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Exploring the criteria and factors affecting firefighters' resilience: A qualitative study

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ABSTRACT

Purpose: Firefighters are exposed to high levels of occupational risk factors, such as safety risks, chemical, ergonomic, and physical hazards that may jeopardize their lives. To overcome these hazards, firefighters must be physically, mentally, and personally fit to work. This study aimed to explore the criteria and factors affecting firefighters' resilience based on stakeholders' experiences.

Methods: This qualitative study was carried out using conventional content analysis. In total, 21 face-to-face interviews were conducted by firefighters who were experienced in the field. The interviews were carried out by firefighters from July 2019 to January 2020. The data were collected using three unstructured interviews and then resumed by 18 semi-structured interviews. Data analysis was done using Graneheim method.

Results: The participants had more than five years of experience in the field of search and rescue. The extracted codes through data analysis were classified into 3 main categories (individual, organizational, and social factors), 9 sub-categories (mental, physical, occupational, managerial, colleagues-related, equipment-related, environmental, community-related, and family-related factors), as well as 19 sub-sub-categories and 570 codes.

Conclusion: Firefighters' personality, physical condition, behavior and psychological characteristics can affect their resilience along with organizational and management factors that play significant role in people's safety. Developing a tool for assessing resilience can help decision makers to have a real depict of firefighters' job qualifications.

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Introduction

Fire is known as one of the main public safety concern all over the world, causing 200,000 deaths each year.[1] Firefighting is inherently a hazardous job[2,3] and they are exposed to dangerous situations when saving people in danger.[4] Therefore, they always face unknown and dynamic environments.[5] Firefighting is a physically demanding job and firefighters are exposed to many hazards during their routine occupational duties.[6] **There are also high incidence rates among firefighters.**[7] A retrospective study on firefighters in Australia showed that 117 out of 1000 workers suffered on-duty injuries each year.[8] Moreover, 1644 duty-related deaths were reported among firefighters from 1990 to 2014 in the United States.[9] Such fatalities are caused by unpredictable and root factors, and more importantly the community traditions and attitude factors, such as firefighters' weak safety attitude, knowledge, and emergency treatment, and poor psychological ability when being exposed to dangerous situations.[10]

The individual personality assessment indicates whether candidates are truly motivated to perform rescue jobs.[11] These type of assessments are intended to determine the firefighters' ability to

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deal with severe and emotional stress when facing fire.[12] It is important to investigate the root causes of occupational injuries, as well as the institutional, social, and individual factors affecting individual safety at workplace.[13] Resilience is defined by various concepts such as being able to withstand stress and job difficulties, individual abilities and having job skills.[14] Resilience is known as a pivotal factor in reducing the incidents and trauma.[15,16] Resilience has been suggested to address the emerging and unpredictable safety risks to consistently achieve high safety performance.[16] Resilience is an individual ability to overcome and adapt to environment.[14] Having personality strengths, using suitable coping strategies, and having social support are characteristics of disaster resilience for rescuers.[17]

In order to minimize casualties, it is essential to have an appropriate tool for assessing firefighters' competence to ensure that they are appropriately suited to handle the hazards of their job. Currently, firefighters are evaluated using several fitness methods; however, it seems that there are less comprehensive standards in all organizations. The National Fire Protection Association (NFPA) has published numerous codes and standards needed for the firefighting job; however, there have been no standard approach to assess work adjustment leading to improper employee recruitments, which can endanger firefighters, their colleagues, the work environment, and their community.[18] In Iran, no medical assessment and fitness for duty has been provided for firefighters during working time and entrance medical exams have been done without considering the job difficulties. Moreover, there have been no valid criteria to assess their fitness for this job.[19] Although many research studies have been conducted on assessing the firefighters' eligibility to continue this job,[20–24] no comprehensive qualitative study has been conducted to explore the criteria and indicators affecting firefighters' safety performance based on their experiences. The qualitative approach is important to gain a fresh perspective on favorite phenomena. Therefore, in order to decrease the fatalities, it is necessary to measure firefighter's job abilities.[25] This study aimed to explore the main factors affecting firefighters' resilience at the work-place to promote their safety. In this study, factors leading to occupational injuries were explored to provide effective strategies to prevent firefighters' occupational vulnerability based on their experience.

Methods

This qualitative study was carried out using a conventional content analysis approach. This method is used when the objective is to create a model to describe a phenomenon in a conceptual form[26] and to organize the data into a structured format.[27]

Participants and data collection procedure

Purposeful sampling method was applied to select interviewees in this study. In total, 21 firefighters, including officers, commanders, and firefighting managers participated in this study. The interviews were conducted in Tehran, Yazd, and Kurdistan from July 2019 to January 2020. The interview conducted by first author who is doing his Ph.D. thesis on firefighter's resilience and has participated in qualitative training courses under the supervision of corresponding author who is professor in the field of health in disaster and emergencies. The interview venue was selected based on the participants' convenience, which was mainly at their workplace. The inclusion criteria were having experience in firefighting and managing firefighting organizations or having theoretical knowledge about “firefighting occupational hazards”. The interviews lasted from 25 to 50 min, with an average of 40 min. The main data gathering technique involved in-depth, face-to-face interviews. The interviews started with three unstructured interviews followed by 18 semi-structured interviews developed by the research team. The questions were asked to explore the criteria and indicators affecting firefighters' occupational resilience, including “Please describe your last incident experience that you had safety challenge and your life was threatened.” “Please explain your experience from one of the most complex incidents that you had.” “Please explain your experience if you or your colleagues were injured in the rescue operation.” “What factors affect firefighters' occupational resilience?” “What kinds of practical skills are necessary for a firefighter to perform safely?“. To achieve data collection objectives, the researcher asked different questions for different interviewees. For the participants to better understand the questions, the interviewer explained the purpose of the study, i.e., investigating the factors affecting occupational resilience. The interviews were continued until data saturation, and somehow no new information was obtained in the last three interviews.

Data analysis

The Graneheim method was used for data analysis in this study. All the interviews were recorded and typed verbatim. After each interview, the recorded audio file was listened several times and typed, and then the transcript texts were reviewed several times by the first author. After specifying the highlighted words and phrases of the text, the preliminary codes were extracted by note-taking. Then the participants' experiences were determined in the form of concepts under the strict supervision by the corresponding author and by consulting other researchers. To allow in-depth understanding of the concepts and to avoid superficial and mechanical coding, the coding and categorization processes or the concepts were implemented manually by paper and pencil. During preliminary coding, the participants' sentences were used and the codes and condensed meaning units were identified. Afterward the codes were classified into categories and sub-categories according to their similarities and differences.

Rigor

The credibility of the study was confirmed by allocating sufficient time for data collection and data analysis, extending engagement of the participants, constantly comparing the findings, understanding participants' experiences by the author; and choosing the most experienced participants and hazard-prone stations. Member check, peer check, and expert check were done for conformability. Member check was done by presenting the transcript of the interviews and the summary of the results to the four participants for the approval of the findings. The validity of data collection and analysis processes was checked by two qualitative researchers in the research team and the process was monitored by the qualitative expert and the corresponding author (expert check and peer check). Most of the data analysis time was devoted to identifying and extracting the codes expressed by different firefighters with different experiences. Then the researchers held several meetings to establish proper relationships between the codes and the categories. In addition, to cover the issue of occupational resilience, the perspectives of the experts from different fields were carefully considered, including the field of occupational safety and health, disaster management, and firefighting. In order to achieve the scientific accuracy of the study, the bracketing process was used to prevent the effect of researchers' subjective opinions. The research process was fully explained to ensure transferability.

Ethical considerations

The interview time was arranged by phone. At the beginning of the interview, the purpose of the study was explained by the interviewer, then permission was received to record the interview and a detailed explanation about research objectives was presented and the participants were assured of confidentiality. At the same time, the participants were given the opportunity to ask questions and affirm their right to withdraw from the study at any time. Verbal and written informed consents were also obtained. The principles of confidentiality and anonymity were explained to the participants. This study was part of a Ph.D. thesis in the field of the Health in Disaster and Emergency in the Public Health Faculty of Tehran University of Medical Sciences. Moreover, the study received ethical approval from the Ethics Committee of Tehran University of Medical Sciences (code: IR. TUMS. SPH.REC.1397.240).

Results

The participants' age range was 26–52 years with the mean age of 36 years. All interviewees had at least 5 years of experience in the field of firefighting. The average of the work experience of the participants was 13 years. Table 1 presents the participants' demographic characteristics. The first author conducted all the interviews. Overall 21 face-to-face interviews were conducted, resulting in the extraction of 502 primary codes. After reviewing extracted codes, the research team merged, and classified them into three main categories, i.e., individual factors, including mental, physical, and occupational factors; organizational factors, including management, colleagues, and equipment; and social factors, including environment, community, and family related factors (Table 2).

Individual factors

According to the results of the study, the individual factors affecting firefighters' resilience included mental, physical, and occupational factors. In this study, individual factors were identified as the most important and widespread component of firefighters' resilience.

Mental factors The eligible firefighters should have a normal mental status and should be able to do their jobs safely. They must also have competence in mood, personality, anxiety, and perceptional factors. Based on the participants' experiences, firefighters' mental properties can affect their performance in incidents and emergencies. Firefighters who have mental health issues cannot do their job safely and they might create problems for themselves and their colleagues, which can jeopardize their lives. Given the nature of the job, firefighters are expected to overcome their emotions and decide logically in their missions, manage stressful and emotional aspects of the job, and have mental adjustment to their jobs. Since this job has high level of mental stress, people with mental disorders may not be able to cope with the people's stress and the stress experienced in difficult situations. Sometimes, it is necessary to decide under too much stress, and if firefighters have mental health problems, they cannot decide properly. People whose properties and loved ones are in danger will create high pressure for rescue workers, and it is important for the firefighters to have ideal mental health to cope with such situations.

" …. One of the hospitals in the area had an elevator that caused many accidents. In one incident a kid was stuck in the elevator, and his dad was with us. The stress brought on us by his dad was enough to insult us. We knew what he was saying was just the result of his anger, but we couldn't do anything about it since his child was in a very risky situation and we could see the child through the doors of the elevator. But well, it puts a lot of pressure on us. This is a very difficult situation psychologically and you should consult a psychologist or counselor." (Participant 5).

Physical factors The physical factors affecting the firefighters' professional performance included physical health and physical fitness. They are related to criteria, such as physical strength, physical endurance, body mass index (BMI), better breathing, sedation, speed, endurance, cardiovascular endurance, muscle balance, vision health, hearing health, physical impairment, musculoskeletal disorders, disability, occupational disease, gastrointestinal problems, heart health, chronic illness, occupational injury, suspicious being sick, healthy diet, smoking, and age. Physical health and physical fitness will affect firefighters' professional performance while doing their job and, they allow firefighters to do foreground tasks without putting themselves or others at risk of injury. Physical health and physical fitness enable a firefighter to stay focusing on a given task and have the muscular endurance to complete it. For instance, based on the participants' experiences, people with musculoskeletal disorders may not be able to perform well in the incident requiring heavy physical labor, and this may endanger their lives. People with hearing impairments may also not be able to hear their colleagues' shouting to inform them of a danger or the sound of a power cord being ignited. If they have a hearing impairment, they may not be able to hear the sound well and may have an accident. Moreover, people with visual impairments would lead to poor diagnosis of hazards.

" …. We turned off the building's electricity in one of the incidents, and then we heard the sound of an electric spark. I was silent. I saw the owner standing there, but he did not say that he had used the electricity illegally. Because it is not known that the fuel is used illegally in the building, so in the case of a gas leak, it will explode. If there is water, it can cause electrical accidents. If I had hearing defect, I would never detect this danger …" (Participant 4). "When you have even a slight physical disability, it can affect your thinking. It means that if one gets tired, he or she can make the wrong decision because of lack of focus." (Participant 1).

Occupational factors Some of the factors affecting firefighters' resilience are related to the nature of the job and job-related factors. This sub-category included four sub-sub-categories, i.e., professional skills, experience, ergonomic factors, and job-related factors and, the extracted codes are shown in Table 2. Experienced people can perform tasks better and more securely, and based on their experience they can identify potential hazards and understand how to control the situation. Since firefighting is a hazardous occupation and many harmful factors, such as sleeping, night work,

Table 1
Characteristics of the participants on the criteria and factors affecting firefighters' occupational resilience based on the stakeholders' experiences in Iran.

Variables	*n* (%)
Age strata (years)	
20–30	4 (19.04)
31–40	14 (66.66)
41–50	2 (9.52)
51–60	1 (4.76)
Work experience (years)	
<7	3 (14.28)
7–15	12 (57.14)
>15	6 (28.57)
Education status	
Diploma	2 (9.52)
Associate diploma	4 (19.04)
Bachelor of science	14 (66.66)
Master of Science	1 (4.76)

Table 2
Factors that influencing firefighters' occupational resilience based on stakeholders' experiences in Iran.

Categories	Sub-categories	Sub-sub-categories	Example of cods
Individual	Mental	Mood	Presence of mental symptoms, anger, tolerating heartbreaking scenes, saddened by the death of colleagues, intellectual conflict, depression, supernatural forces, mental peace, tired of working, mind set of events, fear of previous events, hope for the future, discouragement, tolerance threshold, vigilance,
		Personality	Pride, motivation, sacrifice, negligence, laziness, sensitivity on shared accessories patience, obedience, composure, being fearless, self-confidence, being cautious, temper, 'commitment, flexibility in behavior,
		Anxiety	Stress, stress tolerance, family stress, positive stress, alarm stress, waking up with stress, sleeping with stress, taking work stress to family, anxiety,
		Perceptional factors	Underestimating hazards, acting thoughtfully, evaluation, self-protection, keeping the safe distance, mind fullness, ensuring health, observing safety tips, using PPE, creativity, intellectual readiness, tolerating people's pressure, flexibility
	Physical	Physical health	Lung injury, healthy eyesight, healthy hearing, musculoskeletal disorders, disabled, injured, occupational disease, digestive problems, heart health, chronic illness, occupational injury, smoking,
		Physical fitness	BMI, physical strengthening, physical endurance, physical readiness, agility, sedentary, physical strength, speed, power, cardiac endurance, pulmonary endurance, cardiopulmonary endurance, athletic competence, muscular balance,
	Occupational	Professional skills	Operational literacy, technical skill, material recognition, knowing hazards, navigation, knowing extinguishers, specialty in job position, being up to date, knowing tools, knowing buildings, knowing industries, familiarity with new hazards, skills in various posts, time management, asking people,
		Experience	Exposure to events, experienced people skills, being newly hired, entering accidents experience, practice in the dark, experience in using fire extinguishers, transfer of experiences, writing experiences, experience in a variety of accidents, applying the experience of other countries,
		Job-related factors	Job complexity, unknown risks, dissimilarity of events, specific hazards, heartbreaking scenes, carrying people, carrying heavy objects, unavoidable hazards, road hazards, second job fatigue, burning out job repetitive work, exposure to hazardous substances, job satisfaction, sleeping under the bell, loud noises, physical work, working at night, long working shift
		Ergonomic factors	Sleep disorders, insufficient sleep, working shift, sleeping with stress, equipment matching with body, heat tolerance, cold tolerance, thermal adaptation, enough rest, individuals' physique
Organizational	Managers	Managers performance	collaboration between stations, screening in employment, financial motivation, retraining courses, meritocracy, specialized teams, identifying unsafe buildings, promoting people awareness, Incident Command System (ICS), lack of enough personnel, unnecessary presence of officials,
		Welfare	Financing, nutrition, psychological interventions, meeting individual needs, periodic examinations, recovery, supporting the injured, scientific counseling,
	Colleagues	Colleagues competency	Physical readiness of colleagues, negligence of colleagues, health of others, being social, commander's readiness, commander's composure, personnel's scientific information
		Workplace relationships	Supporting each other, commander's unkindness, transfer of experiences, commander's experience, commander's management, colleagues' experiences, relaxing by colleagues, teamwork, solidarity, communication with the superiors, dividing tasks,
	Equipment	Station	Low station space, station location, receiving few calls, convenient station environment,
		Personal protective equipment	Equipment fitness for people, shared PPE, suitable clothing, complete equipment, worn-out PPE, standard equipment, maintenance of equipment, equipment efficiency, outdated equipment, robots,
Social	Environment	Accident environment	Unknown environments, illegal electricity branches, safe route, wrong use, unsafe storage, uniformity of buildings, standard building, illegal warehousing, defective wiring, extinguishing systems, lack of information about the building,
	Community	Citizens	Trusting people, unsafe behavior of the people, people's attitude towards firefighters, incident information, people wrong guidance, people's culture, obedience, people's lack of awareness, people's cooperation,
	Family	Family-related factors	Family problems, marital status, having children, family worries, family support, disorder in family life, family job information, financial challenge, entertainment programs, family spirit,

and heat exposure threaten the people, ergonomic adaptation must be achieved. Firefighters' personality traits should fit the job so that they are less affected by these factors. In hazardous situations people with professional skills can rely on their ability to perform better than others. They also have better detection ability due to better understanding of various processes. Professional firefighters can use their skills when encountering complex situations. For instance, in some cases, firefighters are exposed to hidden electrical lines and even after shutting off the building's electricity, there might still be electricity in illegal lines and people may be electrocuted. Identifying such risks requires technical skills.

"… Exposure to fire and incident raises one's practical experience. For instance, at this station, we may just have one incident experience every day compared to a situation in which someone has 3 fire and incident alarms a day. I definitely have less experience, even if I have attended all the relevant classes and read all the science-based pamphlets. For instance, Hassan Abad station may have 5 missions a day. The firefighters at this station may be as capable as any other station commander who might have one alarm a day because they were more exposed to various situations." (Participant 1).

Organizational factors

The organizational factors constitute another category which affects firefighters' resilience. Organizational factors include managerial factors, colleague-related factors, and the equipment. The performance of the organization can improve working conditions and thus increase the safety of firefighters in the workplace. In the following sections, the impacts of these factors are further explained.

Managerial factors This sub-category includes managers' performance and welfare. Participants in the study believe that focusing on managerial factors is an important issue for improving safety and mitigating occupational injuries. For instance, preventive management measures, such as regular examinations, specialized training, psychological counseling, and occupational psychology interventions, can prevent many work-related incidents and illnesses. In many cases, personnel safety is affected by

managerial performance and managers' decisions. Moreover, welfare, working hours, salaries, and organizational services play an important role in job satisfaction, and consequently in motivating firefighters. Obviously, motivated people do their job better on missions. Managers can also ensure the safety of people by providing high-quality and sufficient equipment. The ability of managers to select the eligible personnel for the job is very important. Therefore, capable people are both more productive and can have a positive impact on the safety of their colleagues. Managers should be able to evaluate people's performance and competence through regular assessments, and they must try to correct them in appropriate ways in the case of shortcomings. Firefighters injured in accidents should be rehabilitated, since they are both psychologically and physically injured, and if left unmanaged, these injuries can reduce their productivity, leading to performance reduction in future missions.

"… If the organization is not committed to you, or your salary is not enough and you have financial concerns, you will find yourself looking for a second job. This will make you tired in the workplace. It can reduce performance. The motivation is not what you want it to be." (Participant 8). "Last year I injured my back again. I went to rest for 6 months without payment, and then came back. Now my motivation is like an amateur, I feel that my ability is much greater than what it was before, and I am healthier." (Participant 11).

Qualifications of colleagues The results of this study showed that sometimes firefighters' resilience was affected by colleagues. Therefore, performance, level of preparedness, and relationships among colleagues can affect one's safety. The presence of experienced people along with the staff can increase their safety. Professional people are experienced in many scenarios, and based on their experience, they can select the safest method. In addition, having experienced colleagues can increase a person's safety; since when people need help or consensus at the scene of an accident, colleagues can help them. "… We are here together for 24 h, that is, from morning we come to have breakfast together we have classes together, we exercise, … This is a 24-h life-time job. It is not going to be a shift either, so we are a group of 10 people for many years. If these 10 people lose their friendship, it can have bad effects on their productivity …. " (Participant 6).

Equipment The results of this study showed that equipment played an important role in firefighters' occupational resilience. This category was divided in two sub-sub-categories, i.e., personal protective equipment (PPE) and station equipment. The PPE is used to protect firefighters from occupational injuries and illnesses resulting from exposure to chemical, radiological, physical, electrical, mechanical and other hazards. Due to the acute exposure of firefighters to harmful factors, such as heat, toxic fumes, and working at heights and with sharp objects, the availability of PPE plays an important role in ensuring their safety. If the personal protective equipment does not fit the anthropometric characteristics, firefighters do not feel comfortable using it. That is why firefighters do not always use it, or people may be forced to use shared self-containing breathing apparatus (SCBA), which causes those sensitive to using shared equipment to avoid using them. In some cases, the organization may not be able to provide qualified and sufficient PPE to individuals due to some reasons. In Iran, for example, sanctions have stopped the import of high-quality brands, forcing firefighters to use low-quality protective equipment. In addition, weak economic conditions in Iran have forced the organizations not to have enough budget to buy the desired equipment, and all the staff are dissatisfied with the lack of sufficient and up-to-date equipment because they expect to have modern equipment so that they can be safer.

"… We had a case where we brought somebody upstairs from the yard downstairs. Because he did not have the personal protective equipment, he was electrocuted, while we weren't because we had the PPE." (Participant 3). "If you do not change your old clothes or damping equipment, it will certainly affect your safety." (Participant 8). "As a standard you are allowed to use this device for two years, but we sometimes use it for up to six or seven years for some of the reasons we have. Failure to do so, directly, causes problems." (Participant 14).

Social factors

Environment Firefighters are at increased risk of death and injury due to unsafe conditions of residential buildings. Buildings must implement structural and non-structural safety standards. In some areas, there are almost identical modern buildings with wide passages facilitating relief in crisis, and firefighters have a relative understanding of the interior of the buildings. However, the presence of worn-out structures with very narrow alleys and many unfamiliar spaces makes it difficult to execute relief, and firefighters must work hard to carry out their mission. In most of these areas, the fire truck cannot approach the building due to narrow passages and it is forced to settle at a distance from the building. Moreover, poor structure of worn-out buildings causes them to be destroyed earlier in a fire, which puts the lives of firefighters at risk. In areas close to a market, non-standard storage buildings may be used or hazardous materials may be stored in buildings.

"… In a building like Plasco, the builder wanted to save more money in terms of materials used, electrical lines, gas and water utility, and used low-quality materials. This can put a firefighter at risk when operating with the slightest heat or sensitive position." (Participant 13). "Fifty-six percent of our station's coverage areas consist of worn-out urban area. High population density, narrow streets, mid-street beams, mid-street trees, and many other issues affect our safety." (Participant 15).

Society The society-related component can affect firefighters' occupational resilience. Community safety culture plays an important role in the safety of firefighters. When people obey the rules, unreasonable overcrowding can be prevented. Drivers with high safety culture also allow rescue vehicles to pass. In some cases, firefighters need to ask citizens or owners for information about the scene of an accident, and they may, for some reason, mislead firefighters. For example, the owner may have an illegal power outage and does not tell firefighters, and the firefighters may enter the building and get electrocuted due to the power outage. The owner may build illegal warehouses. The owner may have stored illegal and hazardous materials, and try to hide them from firefighters. Therefore, trusting people is important to promote firefighters' safety.

"… One of our concerns is people's view of firefighters. One of the legacies of the Plasco firefighter's incident was that somehow people came to believe in firefighters; before the Plasco incident, when you were going to the scene, you had to sound a siren, you needed to turn on the lights, the way was not opened very much, but now, it is better." (Participant 16). "He says it is a commercial shop and I sell food. They do not tell all the information about the gas capsule or the chemicals behind it. Then we go in to start and something new will happen to our colleagues." (Participant 5).

Family Family can affect the safety performance of individuals; therefore, people supported by the family can function in safer manner. Married people are more cautious than single people, and they always try to take care of their lives. The families which have information about and understanding of the job are better able to understand the firefighters and create the appropriate conditions for them to have psychological, emotional, and counseling support, which will boost their morale and reduce their stress. For example, those who have children are less likely to engage in risky behavior.

People who are divorced or have problems in their relationships are more prone to mental illness, which reduces their performance. Firefighters who have a lively and cheerful family life perform better. After the fatigue caused by the work shift, they can relieve the stress caused by work with enough rest and entertainment with their families and return to work with new spirit and energy.

"… A married person is more careful. Also, the married person with a child has the highest level of attention." (Participant 1). "For example, after the Plasco incident, my wife's morals have changed completely. After the Plasco incident, our families are more supportive of us, but they are stressed. For example, they always think that something is going to happen to us." (Participant 2).

Discussion

Main findings

This study shows that firefighters' resilience is affected by various factors. The most important factors affecting the firefighters' occupational resilience include mental health, physical health, managers' performance, incidents' environment, community, and family-related factors.

The mental health of firefighters can motivate them to perform better in the workplace. Given that most firefighters' lives are spent in the workplace with their co-workers, having the ability to build relationships with co-workers and the people can be effective in ensuring their safety. People with stress, anxiety, and panic disorders do not perform well. The difference in resilience due to the general characteristics was the result of mental health status, and the stress reduction method used for dealing with stress.[28] Considering the psychological burden of this job and high psychological pressures from the people during the rescue, firefighters should be able to control their anger so that they do not suffer from marginal issues. This phenomenon is also seen in other emergency situations that need to be considered for all emergencies like fire safety.[29,30] In many cases, firefighters suffer from wrong decisions and emotional decisions due to failure to withstand these pressures. In line with this study, other studies have shown that mental illnesses can lead to personal loss or injury in firefighters or their coworkers.[31] It is important to periodically check the mental health of the staff and their psychological intervention and counseling, because in most missions, firefighters face disturbing scenes, or they may experience a quasi-accident or an accident that may have a negative psychological impact on them.

One of the most important things in firefighting is to be physically fit. People who are not physically fit cannot perform well in complex missions, and their lives may be at risk.[32] One of the factors that can affect physical fitness is having a disease. Numerous studies have shown that being physically fit can save lives in a crisis.[4,8,13,19] Those who have musculoskeletal disorders or those who have cardiovascular disease and diabetes cannot exercise and therefore do not achieve the desired physical fitness. As a result, they cannot perform well in operational jobs, and they must be assigned to administrative work or reassigned so that their lives are not endangered. Therefore, having a periodic evaluation program for evaluating the employees' level of physical fitness and health to ensure their proper performance should be considered by managers. Unfortunately, it is sometimes observed that this issue is not taken into account, which endangers the lives of firefighters and the public.

Managers' performance can play an important role in protecting the personnel and improving their safety. In line with this study, other studies have found that financial motivation,[33] retraining courses, identifying unsafe buildings, promoting people's awareness, having enough personnel, annual medical evaluations, managers' supervision, mandatory wellness/fitness programs, annual physical ability evaluation, providing full PPE, and building investigation can lead to safety performance and a safe environment for firefighters.[34–36] The organization has to improve individuals' performance by promoting among coworkers. Moreover, station location, number of stations receiving calls, and a convenient work station also affect firefighters' safety. Some stations are located in busy and high-risk areas and their bell is ringing several times a day. Therefore, their personnel have more exposure to incidents and they are consequently more experienced. In addition to spatial analysis, developing tools for better management can be an important managerial factor as indicated in previous studies.[37] This can help firefighters to be more professional and skilled in their jobs, and lead to their appropriate and mature decisions.

Worn outbuildings, lack of structural and non-structural safety, or using buildings for non-defined purposes, such as storage of hazardous materials, or unsafe power lines and the gas lines may endanger the safety of the firefighters. These results confirm some of the causes of Plasco building collapse, including uncertified wiring, lack of safe exit lights, unsafe storage of gas tanks, and weak building supervision and maintenance.[38] Therefore, the inherent safety of the environment in which firefighters operate is important. Observance of building safety and work environment, will improve safety.

The results of this study showed that citizens' behaviors, culture, and safety can affect firefighters' safety. Given that a safer citizen is more concerned with safety behavior and building safety, firefighters will be less exposed to incidents, and they will face safer environments and people. The presence of people in the scene of Plasco incident made several problems. A unified management was necessary to keep away people from the hazardous incidentarea.[38] The citizens' high safety culture increases the safety level, i.e., the safety of the living environment and buildings. It consequently reduces the number of incidents and exposure of firefighters to dangerous conditions thus increasing their safety. It is also important to improve the safety knowledge, behavior, and risk perception as well as risk understanding; since in most areas, there is a gap between knowledge and perception, affecting performance.[39,40] It is then necessary to implement environmental modification, rather than solely focusing on the education. Unfortunately, in some developing countries, such as Iran, there is no investment in prevention. However, by carrying out educational and cultural interventions for the society, it is possible to improve the safety level of the society to reduce the number of accidents, and as a result, increase the firefighters' safety and resilience.

Due to the stressful nature of the firefighting profession, their families should provide support for firefighters. Families' occupational awareness can have a positive impact on their performance. In this way, firefighters will perceive that they are supported by their families which can affect their performance and confidence at work. These results are in line with a study indicating that those firefighters with high levels of family support are less prone to mental health stress caused by their work following tragedies.[41–43] Married firefighters are more cautious than sing ones and those who have a child are much more cautious due to their interest to their wives and children.

Strengths and limitations

This study aimed to identify and determine the components of firefighters' resilience using their experience in Iran. Limited studies have used a qualitative method to investigate factors affecting firefighters' resilience based on experiences of key informants. Most of the participants were experienced firefighters and saturation was reached for all the categories. The interviews

were done in three provinces of Iran with different hazards and different costume and equipment. In this study, some experts did not participate due to being busy or lack of accessibility. However, the researchers tried to achieve data saturation by other experienced firefighters. Given that the nature and regional hazards of the stations and cities were different, the firefighters' experiences and skills were different.

Unsafe behaviors can be due to performance, personality, physical condition, behavior, and psychological characteristics of the individuals themselves, or may be influenced by their managerial and organizational performance, or they can be affected by the environment or community in which firefighters work. According to the findings of this study, the issue which is more striking is that in Iran authorities do not care about preventive actions and regard it as an additional cost.

Senior decision-makers should note that it is not enough for an intervention to only influence the physical fitness and physical condition of individuals. In order to promote firefighters' current level of safety and resiliency, and consequently to have a safe community, preventive interventions must be administrated for firefighters, organizations, the community, and the city environment.

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Ethical statement

This study was part of a Ph.D. thesis in the field of the Health in Disaster and Emergency in the Public Health Faculty of Tehran University of Medical Sciences. Moreover, the study received ethical approval from the Ethics Committee of Tehran University of Medical Sciences (code: IR. TUMS. SPH.REC.1397.240).

Declaration of competing interest

The authors declared that there are no conflicts of interest with respect to the research, authorship, and publication of this article.

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