. Simul Healthc. 2021;16(6):386-91.

30. Jha A, Epstein A. Hospital governance and the quality of care. Health Aff. 2010;29(1):182-7.

31. Vanbrabant L, Martin N, Ramaekers K, Braekers K. Quality of input data in emergency department simulations: Framework and assessment techniques. Simul Model Pract Theory. 2019;91:83-101.

32. Shirazi FB, Moslehi S, Miresmaeili SS. Inter-Sector Partnership in Tabletop Exercises: A Low-Cost but Effective Approach to Increase Hospital Preparedness. J Disast Emerg Res. 2020;3(2):67-9.

33. Aliakbari F, Aein F, Bahrami M. Assessment competencies among emergency nurses for responding in disaster situation with Objective Structured Clinical Examination. J Health Promot Manag. 2014;3(3):47-57. [Persian]

34. Mirmohammad Ali Ie M, Nikbakht Nasrabadi A, Sohrabizadeh S, Khani Jazani R. Essential Professional Competencies for Basic Midwifery Practice in Disasters: A Qualitative Study. Disaster Med Public Health Prep. 2021; Online ahead of print.

35. Alinier G, Oriot D. Simulation-based education: deceiving learners with good intent. Adv Simul. 2022;7:8.

36. Jiang H, Lockee C, Bass K, Fraser I, Norwood EP. Board Oversight of Quality: Any Differences in Process of Care. J Healthc Manag. 2009;54(1):15-29.

37. Jung Y. Virtual Reality Simulation for Disaster Preparedness Training in Hospitals: Integrated Review. J Med Internet Res. 2022;24(1):e30600.

38. Smith B. Generalizability in qualitative research: Misunderstandings, opportunities and recommendations for the sport and exercise sciences. Qual Res Sport Exerc Health. 2018;10(1):137-49.

Appendix 1 An overview of the categories and subcategories during data analysis

Content	Category	Subcategory	Code
Management and leadership	Structure	Location	Hazard mapping (identification of hazards)
			The geographical location of the hospital for simulation
			Location
			Hospital leveling based on risks
		Emergency interior management	Determination of the hospital's capacity to accept patients
			Hospital entrance door for ambulance entry
			A signboard in the hospital space
			Quick assignment of emergency department patients
			Preparing and allocating other hospital wards to the injured
			Coordinating with other departments to receive the injured
			Using guidelines and standards
			Cancellation of elective surgeries and discharge of patients in need of unnecessary services
			Entrance and exit doors of the hospital emergency
			User changes instead of structural ones
			Floating the hospital emergency department
			Medical services, according to the type and severity of emergencies and the number of injured people
			Arranged gate at the hospital entrance
			Laboratory, CT, and sonography in the emergency department, active within 24 hours
			Admission and discharge to the hospital emergency department
	Casualty management	Prioritization and triage	Development of a system and standard for triage in the event of emergencies and disasters
			Screening and triage of the injured and high-risk groups
			Suitable space for triage of the injured
			Essentials in the triage room
			Two-tier triage in epidemics
			Assignment of the injured according to the indicators (6 hours, 12 hours, and 24 hours)
			Cancellation of elective surgeries
		Therapeutic measures	Patients' needs for other para-clinical services: laboratory and radiology
			Providing medical services to the injured according to the treatment protocol
	Command	On-scene management (in-hospital incidents)	Rapid deployment of the command team at the scene
		Incident Command Chain	ICS of the Hospital Incident Command System
			Incident Command Chart in the hospital emergency department
			Description of the tasks of the Incident Command Chart
			EOC of the Incident Command Center at the relevant university
			Establishment, development, and training of an incident control system
	Interactions and cooperation	Intra-organizational interactions	Creating empathy and cooperation within the organization to provide desirable services
			Clinical services (radiology, laboratory, pharmacy, and clinics)
			Inpatient department
			Intensive care unit
			Support and service unit
			Financial, administrative unit
			Medical equipment unit

Appendix 1 An overview of the categories and subcategories during data analysis

Content	Category	Subcategory	Code
		Extra-organizational interactions	Memorandums and inter-organizational agreements to improve the readiness level
			Establishment of cooperation between hospitals in times of emergencies and disasters
			More contact with the Deputy Minister of Health
			Prevention of sending too many casualties to the hospital emergency department
			Military, police, and security forces
	Communications and information	Quick alert	Information tools and devices in case of emergencies and disasters
			Development of a quick alert protocol
			Giving a background to the emergency department and triage nurse about the emergencies
			Definition of a specific code for emergencies, disasters, and required actions
		Staff, casualties, and companions	Increase in confidence and self-esteem of the emergency department staff
			Responding and maintaining the safety of the injured
			Reassuring companions of the injured during the treatment
			Strengthening the spirit and reassurance for recovery
	Manpower	Training infrastructure	Increasing the skills of trainers
			Existence of integrated educational programs and theoretical training measures
			Development of educational-therapeutic protocols following the hospital emergency department
			Using new technologies
			Development of comprehensible guidelines
		Learning and practice	Practice with the help of the latest technology in the world
			Mass Injury
			Management practice
			Teamwork practice
			The practice of calling personnel in emergencies
			Educational scenario using standards
			Participation of all emergency department staff in a possible scenario
			Holding practical, and remote maneuvers as well as courses for revealing weaknesses
			Use of simulators in practice
			Employees' participation in the training platform design
			Performing remote and operational exercises based on the probable scenario
		Empowering	Proper communications with the injured upon arrival
			Calling relief forces in case of emergencies and disasters
			Dealing with aggressive, injured people
			Increasing the speed of action in clinical procedures at the time of emergencies and disasters
			Patient flow based on injury prioritization
			Holding in-department workshops
			Training of personnel to use emergency equipment
			Ability to provide life-saving measures to the injured
			The ability of personnel to prioritize the injured and infectious triage
			Reminders of the duties and roles of emergency personnel during disasters through training
			Development of a comprehensive pre-determined program for training emergency department staff

Appendix 1 An overview of the categories and subcategories during data analysis

Content	Category	Subcategory	Code
			The need to repeat the training due to the change of personnel and to reach a stable state in training
			Call for forces inside and outside the hospital if necessary
			Skills to perform interventions despite the limitations at the time of emergencies and disasters
			Specialized training in mass casualty management and triage
Increase in the resource capacity	Resources	Chain of equipment supply and distribution	Emergency and antidepressant drug depots
			Getting help from pharmaceutical companies in case of emergencies and disasters
			Having an independent pharmacy in the hospital emergency department
			Appointing a trustee for the medicine supply and distribution at the time of emergencies and disasters
			Creative use of the available hospital space
			Concentrated drug stocks in the hospital central pharmacy
			Providing continuous minimum services to other hospitalized patients in proportion to the capacity
			Prioritizing hospital services
			Monitoring and controlling the equipment safety
			Supply and upgrade of equipment in the emergency department
			Maintenance of equipment in a suitable place
			Readiness of emergency equipment to be used
		Physical space of the emergency department	Increase in the hospital capacity by 20 to 25% depending on the number of approved beds
			Predicting and determining a space with non-therapeutic use to increase the capacity
			Determining a location for extra beds and increasing the number of beds
			Triage room at the first entrance to the emergency room
			Cardiopulmonary resuscitation room at the nearest location after the triage room
			Increase in hospital resources according to available resources
			Completing equipment in the hospital emergency rooms
		Financial resources Budget allocation	Requirement of a correct estimation
			Cost-effectiveness
			Allocation of funds commensurate with the hospital level
Modern technology approaches	Information technology	Role of information systems	Discrete-event based on the process
			Agent-based on interactions between the environment and beings or the interactions between people and the environment
			Dynamic systems based on agent influences
			Mix Reality: the fusion of real information in the digital world
			Virtual Reality: floating the user in a completely virtual world
			Augmented Reality: the use of digital reform in the real world
			Extensive reality: using the above three methods in the simulator design
			Creation of a real-world sense
			Multi-dimensionalization

Appendix 1 An overview of the categories and subcategories during data analysis

Content	Category	Subcategory	Code
		Implementation	Extraction of the probable scenario
			Educational draft (details)
			Specialists in the fields of technical engineering and health
			A cohesive card
			Educational scenario analysis
			Users' participation during the production process
			Simple, comfortable, teachable, and playable
			Increasing knowledge, awareness, skills, and self-esteem of the target group
			Charm at every step
			Using rewards during the game
			Attractive music for each stage
			Storytelling or guidance before starting work for the target group
			Multiple options and decision-making power for the target group
			Using the target group as a pilot to detect errors
Rules and policies	Policymaking and planning	Planning requirements	Development of a hospital preparation plan
			Development of contingency plans with a possible scenario
		Macro strategic plans	Previous hospital planning for disaster management
			Upgrade of the hospital capacity according to the emergency type
			Focus on the supply and distribution of resources in the country
			The need to support hospitals to develop and equip their emergency departments
	Protocols, processes, and rules	Development of protocols and processes	Treatment protocols
			Triage protocols
			Communication processes
		Taking advantage of the rules	Development of guidelines for diagnosis, treatment, and care by specialists and stakeholders
			Development of guidelines for standard rules in the simulation design for the target group
			Applying a new teaching method for practical and skill training
			Inclusion of simulation programs in training programs