Exploring the Effective Factors on Fires Related Injuries in Residential Buildings Inhabitants: Findings from a Paradigm Model

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Abstract

Background

Fires is one of the most important hazards leading to human casualties as well as financial losses in the world, mostly in low- and middle- income countries. This study aims to provide in-depth information on fires in residential buildings and explain the safety process against fires in Iran.

Methods

This study has a qualitative study design using a grounded theory principle, recommended by Strauss and Corbin, and using the Paradigm Model. The data were collected via in-depth interviews with 27 participants, including injured patients, health professionals, firefighters and other stakeholders in Iran, who have practical experience or theoretical knowledge about management and action after fires. Data were analyzed based on a grounded theory approach, using the Paradigm model.

Results

Synergistic building safety deficiency and qualitative relief defects were identified as the center of this study. This reflects participants' experience essence on the barriers to preventing fires related injuries in residential areas in Iran. These issues are debatable at various levels, from local and national policy to individual characteristics and behaviors of people and inhabitants of residential buildings against fires.

Conclusions

The safety of building's occupants requires the improvement of many factors at the local and national level. Safety construction of buildings, urban infrastructure and public education should be taken into consideration to promote community safety.

Introduction

Fires is one of the most important hazards leading to mortality in the world. About one percent of the global burden of diseases is related to fires and it has lots of socio-economic and environmental impacts, and also large effects on human health (1). According to the World Health Organization (WHO), every year fires cause many human casualties as well as financial losses in the world, mostly in low- and middle-income countries (LMICs) (2). Globally, fires are one of the most important causes of death and disability (3). Some people believe that events like fires is the act of God, therefore they do not make any attempts for preventive measures (4).

The building fires are a big threat to the safety of the occupants of the buildings (5). Since homes are an important cross between lifestyle and health issues, there is probability of occurrence of many injuries (6).

In total, 77% of the fires reported in 2015 were in buildings including homes, hotels, and dormitories, 73% of which had happened at residential buildings (7). Inhalation of smoke, severe burns and deaths due to fires in residential buildings are devastating events, that most of them can be prevented (8). A large number of deaths are related to unintentional injuries occurring in residential buildings (9). Fires and burns are the third cause of death consequent of domestic incidents. The fires-related injuries account for about 36 per 100,000 people per year that most of them are as a result of exposure to unwanted and unintentional fires and one third of them are hospitalized or dead (10).

Iran is a hazardous country that is exposed to natural and man-made hazards (11). According to a conducted survey in Iran between 1990 and 2000, there were between 600 and 900 fires per million inhabitants per year in cities (12). A national study in Iran shows that about 41% of injuries in residential buildings were related to fires and burns (10).

In order to prevent injuries, mortality and financial damage caused by fire in residential areas, the causes of these fires should be identified (13). On the other hand, the most effective interventions for preventing fires in residential areas, and how people behave during a fire, should be specified as well. However, in terms of promoting fire safety policy, it is important to know why a particular incident causes a lot of casualties and why an incident seems to be disastrous, has less casualties (14). Several studies have shown that using stakeholder experiences is one of the important ways to promote the phenomenon of interest, as emphasized by the WHO (15, 16). In spite of the numerous studies in relation to building fires in other countries, few studies have been carried out in Iran, most of them is quantitative (10, 12, 17, 18). But at the moment our knowledge about how the occupants of buildings confront with fires based on their experiences is limited, well as what causes the spread of fires. Exploring experiences of stakeholders and assessing safety process in the inhabitants of residential buildings can help improve the safety and health of people in confronting fires. Therefore, the necessity of new approach especially qualitative studies in this field seems is necessary. This exploratory study was designed to explain the process of occupants' safety in residential buildings against fire-related injuries, drawing on the experiences of victims, firefighters, healthcare providers and other relevant stakeholders. In this study we have used a qualitative approach to provide in-depth information on fires in residential buildings and explain the safety process against fires in Iran.

Methods

Design
Grounded theory principle recommended by Strauss and Corbin's, employing the paradigm model was used for data collection and data analysis. One of the main goals of the grounded theory is to create hypothesis, theories and experimental models based on empirical data. This approach is appropriate

when investigating a new area or seeking to explore a known area from a new perspective (19, 20).

Study Setting

The study was conducted at national level in Iran, located in southwestern Asia and the Middle East (21), in 2017. It should be noted that the participants' selection was based on the interviewees of residential buildings, fire centers, hospitals and work stations.

Study Participants and Data Collection

The study participants include firefighters, doctors, nurses involved in the provision of health care services, injured and those who have exposed and experienced fire, and other stakeholders who have practical experience or theoretical knowledge about management and action after fire, who were selected based on study requirements. Interviews were done by (MRS) principal investigator and 27 participants were included in the study (Table 1). This selection was based on purposeful sampling following by theoretical sampling. The criteria for choosing participants with a living experience were the willingness and ability to transfer experiences. Selection of participants and data collection continued by means of theoretical saturation.

For data collection, interviews were conducted through semi-structured interviews. The research use audio recording to collect data. The interviews began with general question including: What happened on the day of fire? What did you do to prevent fire-related injuries? How do you keep safe from fire-caused injury? What are the barriers to building safety against fires? And continued with exploratory or in-depth questions such as: Please explain more, give an example of your true experiences. until the saturation of the findings from the interviews continued. The interviews with the participants lasted from 40 to 60 minutes. This period was considered based on the criteria of tolerance, the amount of information and the willingness and agreement of the participants.

Data analysis

All interviews were recorded, transcribed verbatim and analyzed based on a grounded theory approach, using the Paradigm model and then typed using Word Office 2007 software. It should be noted that the collection and analysis of data were conducted simultaneously and based on the grounded theory approach and using the paradigm model (22). The initial analysis of each interview was conducted before the next interview, and if new concepts were raised, it would try to be explored in subsequent interviews.

Data analysis was performed at three levels including open coding, axial coding and selective coding (19, 22). To explore and investigate the relationship between concepts, we used the paradigm model. The main purpose of the paradigm model is to enable the researcher to systematically think about data and associate classifications and concepts in complex ways (19, 20). The main components of the paradigm model technique include: causal condition, contextual conditions, interactions or strategies taken in response to phenomena, and intermediary conditions (conditions of intervention) which are broader and

wider range of interactions affecting on action/ reactions entirely based on Corbin & Strauss proposed model in 2008. Data analysis was done by (MRS) principal investigator, in collaboration with co-authors.

 Trustworthiness

In the study, Lincoln and Guba criteria were used to validate the results and robustness and Rigor. For credibility of the findings, proper interaction with the participants involved a prolonged engagement, including 18 months for data collection and analysis, a constant comparative analysis method was used. Data integration and data member check, as well as investigator triangulation by means of checking open coding process was employed. Expert check in the qualitative study by two qualitative experts in this area, DKZ & KhN, was performed by supervision on the whole process as well as providing direct quotes and examples.

In the current study, in order to confirm the compliance of participants' experiences with the results, the text of the interview and the coded concepts of the data were provided to several participants. Most of the researchers in this study specialized in safety promotion and injury prevention. Reflector commentary and copywriting was first used to verify dependability. Also, transferability was provided with detailed description of the method for comparing with other readers in their own settings. Moreover, the transferability was achieved using scientific consultation with professors. For conformability of the researchers' neutrality, the agreement on codes and themes was approved. This study was approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, on December 20, 2016, with the ID [IR.SSU.SPH.REC.1395.110] (23).

Result

The result of the analysis of the obtained data was 2172 initial or open code. After removing the unrelated codes and merging some of the codes, the initial categories and finally the original categories were obtained. Synergistic building safety deficiency and qualitative relief defects were identified as the core category as the center of this study. This reflects participants' experience essence on the barriers to preventing fire related injuries in residential areas in Iran. These issues are debatable at various levels, from local and national policy to individual characteristics and behaviors of people and inhabitants of residential buildings against fires.

Causal Conditions

In this study, Causal Conditions are events or phenomena that results in the creation or severity of an injury resulting from a fire or a reduction in the safety of residential buildings inhabitants. Unsafe buildings against fire, individual risk characteristics and behaviors are major barriers to the safety of inhabitants of residential buildings against fire.

(A) Individual hazardous features and behaviors

According to the participants, lack of belief in safety and a low understanding of fire risk and the resulting injuries are among the most important factors in the creation and spread of fire as well as the injuries caused by it among inhabitants' residential buildings that are considered as barriers to safety.

"Most of us think that these events are for others and we do not believe it. And unfortunately, we believe it

when we get injured. Also, we are willing to spend thousands of dollars on surgery for burning scars, but we are not willing to spend less money on preventing it. Because we do not know the importance of it" (P15).

"We had a case that a mother put the baby sleep next to the heater after bathing and one side of the blanket was on the heater and the other side of it was thrown over the baby to warm her baby and she went out of the room" (P 19).

Human behavior during fires is the most important aspect of safety in the residents of the building. Dangerous behavior and unsafe lifestyle of residents living in residential buildings due to their low attitude towards safety are among the most important risk factors for their health and also one of the barriers to fire related injuries prevention.

"The mistake that is made during a fire is that when the detector declares a fire, we try to extinct it, in case we should save ourselves. Because without informing the firefighter it may waste the time and jeopardize our lives" (P 12). Another surprising case happened in 2017 was the use of gas cylinders to open the sewer pipe by a number of people, which caused gas leakage in several floors and a huge fire ..." (P15).

B) Unsafe Buildings

The experiences of participants in this study suggest that the weakness in the structure of residential buildings can prevent the safety of residents of these buildings against fire and the resulting injuries. Inappropriate interior design, such as: lack of emergency exit paths, lack of design and installation of fire warning systems and the use of unsafe and low-quality building materials, are among the safety barriers for inhabitants of residential buildings against fire.

"... We give an example inside a residential complex about 3 years ago, and one of the drawbacks that caused the spread of fire was that the elevator and the staircase were in one place beside. The building also had no escape stairs and fireproof doors ..." (P8).

".... Another obstacle is the lack of maintenance of fire extinguishing and warning systems in buildings that cannot be served when they are needed, residents unplug them because of smoking..." (P5).

".... We often see that in construction of the roof of newly built houses Styrofoam are used that are rapidly expanding due to fire and it is accompanied by a lot of smoke that not only causes the spread of fire but also it has suffocating smoke for residents ..." (P6)

Contextual Conditions

Contextual conditions are a series of conditions that create situations or problems through which groups or individuals respond by their actions/interactions (19, 24).The Participants described some underlying factors that influenced a systematic safety process from fire related injuries and also the choice of strategy. "The weakness of the safety culture"," Legislation and oversight defect", "Lack of awareness" and "insufficient economic support" are among the underlying conditions in this study.

A) The weakness of safety culture

Based on the experience gained, the culture of the people is such that people pay a lot of attention to decorating the home and put safety in next priority. The installation of flammable fixtures and furniture

inside residential buildings near the heating equipment can spread the fire and increase the injuries.

"...... We went in a residential complex to firefighting operations, a stove was clinging to the table and there was a cloth on the table, which that could cause fire...." (P4).

B) Legislation and oversight defect

Most contributors consider the inadequate laws and supervision of building safety as a cause of fires. According to Participants' opinion, legislation to improve safety of buildings has been less considered by policy makers,

"... Fire alarm and extinguishing systems that should be in all buildings only in buildings above 5 floors is mandatory in our country, and this requirement is only demanded until the end of the construction, and thereafter there is no supervision..." (P1).

"... To save the economy, building manufacturers will ignore safety systems, and even Building buyers do not pay attention to the fact whether buildings have safety systems or not" (P15).

C) Lack of awareness

The participants described that safety defect is one of the most important concepts that influenced the fire process and it means that knowledge, skills and safety literacy of people in the field of safety are inadequate. So that lack of education, insufficient knowledge and information in occupants of residential buildings can have a negative effect on their behavior during the fire and cause increased damage and injuries.

"... Most people do not know how to deal with the fires and the related safety tips. Unfortunately, there is little education because of the safety topics are not a priority of our lives ..." (P3).

D) Insufficient Economic Support

Another important issue in Iran is economic issues that contributed to the safety of occupants of building. Many contributors have said that the use of cheaper equipment, which has a lower quality, will reduce the safety of occupants against fires.

"... constructing a standard building imposes a lot of costs on manufacturers, and manufacturers try to ignore safety systems, and even our buyers do not pay attention to the fact whether their building have safety systems or not" (P15).

Intervening Conditions

These conditions either facilitate or constrain the action/interactional strategies taken within a specific context (24). Factors, such as an increasing number of injuries and providing free-of-charge hospital trauma care for RTIs victims could be seen as intervening conditions.

In this study, the intervening conditions are a vast field of structure that influences the safety of inhabitants of residential buildings against fire. These conditions either accelerates or restricts the implementation of the strategies taken within a specific context (24). The weakness in accident management, the inadequacy of skills and equipment of relief forces, and lack of access to the site of the accident are among the factors that challenge the effectiveness of relief and rescue services. Also, poor coordination of relief and work interference between relief service providers that provide services

simultaneously (firefighters, pre-hospital and police service providers), can exacerbate injuries, waste of time and increase the cost of relief to make.

Weakness of Incident Scene Management

This category refers to problems due to management weakness in scene of the accident and relief workers causing disturbance in the delivery of relief forces such as fire department and pre-hospital emergency.

"... We are prepared as pre-hospital emergency forces in front of the building to help the injured people, but firefighters took injured out from the back of the building. We do not have a common language for coordination. ..." (P1).

Inadequate Skills and Equipment of the Relief Forces

According to the experiences of the participants, lack of operational skills, as well as inadequate and not up-to-date equipment of the operational teams, will make it difficult to provide relief to the injured.

".... Our firefighters who are able to enter the hot zone do not have enough knowledge to rehabilitate and treat the injured because they lack medical knowledge...." (P1).

"... Many injured people should be taken to medical care centers in hot zone, but the pre-hospital emergency forces do not have these fire safety equipment and tools, even an ambulance that can enter the area. Because of the inability to enter the area, we have a higher mortality rate" (P1).

Lack of Access to the incident areas

This refers to the obstacles that impede the timely arrival of firefighters on incident areas and the provision of favorable relief services to the injured.

"... Among the barriers to the relief of firefighters are the problem accessing to the incident areas, such as tight passageways, in-city electric wires, some green spaces and trees front of buildings, preventing the transfer of our equipment. For example, they give permission to building construction at six-meter passage" (P26).

Actions / Interaction Strategies

Action/interaction strategies are purposeful or deliberate course of actions, which are taken by individuals or groups in response to events, problems or issues which occur under certain conditions (24).

Action/interaction strategies include targeted and planned actions that are addressed by individuals or groups in response to events, problems or issues that occur under certain situations (24). Contributors explained that various actors involved in the safety of inhabitants of residential buildings respond in different ways to factors affecting fire related injuries. They used a set of approaches and measures to face Synergic defects of building safety and relief quality. These actions were called "Scramble for safety against fire related injuries", which included both adaptive and maladaptive strategies.

A) Adaptive strategies

These strategies were responses and efforts made by individuals or groups against synergic defects of

building safety and relief quality, and ultimately for the safety of themselves and others against fire related injuries.

The adaptive strategies consisted of five sub-categories: self-protection, getting help from rescue forces, equipping buildings with safety devices, judicial approach with inhabitants of unsafe buildings and trying to upgrade relief services.

Self-protection and getting help from rescue forces

According to most contributors, one of the ways to increase the safety and prevention of fire-related injuries in residential buildings is to protect themselves against fire and announcing to the relief forces, especially firefighters and pre-hospital emergency departments.

"In case of a fire, the first duty of residents is to evacuate the building and remove themselves and the family members, especially people with disabilities. The second task is announcing to the fire department and other relief forces such as the emergency and if we do not have escape way, we have to go to the roof so that the relief forces can save us through it" (P1).

Equipping the Building with Safety devices

Based on the findings, one of the strategies used by people to provide safety from fire related injuries was to equip the building with safety devices such as fire extinguishers and fire detection systems, which is one of the concepts derived from this study.

"... After experiencing a fire, we learned a lot: one was that we did not have any firefighting equipment at home, but after that we bought a fire extinguisher and one Co_2 capsule for electrical fires ..." (P22).

Judicial approach with inhabitants of unsafe buildings

judicial collision with inhabitants and owners of buildings that their buildings were unsafe to fire was an effective strategy used by fire safety supervisors.

" After visiting more than 200 buildings, we sent a written note for buildings owners that their buildings had a safety problem. Then, in cooperation with the judiciary, sent warning letter to resolve the safety problems. So, they were required to resolve the problem and make their buildings safer than in the past ..." (P26).

Trying to promote of relief services

The efforts that relief agencies were undertaking to promote relief services to reduce the weakness of fire prevention and, ultimately, to safety promotion of people against fire related injuries.

".... After fires that we feel we have weakness, we have meetings with to fix those weaknesses and, as far as our affordability allows, we started to buy firefighting equipment. ..." (P26).

"..... After the special fires that we are weak, we will have meetings with the operational commanders to resolve those weaknesses and, as far as our financial matters allow us, we will purchase firefighting equipment." (P26).

B) Maladaptive response

some people show reactions against synergic defects of building safety and relief quality, which endangers their health. These proceedings were classified as maladaptive responses. The maladaptive response includes; surrendering to the problem or ignoring them, as well as inappropriate actions and responses described below:

Surrendering / Fatalism

Based on the experiences and understanding of participants, giving up and not paying attention to preventive approaches increases the likelihood of injuries.

"... Fatalism cause disregard for prevention. We have to raise our skills and this is not possible except by destroying the culture of fatalism. If I'm not a fatalist, I will not abandon my house with God's protection and for that I will create safety solutions ...." (P1).

Inappropriate actions and responses

According to the experience of participants, fire extinguishing without the necessary equipment and skills as well as doing hazardous measures to escape, can increase the risks of building fire and injuries related to them.

".... The fires that I experienced was very intense and terrible, I proceeded to fire extinguishing without any firefighting equipment and I got burned, because without experience, I tried to put it off ...." (P22).

Consequences

The consequences are derived from the use of action / interaction strategies chosen by actors (24). The strategies employed by different actors involved in the safety of fire related injuries to residential buildings have created the implications that the study called "scramble for safety against fire related injuries" which included both adaptive and maladaptive strategies.

Safe building against fire and changing to living safely of fire are adaptive strategies that have been extracted from contributors' experiences. On the other hand, the maladaptive strategies are other types of consequences that consist of two sub-categories: physical and mental injury and financial damage.

"... After experiencing a fire, we avoided from any danger especially fire and if I see a fire, according to the previous experience, I don't become nervous and will do better. We also removed the Gas cylinder from the home appliances. We removed all flammable materials from houses ..." (P22).

"... This injury that I saw will never be compensated for me and I have lost my spirit. I'm very anxious and stressed. I'm afraid of the match. A while ago, a gentleman wanted to smoke, I was anxious and scared, and I became unconscious...." (P19).

Discussion

The findings of this study indicate that the main obstacle to the safety of inhabitants of residential buildings against fires is "Synergic defects of building safety and relief quality". Unfavorable buildings

against fire, individual risk characteristics and behaviors were identified as the main risk factors. Other factors affecting safety in this study included the inadequate structure of building and city that increase the risk of fire related injuries. Various strategies used to deal with these conditions that have caused financial damage, physical injury and psychiatric disorders; although some strategies have used for protection in the community and people against fire, but focus is more on causal and contextual conditions.

Socioeconomic instability

The socioeconomic factors, such as challenges related to safety culture, legislation and oversight defect, economic challenges, and lack of education and safety knowledge, are the main obstacles to safety. Participants' experiences imply that the increased incidence of injuries occurs in the lower socio-economic societies. Several studies also show that injuries in LMICs are higher than the other regions (25-27). A study in Canada aimed at determining the risk factors for fire related injuries in inhabitants of residential buildings (28). This study showed that mortality rates were significantly higher in people with lower socioeconomic status which it could be due to the low knowledge and financial inability to provide safe equipment. Considering the high level of fire related injuries in LMICs, preventive measures such as the distribution of safety equipment are among the most endangered households that can be used. This study, which was conducted in collaboration with the WHO, also shows that injuries from incidents including fires in LMICs are 3.5 times higher than high income countries (29).

Lack of Awareness

Inadequate awareness of safety and fire prevention was identified as a major barrier to the safety of building occupants against fire. Moreover, lack of awareness seems to be partly due to the lack of an organized public education system, this topic is also mentioned in several studies (27, 30). Therefore, public education systems as well as professional training should be developed to raise the community awareness (31). In order to raise the awareness of professional staff, especially firefighters and emergency medical technician (EMT), basic and continuing education is required. Several studies have also emphasized the impact of these trainings on improving the awareness of relief forces and as a result promoting community safety (32, 33).

Poor Coordination of the Rescue Team

Weak coordination of relief forces in the fire scene is one of the main obstacles to providing effective relief services, partly influenced by the lack of an integrated system in the country. Some issues that have contributed to the poor coordination of relief forces in fire scene include the absence of unity of command and the lack of common language for relief teams and also the diverse knowledge of relief teams. The lack of coordination for providing timely and appropriate care in the scene of events has been mentioned as the main challenge of the incident scene in several studies in Iran (18, 20, 34, 35). Moreover, the lack of unity of command especially when the multiple organizations should be taken place on the scene has been the main challenges facing the management of the fire scene for various events in Iran and other LMICs (20, 35). One of the ways to overcome this can be a unified incident command system in

the scene and the use of a single emergency number, which now requires much more attention in these settings.

Safety weakness of Building against Fire

There are several underlying factors that indirectly and in combination with other factors, have an effective impact on safety. Based on experiences of contributors, one of the safety barriers and also one of the factors contributing to the injury of residents against fire is the unreliability of residential buildings against fire. The use of non-standard materials in the construction of buildings, the lack of installation of fire extinguishing equipment, the absence of escape stairs or the emergency exit are factors that increase the fire related injuries in the occupants. In several studies, unsafe buildings are known as one of the major risk factors of fires and injuries caused by it (25, 30, 36-38). Improvement of structural safety may be difficult in the short term because most of them are old and changing their physical structure is very expensive, but to build new structures have to be more supervision for safety.

Resident characteristics and behaviors

According to participants' experiences, the individual characteristics including vulnerable age groups, disabilities and patients, high-risk behaviors such non-consideration of safety and its negligence, are among the factors that are obstacles of safety against fire. In many studies it has been consistently reported that buildings with more elderly, disabled, and sick people are more likely to be affected by fire and death (13, 39-41). The lack of attention to the value of the people's lives especially the vulnerable groups in incidents and fires seems to be one of the causes of injuries in these groups. Special attention to this group can enhance their safety during incidents. This issue should be addressed by policy makers in the LMICs infrastructure, like Iran, and pay more attention to vulnerable groups during constructing buildings. The results of previous study also showed that safe behavior and lifestyle against fire play vital role in preventing injuries during a fire (42). Therefore, in order to promote the safety of occupants of residential homes, attention should take place on understanding risk as well as promoting risk perception as an important issue.

Strengths and limitations

The present study is one of the few qualitative studies in Iran according to the experiences of various stakeholders such as both policy makers and fire victims, to exploration the process a safety for fires-related injuries in building's occupants. Using the paradigm model in this study helped to explore and understand the complex relationships between identified concepts and categories. The limitation of the study is that the process is partly objective and exploration of experiences partially explains the structure of a quantitative study. Due to their physical condition of some fire victims, interviews with some hospitalized patients were difficult. However, these factors have resulted to a prolonged process of collecting data, and were taken place with more time spending.

Conclusion

Synergic defects of building safety and relief quality consider as a major barrier to safety and preventing injuries to building's occupants. The safety of occupants requires the improvement of many factors at the local and national level. Safety construction of buildings and urban infrastructure should be taken into consideration. Also building a national integrated rescue system is necessary in order to expedite the time and quality of relief to injured and improves communication and interaction between emergency workers. In addition, public education is needed for people and also continuing vocational training for relief forces to promote community safety.

Abbreviations

WHO: World Health Organization, **LMICs**: Low- and middle-income countries, **EMT**: Emergency Medical Technician, **RTIs**: Road Traffic Injuries.

Declarations

Ethics approval and consent to participate:

This study was approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences, Yazd, on December 20, 2016, with the ID [IR.SSU.SPH.REC.1395.110]. This study has a qualitative study design using a grounded theory principle, and the data were collected via in-depth interviews. Therefore, the verbal informed consent was obtained from all participants prior to participation in the study. This form of informed consent was approved by the Ethics Committee.

Consent for publication:

Not applicable.

Availability of data and material

The analyzed datasets during this study are available from the corresponding author on reasonable request.

Competing interests:

All authors declare that they have no competing interests.

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Authors' contributions:

MRS has made substantial contributions to the conception and design of the study, took responsibility for and coordinated the acquisition of data and contributed actively in the analysis of the data and the writing of the manuscript. DKZ has made substantial contributions to the conception and design of the study, interpretation of the data, and writing up the manuscript. KhN contributed to the design of the study and preparation of the manuscript. AA contributed to the study design, data analysis, and interpretation. All authors read and approved the final manuscript.

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Tables

Table 1: Characteristics of participants in the study and their organizational units on factors influencing the safety against residential building fire related injuries

Percent	No	Participants (N=25)	
88	22	Male	Gender
12	3	Female	
40	10	Firefighter	Role
16	4	Experts	
4	1	Physician	
12	3	Nurse	
24	6	Fires victims	
4	1	Witnesses of fires	
8	2	Ministry of health and medical Education	Organizational
4	1	Ministry of interior	
4	1	University of medical sciences	
40	10	Hospital	
40	10	Fire station	
4	1	Other	

Table 2: The concept of safety related category against fire related injuries in residential buildings based on participant's experiences

Categories	Subcategories	First Categories
ocioeconomic instability	Weakness of the safety culture	Not safety priority
		Unsafe life style
		Insufficient belief to security
		Not paying enough attention to the human's lives
	Defect in law and supervision	Weakness of supervision
		Not paying attention to the law enforcement
		Weakness of laws
	Insufficient economic support	Inability of fire insurance
		Lack of security subsidy
		Failure to provide safe building and equipment
		Unbalanced prices of energies
	Lack of awareness	Flaw in public education
		Lack of safety literacy in people
Inadequate effectiveness of relief and rescue services	Weakness in coordination	Different knowledge of relief teams
		No unified command
		Lack of common language among relief teams
	Technical support failure	Lack of knowledge and skills of relief teams
		Lack of inefficient equipment and technology of relief teams
	Lack of access to the incident site	lack of emergency lane on roadside
		Population crowding and involvement in the scene of the incident
		Inappropriate urban structure
		car parking on the road
ing safety shortcoming	Unsafe structures	Inappropriate interior design
		Use of non-quality building materials
	Inadequate internal safety	Lack of design and installation of safety equipment (decontamination and …)
		Inappropriate layout of the interior of the building

	unsafe use of energy resources	Insufficient equipment maintenance inside the building
		Incorrect use of gas
		Incorrect use of electricity
		Inappropriate storage of fuel
challenges related to building residents	Vulnerable people	Special age groups
		Disability and paralytic Patients
	Human behavioral errors	Failure to safety supervision
		Carelessness and neglect
		Inappropriate use of flammable materials
	Low risk understanding	Lack of attention to prevention
		Available flammable materials
		Lacking learning from previous events
active quest for safety	Effective interactive effort (adaptive strategies)	Self-protection
		Assisting the relief and technical forces
		Equipping the building with safety equipment
		Judicial treatment of residents of non-secure buildings
		Trying to upgrade relief services
	Error and controversy (maladaptive strategies)	Inappropriate actions and responses
		surrendering against incidents
Interactive effect	Injury and damage	Financial losses
		Construction damage
		Physical injury
		Psychiatric disorders
	Safety and fire safety	Securing the building against fire
		Change in safe direction of fire

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