


Original Research

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Determining the Factors Affecting the Retrofitting of Health-Care Facilities: A Qualitative Study

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Abstract

Objective: Health services are the first and most important demand for the affected people after disasters. Hospitals and staff of health centers are directly affected by disasters, and this issue is more critical due to the hospital conditions, such as the presence of patients, medical facilities, and equipment. Therefore, it is necessary to make hospitals retrofit against disasters.

Methods: This study was conducted qualitatively to extract experts' opinions about the factors affecting the retrofitting of health-care facilities in 2021. Semi-structured interviews were the basis of the data. In addition, to obtain data from different sources (triangulation), a focus group discussion (FGD) was held after the interviews.

Results: The findings of this study were extracted from interviewees and FGD in the form of 2 categories, 6 subcategories, and 23 codes. Main categories included external and internal factors. The subcategories of external factors were General government policies to reduce risk, The Programs of the Ministry of Health, and medical universities for retrofitting and Uncontrollable external factors. The subcategories of internal factors were Exposure of managers and staff of health-care organizations to various disasters, determining the types of vulnerabilities in health-care facilities, and Factors related to managerial actions.

Conclusions: Retrofitting health-care facilities is one of the requirements for designing and constructing these facilities. The role of governments in this issue is more than other stakeholders because governments are the trustee of the health system and are responsible for the people's health. Therefore, governments must plan for the retrofitting of health facilities according to the disaster risk analysis and prioritization and their resources. Although, external factors play a very important role in influencing retrofitting policies, the role of internal factors should not be neglected. None of the internal and external factors alone can have a significant effect on retrofitting activities. For this purpose, a suitable combination of factors should be determined and the goal of the system should be to achieve resistant and resilient facilities against disasters.

Natural and man-made disasters, in any form or for any reason, are obstacles to the sustainable development of societies. The incidence of this type of disaster is increasing globally.¹ The impact of a disaster can seriously disrupt or destroy a community's resources and performance and includes widespread human, material, economic, or environmental losses that are often beyond the capacity of the affected community to cope.² Although disasters often occur due to natural disasters, they can be of human origin. Disasters often happen suddenly, so they can overshadow basic infrastructure and disrupt its operation.³ Studies show that the effects of disasters are more pronounced in developing countries. Since 1990, natural disasters have caused approximately \$1 trillion in damage in Asia, accounting for almost half the estimated global cost of natural disaster damage.⁴

Health services are the first and most important demand for the affected people after disasters. Local governments must provide essential services to communities and citizens, such as health-care services, which are very important for the resilience of communities after various disasters.⁵ Health facilities, especially hospitals, are essential in response to disasters for emergency treatment and trauma care.⁶ The existence of health centers is one of the basic needs of human societies at all times, especially during natural disasters such as volcanoes, storms, floods, and earthquakes.⁷ The uninterrupted service and use of a hospital before and after disasters are among the most prominent problems that all members of society, especially officials, should address.⁸ Health-care systems play a crucial role in disaster response. Hospitals and health centers must provide adequate care for the victims of any type of accident and provide the necessary services to maintain the community's health. It is expected that health centers, especially hospitals, will be ready to deal with any type of disaster.⁹

Hospitals and staff of health centers do not work in separate systems. Still, they are directly affected by accidents and crises caused by it, and this issue is more critical due to the hospital conditions, such as the presence of patients, medical facilities, and equipment.¹⁰ System and organization vulnerability refers to the organization's ability to respond to risks and accidents. Hospitals and health centers are complex and have the potential to be vulnerable to a variety of natural and man-made disasters. Disasters in the past are helpful experiences and perspectives for disaster management.¹¹ In the 2003 Bam earthquake in Iran, for example, almost all public and private hospitals were destroyed, and it was impossible to provide services to the affected people.¹² In the Zarand earthquake in 2005 in Iran, only due to nonstructural damage and the absence of staff, the hospital was inactive for approximately 6 h. It could not provide services to patients, which happened while the hospital structure was not damaged.¹³

Because hospitals and health-care organizations play a crucial role in providing medical care to communities, according to the Hugo and Sendai frameworks, risk mitigation measures must be used to ensure the resilience of critical infrastructure, especially hospitals. The Sendai framework has a direct impact on health because it promotes the safety of health-care facilities.¹⁴ In recent years, the World Health Organization (WHO) has published reports on safe hospitals and tools for hospital safety as part of a disaster preparedness program.¹⁵ The WHO defines a safe hospital as a facility that operates to the maximum and provides accessible services during disasters, emergencies, and crises. The Safety Hospital Initiative (SHI) concept states that retrofitting health-care facilities is a cost-effective investment compared to the cost of rebuilding areas after a disaster.¹⁰ In past years, there have been reports on the safety evaluation of hospitals in different countries. In their study, Ardalan et al. used the quantitative HSI tool to study the safety of hospitals in Iran. According to their findings, none of the hospitals were in complete safety, and all hospitals were in moderate to low safety. In this study, only the report of safety status and retrofitting is emphasized, and the factors affecting it are not identified.¹⁶ To determine the requirements for retrofitting health-care facilities in Serbia, Lapčević et al. conducted a study that showed a high level of safety against climate hazards in Serbia. In their study, they showed that, to retrofit, special attention should be given to the type of hazards in the study area. The current research was on the safety of health centers against floods without considering the factors influencing the retrofitting.¹⁷ Moradi et al. examined the risk and safety analysis and retrofitting of hospitals. Their findings show that several factors in different countries can affect the safety and retrofit of hospitals. These factors are unique in each environment, and it is impossible to plan for retrofitting based on a single pattern for all regions and countries.¹⁰ Jahangiri et al. examined the challenges of using hospital safety tools. According to their findings, some factors such as lack of skilled manpower to conduct assessments, non-acceptance of assessment results by technical offices due to lack of knowledge of safety assessment tools, and lack of awareness of hospital managers are among the most important challenges. They emphasize that, to better understand the factors affecting safety and retrofitting, qualitative studies can be used and factors can be identified based on the conditions of each specific area.¹⁸ The WHO emphasizes that, using tools such as his, it is possible to determine the degree of safety of health facilities as well as their retrofitting requirements. However, there are factors that lead to the heterogeneity of these measures in different countries and in different environments. These factors are highly variable

depending on the study environment and must be identified in order to implement more and better-retrofitting measures.¹⁰ Brankov et al. state that it is very important for urban planning in the field of resilience to identify the factors that affect it; because ignoring them can affect even the best programs and prevent their success. These factors can vary depending on the environment; therefore, it is not possible to plan for other regions based on the actions and plans of 1 country and even a specific region.¹⁹

As shown, often in studies in the field of retrofitting and safety, researchers have used quantitative tools to report on the current situation and determine the requirements, and due to the differences in retrofitting programs between different countries and societies, less attention has been paid. Considering the mentioned cases and the great importance of health facilities, especially hospitals in disaster management and the need to remain active and productive at the time of accidents, the present study was designed and performed qualitatively to determine the factors affecting retrofitting of health-care facilities.

Methods

Study Design and Participants

This study was conducted qualitatively to extract experts' opinions about the factors affecting the retrofitting of health-care facilities in 2021. Semi-structured interviews were the basis of the data. The sample of the present study consisted of heads and managers of teaching hospitals in Kerman, engineers and officials of hospital facilities, technical office, and civil development of Kerman University of Medical Sciences. These people were selected purposefully and by the snowball method. Fifteen people participated in this study. Sampling was continued until data saturation so that no new data were obtained. Inclusion criteria were 5 y or more of service experience in their job position and high interest and motivation to participate in the research. The interview process was face-to-face and semi-structured. This type of interview was appropriate due to the flexibility and depth of qualitative research. The interviews were conducted individually from March 2021 to September 2021. The participants themselves determined the time and place of the interview. To prepare interview questions, a review of the relevant texts and expert opinions were examined. In addition, exploratory questions were used during the discussion to clarify the subject. To avoid possible problems, the interviews were recorded through an electronic device, and Documentation was done immediately. The interviews continued until topic saturation was achieved or no new ideas emerged from subsequent interviews. The interviewer wrote the critical statements of the participants at the same time as the interview. The notes and the essential topics from each interview were summarized in particular forms. This form included the following information: demographic information of the interviewee, place of consultation, academic rank of the interviewee at the university (if any), date and time of the interview, and other necessary information. The estimated time for each interview was approximately 35 min. To analyze the data of this study, the contractual content analysis method proposed by Graneheim and Lundman was used.²⁰ In addition, to obtain data from different sources (triangulation), a focus group discussion (FGD) was held after the interviews. The group consisted of 10 specialists in civil engineering, facilities, and architectural engineering with experience in cooperation or participation in health-care facilities projects. The duration of FGD was 90 min, which was done in

Table 1. Classification of categories, sub-categories and codes

Category	Sub-category	Code
1 External factors	General government policies to reduce risk	1. Macro-policies of the country 2. Obliging governments to observe macro-policies 3. Conduct risk analysis studies and assess priorities 4. Pay attention to global risk reduction frameworks and programs such as Sendai
	The Programs of the Ministry of Health and universities of medical sciences for retrofitting	1. Designing special programs 2. Regular monitoring of programs and reporting to high levels 3. Participation of organizations in designing a dedicated program 4. Design guidelines and standards for primitive design and installation 5. Continuous supervision of the technical office of the university
	Uncontrollable external factors	1. Severity of various events 2. Non-organizational factors
2 Internal factors	Exposure of managers and staff in health-care organizations to various disasters	1. History of disasters and the history of managers in dealing with different types of disasters 2. Diversity of perceptions of risks based on diversity of experiences
	Determining the types of vulnerabilities in health-care spaces	1. Vulnerability of structural components 2. Vulnerability of non-structural components 3. vulnerability of personnel and performance
	Factors related to managerial actions	1. Economic and budgetary factors 2. Attitudes of managers 3. Education 4. Skilled and committed manpower 5. Rapid changes of managers 6. Use experts for retrofitting 7. Reasonable purchase

November 2021. After the data reached saturation, the interviews were entered into MAXQDA software for coding and content analysis. The output was collected as a list of factors affecting the retrofitting of health-care facilities.

Contractual Content Analysis

To achieve data immersion, the interviews were overheard several times by the researcher and handwritten and typed word for word. The typed text was revised several times to confirm the accuracy of the information. Then, to extract the codes, the obtained data were read carefully and the prominent words of the text were determined and encoded in the software environment by writing notes in the margin of the text. Participants' keywords and the researcher's impressions of the statements were used for initial coding. By coding, meaning units were extracted from the participants' statements and the codes were classified based on similarities and differences, and then by comparing them, the main classes were obtained. MAXQDA software was used to analyze the qualitative data.

Data validity

To ensure the validity and reliability of the study, Lincoln and Guba evaluation methods were used, which is equivalent to the validity and reliability of quantitative research. Based on this method, 4 criteria of validity, transferability, reliability, and verifiability were considered for evaluation.²¹ To achieve these criteria, the following steps were taken: *Validity*. Sufficient time was spent to conduct this research, and the research process was approved by 4 experts. Also, to ensure the same views of the coders, 2 coders were used to codify several interview samples. *Transferability*. To ensure transferability of research findings, 3 experts who were not involved in the research were consulted on the research findings. To ensure the transferability in the data

analysis stage, special coding and symbol analysis procedures were used. Research details and notes were recorded at all stages of the work to ensure reliability. *Verifiability*. If the research findings are verifiable, all details must be carefully recorded at all stages, which was done for the present study. Also, all data, notes, documents, and recordings were kept for possible further reviews.

Ethics

The ethics committee of Kerman University of Medical Sciences (code number: IR.KMU.REC.1400.620) approved the study protocol. All participants were informed about the purpose and method of the research and informed consent was obtained from them. Regarding the ethical considerations of qualitative studies, participants ensured confidentiality and anonymity. In addition, participants were told that they could withdraw at any stage of the study for any reason.

Results

The findings of this study were extracted from the quotations of the interviewees in the form of 2 categories, 6 subcategories, and 23 codes. These findings can be seen in [Table 1](#).

The main categories known in these studies include 2 categories as external factors and internal factors. In addition, each category was divided into 3 subcategories. In the category of external factors, General government policies to reduce risk, the Programs of the Ministry of Health and universities of medical sciences for retrofitting and uncontrollable external factors were classified as sub-categories. Exposure of managers and staff in health-care organizations to various disasters, determining the types of vulnerabilities in health-care facilities and factors related to managerial actions were divided into sub-categories of internal factors. The subcategories and extracted codes are described below.

General Government Policies to Reduce Risk

This category deals with major issues related to retrofitting, which are the basis for retrofitting measures, and is divided into 4 codes:

Attention to retrofitting in the country's macro-policies was one of the topics that the interviewees emphasized. According to them, the programs that have become macro-policies are more advanced because they are pursued by the highest official of the country. For this reason, retrofitting programs, and especially retrofitting critical facilities such as hospitals, should be turned into a macro-policy and communicated to all responsible institutions. An expert said in this regard "Until such programs become the country's macro-policy, I do not think they can be expected to be pursued and implemented, because the vision of the majority of managers is short-term and limited to their management time" (P.1) and another expert said "Experience has shown that if an important issue like this one wants to involve everyone, and obsessively do it, must go into macro-politics because people know that it follows up from above country" (P.11).

Requiring governments to adhere to macro-policies was another issue raised by experts. An interviewee said "If a plan becomes a macro-policy, but the government comes and pays attention only to its own short-term plans, it will definitely fail. Programs such as those that require a lot of time and money must have an executive guarantee, not just in Mr. X government, but in all governments" (P.3).

Another issue addressed by the participants was conducting risk analysis studies and setting priorities. They believed that it was futile to carry out any kind of rehabilitation program without conducting a risk analysis, because the nature of the risks and the type of effects on health-care facilities, required different methods of retrofitting. An expert said "If we do not risk analysis and then plan for retrofitting, it is like shooting in the dark, it is a pointless task. When risk analysis is done at the macro level, the government knows which areas are being threatened and should think about them and allocate the necessary funding. Of course, this risk analysis must be both macro and regional, because it must determine the distribution of risks across the country and which region needs a plan with high priority" (P.1).

Paying attention to global risk reduction frameworks and programs such as Sendai was one of the most important for the participants. An expert said, "In my opinion, the best example of action plans is in the framework of Hugo and then Sendai. In these plans, it is clearly stated that the solution to reduce disaster risks is risk management and what risk management action is better for health-care facilities than retrofitting?" (P.6).

Programs of the Ministry of Health and Universities of Medical Sciences for Retrofitting

The second sub-category extracted from the interviews was the Programs of the Ministry of Health and universities of medical sciences for retrofitting, which includes 5 codes.

Designing specific programs was one of the topics mentioned by the interviewees. An expert said, "When the Ministry of Health knows what the danger is in which city and how it threatens your health-care facilities, then time and expenses can be used in the best way. For example, city A is on a fault and is threatened by earthquakes. An Earthquake retrofitting program is definitely a priority for hospitals. In city B, which is on the path to floods, they must be resistant to floods" (P.5). Another expert said, "In addition to the ministry, medical universities must be fully aware of their environment and where they are threatened. When the University

of Medical Sciences knows what is threatening its spaces, it should plan for them to make them resilient based on risk" (P.9).

Another issue in this section is regular monitoring of programs and reporting to high levels. A participant said, "The Ministry of Health should know whether University X has a retrofitting program or not, and if so, what it is doing now and at what stage. In this way, with accurate information, the ministry knows what to report to high-ranking officials, or what to expect if an accident occurs right now" (P.1).

From the interviewees' point of view, the participation of stakeholder organizations in designing a special program is one of the important issues in the success of retrofitting programs. An expert said, "Someone from the ministry prepares a plan and sends it to me, which must be fully implemented. How does he know the conditions of our region? How does he know our vulnerability? Is it possible to consider a uniform program for such geographical diversity? What is the result? That program will definitely not run. But when we write the details of the program ourselves, we oblige ourselves to follow it" (P.14).

Study participants believed that the guidelines and standards for primitive design and installation by medical universities were very important in the field of retrofitting. A participant said, "If there are no guidelines and standards, it is illogical to follow them. This guide should consider the conditions of a particular area and be designed accordingly, such as the risks and the importance of the facilities and the degree of vulnerability. In this way, it is understandable for people, and in addition, it actually prevents the occurrence of unfortunate consequences" (P.7).

Continuous monitoring of the university's technical office was another topic mentioned by the participants. An interviewee said, "If a plan is designed and implemented but only observed at the beginning, I think it will fail. The technical office must periodically visit all health facilities, understand their needs, and quickly retrofit them" (P.12).

Uncontrollable External Factors

The third subcategory identified in this study is uncontrollable external factors. These factors refer to factors that are not under control due to their unexpected nature and sudden nature, and due to the lack of clarity of their effects, no precise plan can be considered for them. Two examples of uncontrollable external factors identified are listed below:

The severity of the incidents was one of the issues raised by the participants. One of the experts said, "I want to give you an example. Suppose we did retrofit for an earthquake, and now an earthquake has occurred that is so strong that there is nothing left of the structure and the non-structure. Or, for example, our telecommunication antenna has strengthened, but suddenly a severe storm disrupts all system performance. So, we have to think about these uncontrollable things" (P.5).

Nonorganizational factors were another issue discussed in the field of uncontrollable external factors. These are the factors that have not caused the system to malfunction due to direct damage, and mainly indirectly disrupt the system's performance. For example, hospital water tanks may be standardized and retrofitted, And, in a disaster, meet the needs of the current capacity of patients, However, following a major accident and the subsequent increase in hospital capacity, the water supply system may not be able to meet the needs. An interviewee said, "Some other important factors, are external and environmental; For example, the occurrence of events called Complete Emergency may not have

directly affected the system, but we see a system blockage that has disrupted performance, and these factors are called non-organizational blockages. For example, consider the telephone system. This system is completely at your disposal; it is well cared for, proper lines are used, you protect it from dangers and you consider all these things. However, due to the heavy external use of the system by patients, companions and relatives who want to be informed about the accident, and despite the planned arrangements, we are facing the loss of the system, and these cases are not at the disposal of the management and these are the same non-organizational factors" (P.8).

Exposure of Managers and Staff in Health-Care Organizations to Various Disasters

Exposure of managers and staff in health-care organizations to various disasters is another sub-category in this study, which itself includes 2 codes.

The history of disasters and the history of managers in dealing with different types of disasters was a topic raised by many participants. An expert said, "Consider the manager who was present at the earthquake and the building where he was the manager, was damaged. Well, now he is the first person who can tell you what happened at that moment and how the system was damaged? So, when we are going to make a plan, he can help very well and he will be effective in advancing it" (P.6).

Diversity of perceptions of risks based on diversity of experiences is another code identified in this area. An interviewee said, "There is a manager and disaster is just earthquakes for him, because, for example, he has experience in two or three earthquakes. Now he has spent all his resources on earthquakes. Then suppose a sudden hurricane caused by climate change occurs in the region. What happens? The organization certainly has no resistance to deal with it because it did not anticipate and was not resilient" (P.3).

Determining the Types of Vulnerabilities in Health-Care Facilities

The fifth subcategory identified in the present study is the identification of vulnerabilities in health-care facilities, which includes 3 codes. The vulnerability of structural components was one of the issues identified in this field. An expert said, "I will say the importance of the structure in such a way that if the structure is destroyed, the non-structural components and manpower will also be practically destroyed. When the roof of a building with expensive diagnostic and therapeutic equipment collapses, both the device and the operator are destroyed. So, you see that three components, structural and non-structural, and manpower were destroyed at the same time, and that means the impossibility of providing service" (P.11). Another expert said "In order to make a place retrofit, you must first recognize its weaknesses, and since structural components cover other non-structural components and manpower, they are very important. And they need to be given a lot of attention in disaster retrofitting programs such as earthquakes" (P.7).

Another issue in this subcategory is the vulnerability of non-structural components. An interviewee said, "Consider a situation where a building is in the best condition of structural retrofitting, and there was an earthquake and no damage was done to the building and in this situation, the electricity of the city was cut off. But due to the lack of protection for the battery, the earthquake caused the generator battery clamp to come off and the generator

could not turn on. So, what will happen now? "More than 90% of the hospital and almost all the equipment works with electricity, so it is not possible to provide services" (P.13). Another said, "For many people, when it comes to retrofitting, the first thing that comes to mind is buildings. But in many cases, such as the Zarand earthquake, the structure suffered very little damage, but the hospital was inactive for hours due to damage to non-structural components. So we realize that retrofitting is not just about the structure. A strong building cannot be serviced without a water supply system or without oxygen" (P.10).

Another code in this subcategory is personnel and performance vulnerability. An expert said, "I have experienced the presence in several earthquakes. There was a time when there was an earthquake and the wall or ceiling of the hospital collapsed, leading to the death of skilled personnel, and there was no replacement. This means that we could no longer provide that specific service. There was a time when our staff was not harmed but was informed that his/her wife and child were under the rubble. So, do you think this person will stay in the workplace? He will definitely help his family and we will still not be able to provide that service" (P.8).

Factors Related to Managerial Actions

The sixth and last sub-category identified in this study is Factors related to managerial actions. Unlike the factors mentioned above, these factors do not involve the macro or regional policy-maker; rather, they are factors that occur within an organization and can greatly reduce the problems associated with retrofitting. This subcategory is divided into 7 codes, which are described below.

Economic and budgetary factors are the first code that experts have emphasized. An expert said, "The financial situation of the hospital can play an important role in retrofitting. When the financial situation is good and the hospital can spend part of its income on retrofitting along with its other expenses, it can definitely be effective in reducing risks and increasing resistance. But we see that managers are paying more attention to problems that are bold and can be resolved quickly" (P.7).

Another code is the attitude of the managers of the organization, which according to the participants has a great impact on the implementation of retrofitting activities. An interviewee said, "We can say that the most important factor in this issue is the attitude of management. When a manager is aware and has the mindset of how sensitive and important the issue of retrofitting is, he or she will make a good plan to train and improve safety and, in addition, when budgeting, will consider an amount for retrofitting. In this way, there is no need to use other credits and resources to do retrofitting" (P.2). Another interviewee said, "the attitude and thinking style of the manager is actually the heart of the matter. If you have a lot of money, if the manager does not want it, it is not possible to spend this money on retrofitting. So we see practically everything goes back to the management attitude" (P.4).

Another code in this subcategory is education. An expert said, "In my opinion only education, education, education. Nurses and doctors have to take a series of courses every year. So why not one of these courses for retrofitting? At least the doctor can make his office more resilient. Two hours of training counts as in-service. By teaching this belief, it must enter into our medical community, and this will take time" (P.3). Another expert said, "Training is one of the main keys in retrofitting. Since retrofitting terms are often intangible, many may not understand it and they think it's a complex engineering job and requires special measures. But it is easy to hold training courses for staff and familiarize them with

their environment and its hazards and taught simple measures for retrofitting” (P.12).

The importance of paying attention to skilled and committed manpower was one of the items emphasized by the study participants. One of them believed that, “We should not neglect manpower. However, what is being said is ultimately done by the same manpower. Manpower must be compassionate and committed and know that if they do not comply, they may be the first to be harmed. Therefore, the motivation and commitment of the staff must be increased in different ways” (P.9).

Fast changes in managers at different levels of health-care organizations were other issues raised by experts. An expert said, “Well, there is another thing that many managers change quickly, and it is natural that not all people have the same thoughts and attitudes, and thus with a change in hospital management, the hospital behavior may change. So, what now? How do you know next the person has a vision for retrofitting? So, we see that when the manager leaves, all the experiences and programs are gone. Now suppose that the same manager studies and plans to retrofit, and suddenly this person is removed from his post and replaced by another person. What is the result? Loss of time and money and of course everything in this matter goes back to the first point” (P.4).

Using experts for retrofitting is one of the sensitive and key issues in this topic that was mentioned by the participants in the study. An expert said, “On the other hand, we see people being sent to hospitals by the university to perform the retrofit. Most of these people do not know much about hospital systems and their importance, as well as various methods of retrofitting. Somehow they only think that if, for example, something hardens in its place, it becomes resistant. No, it is not. In my opinion, this issue requires expertise for someone to be responsible for this. Has read about it, taken the time and can analyze it well” (P.11).

Another important and vital issue in the discussion of retrofitting is the reasonable purchase by the broker and the contractor. An interviewee said, “I think shopping is very important, why? Because these products are to be used in the building or for maintenance. Well, at first, the purchased product should be of good quality, for example, it should not be destroyed as soon as the voltage fluctuates a little or a little water collects around it. So it is better to buy a good brand that has high efficiency and safety. Well, when we send someone to buy, it is better to make him fully aware that he should not just buy something cheap. He should buy goods or materials that are strong and can help increase the strength of the building and then pay attention to its price. This is a matter of human life and it is not possible to endanger people’s lives just for some money” (P.6).

Discussion

This study investigated the factors affecting the retrofitting of health-care facilities. The main subcategories in this study are: General government policies to reduce risk, the Programs of the Ministry of Health and universities of medical sciences for retrofitting, Uncontrollable external factors, Exposure of managers and staff in health care organizations to various disasters, determining the types of vulnerabilities in health-care facilities, and Factors related to managerial actions.

Because governments are responsible for the people’s health, the role of governments as trustees is stated in all international programs and protocols aimed at promoting the safety and health of the people. For this reason, governments must design and

implement risk mitigation and safety programs in their macro-policies. Zhang et al. state that the impact of disasters is not limited to the event area, and the whole society will be affected by its effects, so the importance of addressing retrofitting should be at the level of the country’s macro policies. When a plan is included in macro-policies and becomes a vision for the country, its implementation will be a priority for governments.²² When a program has become part of the country’s macro policy, a mechanism must be considered that requires all governments to always adhere to it. In many countries, the president or head of government changes every 4 y, so paying attention to this is essential. The findings of this study showed that, in addition to macro-policies and the obligation of governments to comply with them, exceptional attention to global programs such as Sendai or the Hugo Framework could be very useful in retrofitting. International programs based on the collective wisdom and global experience contain critical information that can significantly reduce the cost of post-disaster recovery. The study by Montejano-Castillo et al. showed that attention to frameworks such as Sendai play an undeniable role in the safety and retrofitting of health-care facilities and should become a culture in all components of a vulnerable community.²³ On the other hand, any planning without risk analysis will lead to failure and waste of resources. A retrofitting policy can only be considered when risk analysis and recognition studies have been conducted at the community level and an overview of the dangers that threaten the whole community has been obtained. Nuti and Vanzi sought to answer the question, “when is retrofitting necessary?” They found that risk analysis must first be performed to plan to retrofit. After identifying the hazards and their possible impact on different facilities, it is necessary to prepare for retrofitting in other dimensions. This will save you time and money.²⁴ Moradi et al. emphasize that any attempt to retrofit hospitals without conducting a risk analysis in the region will lead to failure because, based on the needs and priorities of the area, the necessary needs assessment and action have not been taken.¹⁰ A study by Alesch and Petak showed that policy-making and related legislation are required to rehabilitate and retrofit dilapidated hospital buildings at risk of damage. In addition, when policy-making occurs, its enforcement guarantees increase, and governments are required by law to act to retrofit health facilities.²⁵

The Ministry of Health, as part of the government, is responsible for implementing that part of the country’s policies that includes the health of individuals in society. The Ministry of Health is a government institution directly responsible for the health of the people and the community. It carries out this responsibility through the medical universities in each province. In their study, Adida et al. state that all health-care facilities are related to the Ministry of Health, and a retrofitting plan is essential for them. Therefore, planning the retrofitting of health facilities should be one of the most important tasks of this ministry.²⁶ Based on the findings of this study, designing specific programs for each region and based on the disaster priority of the area will increase the acceptance and understanding of risk and, in addition, will lead to actions that have high-cost benefits. Therefore, rare resources can be well managed. On the 1 hand, organizations’ participation can increase the program’s acceptance. On the other hand, it will lead to the practical implementation of retrofitting measures. Once the risk analysis studies have been conducted, the Ministry of Health knows which risks threaten health facilities. Therefore, it can develop retrofit programs through medical universities. It should be noted that only planning is not enough. The Ministry of Health is required to monitor programs for retrofit health facilities

continuously, and this responsibility must be done through medical universities. Once universities have developed a program based on the identified risks, they should consider themselves required to implement the program and report to Ministry of Health. Perry and Lindell emphasize that the specific programs that the implementing organizations have been involved in developing are much more acceptable than the programs communicated from the highest level with details to be implemented in the region. The best scenario is when the general principles of retrofitting programs are sent to medical universities, and they write the details according to their specific circumstances.²⁷ The study by Boshier and Dainty emphasizes that planning for retrofit construction is one of the requirements in reducing the risk of disasters. When organizations such as medical universities play a significant role in this planning, they mostly comply with it.²⁸

Uncontrollable external factors are other significant factors in the retrofitting of health-care facilities. Imposition factors are on the system from the outside and damage system performance. Different incidents can occur with different intensities. It is clear that the level of vulnerability also varies at different intensities. Factors, such as the magnitude of an earthquake or the power of a storm, cause significant damage to the system at high intensities, despite the retrofitting. The best way to deal with external factors is to recognize them, predict their effects, and reduce them. For example, a dedicated crisis hotline for the hospital can be considered to prevent disruption of the telephone communication system. Priyadharsini et al. state that interference in telecommunication systems during disasters can disrupt the functioning of the entire system and lead to a reduction in the relief process. This interference may have been imposed on the design from the outside, despite the necessary arrangements by the system. For this purpose, essential predictions must be made for these conditions.²⁹

The study's findings showed that the exposure of managers at various levels, from macro to operational levels, to multiple disasters, could play a significant role in understanding the importance of disasters and their effects and retrofitting. Burkle states that managers who were present in the disaster or were at the decision-making level are well aware of the importance of retrofitting health-care facilities and can help others to pay attention to justify this. At the operational level, these people facilitate the implementation of retrofitting programs and provide the necessary space and resources.³⁰ One of the most critical aspects of retrofitting is that the managers' approach does not only include a specific type of risk. The importance of this issue becomes apparent when all resources on retrofitting facilities against a particular type of risk. Over time, a different kind of risk arises as conditions change. In this case, the system has no preparedness to face and, as a result, may be seriously damaged. The study by Sullivan-Wiley and Gianotti showed that managers' inattention to various disasters occurs for several reasons: inability to process information, lack of exposure to disasters, and, as a result, terrible experience and failure to recognize and understand the consequences of disasters. The result of this inattention will be putting the organization at risk. However, having experience is not the only reason to comply with retrofitting requirements, which should become a perception for managers to affect their performance.³¹

A correct understanding of the types of damages in health-care facilities is fundamental for the authorities and the personnel working in these facilities. Still, when talking about retrofitting, all attention is drawn to the structure and its accessories; but it is

necessary to pay attention to other components. Safety components are generally structural, non-structural, and functional. Together, these factors lead to the productivity of a collection, and without each, there will be virtually no efficiency and service delivery. Based on the findings of this study, recognizing the types of vulnerabilities in health-care facilities can be crucial in performing retrofitting measures. In their research, Moradi et al. state that recognizing different components in the organization can lead to identifying their interaction with each other and be effective in retrofit planning. Suppose the manager performs retrofitting measures only for structural components and neglects non-structural components and personnel. In that case, he will witness a loss of organizational performance during the disaster.¹⁰ Achour et al. states that structural components generally include brick columns, building foundations, load-bearing walls, the location of vital facilities, and so on. Structural components are so crucial that non-structural and functional components will also be damaged if they are damaged. When a building collapses, the workforce on site will also be impaired, and the equipment will be destroyed under the rubble.³² Lakbala also shows that paying attention to nonstructural components is very important. These components are the items that make it possible for the complex to continue providing services and include electricity supply system, water supply, sewerage system, communication system, medical gases, architectural elements, etc. Nonstructural components are often costly, and malfunctions can disrupt the entire assembly. Ultimately, the workforce is the beating heart of health-care systems. Service will not be present to victims if the skilled workforce is unavailable in an emergency. Disasters can affect personnel directly or indirectly due to the injury of family members or close relatives, leading to the impossibility of providing services to them.³³ Therefore, it is necessary to comply with all the components of the organization for retrofitting. The research of Gabbianelli et al. showed that the effect of structural and non-structural components on each other should be considered and then designed for retrofitting programs. Non-structural components can deactivate the organization without strength and retrofitting in situations where the structure may not even be damaged.³⁴ The study of Achour et al., which investigates the status of hospitals' structural and nonstructural components in earthquakes, shows that these components behave differently in the face of an earthquake. On the other hand, they affect each other to a great extent. In addition, in the recent earthquakes, nonstructural components were mainly damaged and disrupted the hospital operation.³²

The research findings showed that other factors would affect retrofitting at the level of health-care facilities and the general factors previously described. Factors are into 2 categories of controllable internal factors and uncontrollable external factors. Internal factors are those that, with simple decisions, can play a significant role in retrofitting. The quality of materials and equipment purchased for the hospital can play a decisive role in the organization's survival during disasters. Economic and budget factors and managers' attitudes are other internal factors. Budget and attitude are very much influenced by each other. If organization's financial resources is insufficient, there will be no safety Even if the attitude of managers is positive. Another critical issue identified in retrofit is education. In retrofit assessment metrics, many items do not need to be repaired or relocated, and safety can only be achieved with proper training and apply them by personnel. The rapid change in the position of managers in health-care organizations has indirect but significant effects on the issue of

retrofitting. Maybe there is a manager with a retrofit approach and attitude who defines a budget for it. After some time, while the system is running a retrofitting program, he will step down, and all his programs and experiences will be lost. So, reinstallation programs may be out of order and no longer run. Rapid changes and uncertainty of a fixed position also lead to short-term vision. In this situation, managers focus only on short-term and quick-return programs. If the idea of managers is long-term, their purchases will be more reasonable and provide quality goods with high efficiency for the organization. Mohammadpour et al. showed that by strengthening the existing systems and ensuring safety, productivity could also be increased, which requires rational purchases of equipment and, on the other hand, the attitude of managers on how to use them.³⁵ The findings of Kagawa and Selby show that, with the development of disaster education processes and disaster risk reduction measures, and as a result, retrofitting can be achieved.³⁶ As seen, the results of other studies confirmed the findings of this study. Based on the analysis of the conducted studies, many of the identified factors are common in developing countries, and in this way, the results of this study will be very useful in strategic planning in these countries.

Conclusions

Health-care facilities, especially hospitals, are one of the most critical infrastructures of a community to meet the needs of disasters. If these facilities are damaged, health services will not be effective and can even lead to secondary disasters in the affected community. Accordingly, retrofitting health-care facilities is one of the requirements for designing and constructing these spaces. The present study sought to identify the factors affecting these spaces' retrofit. Several factors were identified in this study, each of which can play an essential role in changing the attitude of managers toward retrofitting these facilities. Among the known elements, the role of governments in this issue is more than other stakeholders because most of them are the trustee of the health system and are responsible for the people's health. In addition, they have a direct responsibility in response to disasters. Therefore, governments must take measures to retrofit health facilities. A critical point in this regard is that it is impossible to have a single instruction for all countries; disasters are not the same in different regions, and more importantly, the resources available in countries are various. Therefore, governments must plan for the retrofitting of health facilities according to the disaster risk analysis and prioritization and their resources. External factors play a very important role in influencing retrofitting policies, and in many countries, especially developing countries, many hospital actions depend on the decisions of the central government. However, the role of internal factors should not be neglected. Internal factors can lead to the establishment of a bottom-up disaster management system and improvement of the efficiency and effectiveness of decisions. People who are present in critical and disaster-prone places and have the experience of facing disasters can better understand the risk. As a result, they know their strengths and weaknesses more than others and can encourage the government officials to make retrofit. Finally, none of the internal and external factors alone can have a significant effect on retrofitting activities. For this purpose, a suitable combination of factors should be determined and the goal of the system should be to achieve resistant and resilient facilities against disasters.

Limitations

The main limitation of this study is that the present study was conducted in Iran and its results were obtained according to the culture and the type of accidents and disasters in this country. Therefore, the results may not be generalizable to all societies, especially developed countries.

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