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Fire safety behavior model for residential buildings: Implications for disaster risk reduction

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ABSTRACT

Starting from the unexplored level of the fire safety of citizens in Serbia, this paper presents the results of quantitative research regarding a fire safety behavior model for residential buildings in Serbia. The research was conducted using a questionnaire that was provided and then collected online for 540 respondents during April 2021. The study's objective was to determine to what degree education level and gender influence the prediction of the fire safety behavior model (individual preparedness, personal security, fire risk, fire prevention knowledge) for residential buildings in Serbia. The multivariate regression analyses showed that the most important predictor of individual preparedness, personal security, and fire risk perception was gender, followed by age. On the other hand, education level, ownership status, and monthly income did not significantly affect individual preparedness for fire protection, personal security, fire risk, and prevention knowledge. Moreover, the results showed the main reasons for not taking preventive actions are the high cost of the equipment, not being familiar with the exact measures to take, believing that the emergency services would provide them with the necessary assistance, a lack of time, etc. The obtained results can be used to improve the preparedness of citizens to respond in a timely and appropriate manner to fires in residential buildings and create programs and campaigns to improve awareness among the general public.

1. Introduction

Fire disasters in residential buildings are most commonly the result of human activities and are classified as events inflicting significant property damage and endangering human health and life. The degree of fire response performance in the case of a building fire is determined by three factors: fire, human, and building characteristics [1]. Worldwide, fires cause more than 300,000 deaths annually; millions of people sustain permanent injuries and about 95% of deaths are recorded in low- and middle-income countries, to which Serbia belongs [2].

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Fire safety relates to fire prevention, minimizing the spread of fire and smoke, extinguishing a fire, and the possibility of a swift and safe evacuation. Aside from that, fire safety regulations reflect how people think about this subject in society at large as well as in politics [3]. In the past, a significant number of fires in residential buildings were due to the non-combustible disposal of smoking material in wastepaper baskets, as well as the flaws in prevention and safety regulations [4–7]. Building fires, especially residential ones, remain a critical concern of society, as 39.7% of all fires occur in residential buildings. Society responds to the threat of fire in buildings in different ways, i.e., fire service intervention, insurance, building regulations, education on fire hazards, controls on the use of materials and products in buildings, and the design of buildings to resist the effects of fire [8].

Numerous fires in buildings highlight the importance of the occupants' behavior for the survival of a fire [3], whereas the presence of firefighting equipment in buildings is one of the major indicators of the preparedness of residents to respond to fire [9]. Even if an attempt to extinguish a fire is not possible or successful, the timely detection of smoke can be life-saving. Fires, particularly those that break out in buildings shared by a large number of people, are characterized by serious shortcomings in terms of firefighting and rescue activities owing to the dramatic increase in fire breakouts and difficulties in managing ventilation and providing evacuation routes [10].

Several different preventive measures can considerably reduce the number of injuries and deaths caused by fires in residential buildings; however, no reliable information on effective measures among different groups of occupants is available. This has resulted in the implementation of general measures among all population groups, which has proved ineffective in the case of certain groups, such as the elderly, the disabled, and children [11]. One of the recommendations [12] suggests the use of a fire protection approach that distinguishes between two primary groups requiring different strategies. Fire protection measures typically combine active and passive fire protection systems. In the former, fire or its effects are controlled either by an individual or by automatically activated devices, whereas passive prevention measures are implemented in the construction phase of a building. The critical component of passive protection is fire resistance which prevents the spread of fire and the collapse of a building [13]. As [14] observes, protection and early warning systems, such as smoke detection systems, automatic fire extinguishing systems (sprinklers), and the use of non-flammable materials in construction, are essential for reducing the consequences of fire.

Unfortunately, the situation in the field of fire protection in Serbia is very unsatisfactory and is characterized by imprecise legislation on fires in residential buildings, a low level of preparedness of fire protection entities and citizens to implement preventive measures, and also a very low level of fire safety culture [15]. In addition, there is socially irresponsible behavior which is reflected in the failure to educate (through seminars, trainings, workshops, campaigns) [16–18] citizens on preventive measures and proper responses in such situations, as well as the failure to organize evacuation exercises and the failure to inspect residential buildings to determine the correctness of built-in fire-fighting installations [19]. Besides that, the fire load density in residential buildings in Serbia has increased by about 110% in the last 30 years [20].

There has been an increase in the number of fires in residential buildings in Serbia, but also in the severity of the consequences, which is reflected in the greater number of dead and injured people annually [15]. Fires in older buildings most often occur due to damaged or faulty installations, but also due to the overloading of electrical installations. In the period from 2004 to 2008, 89 people died in Serbia annually, i.e., 12 inhabitants per one million, or 0.45 per 100 fires, and this classifies Serbia in the group of seven countries with a high risk interval [21,22]. The Law on Fire Protection (Official Gazette of the Republic of Serbia, 87/2018) regulates the system of fire protection, the rights and obligations of state bodies, bodies of the autonomous province and bodies of local self-government, companies, other legal and natural persons, as well as firefighting organizations and services. According to this, housing facilities must be designed, built, used and maintained in a way that provides conditions for the safe evacuation of people. Moreover, during the design and construction of the facility, the basic requirements for fire protection must be provided so that in the event of a fire, the load-bearing capacity of the structure is preserved for a certain period of time, and so that we can prevent the spread of fire and smoke inside the building, the spread of fire to neighboring buildings, and so we can enable the safe and secure evacuation of people—i.e., their rescue (Official Gazette of the Republic of Serbia, 87/2018).

Starting from the unexplored level of the fire safety of citizens in residential buildings in Serbia, the aim of this paper was to establish the level and impact of certain demographic and socioeconomic characteristics on the fire safety behavior model (individual preparedness, personal security, fire risk, knowledge on fire protection) for residential buildings in Serbia. In addition, this study's objective was to determine to what degree education level and gender influence the prediction of the fire safety behavior model. This paper posits the general hypothesis that education and gender predict variables associated with the fire safety behavior model.

This research addresses research gaps in the field of fire safety in Serbia, as follows: (a) the unexplored fire safety of citizens in residential buildings in Serbia; (b) the underdevelopment of theoretical and empirical databases on the behavior of people in fires in residential buildings in Serbia; (c) the inability to design disaster risk reduction campaigns in residential buildings, due to the unavailability of data on fire preparedness and perception; (d) the inability to improve the effectiveness of strategies, tactics and procedures for the protection and rescue of people during fires in residential buildings; and (e) the impossibility of drawing scientific and practical conclusions based on a comparison of the perception of fire safety in Serbia and other developed countries around the world, etc.

1.1. Literature review

Numerous empirical studies have confirmed that the citizens' preparedness for different disasters, such as residential fires, is crucial to reducing negative consequences [23–30]. Nevertheless, a high degree of unpreparedness of both states and citizens for disasters has been evidenced, which imposes the need to put an emphasis on the importance of investigating how people perceive and face dangers instead of focusing solely on physical dangers [31–34]. Studies on the preparedness of people to respond to fires highlight various fire mitigation programs aimed at raising public awareness and working to minimize the chances of both personal and community harm. In

this regard, installing fire-resistant roofing, providing defensible space around the home, and reducing fuel loads within the community are residents' efforts to confront potential fire risks [35]. By studying three different community preparedness programs [36], identified the three primary reasons for participating in them: fire experience, agency engagement, and personal and family protection. In addition [37], found that socially vulnerable communities are less engaged in federal fire mitigation efforts than other less vulnerable communities. It can be said that individual preparedness for residential fires refers to the set of knowledge, skills, trained behavior, and appropriate emergency response equipment when an emergency service arrives [38]. Despite the awareness of individuals and households of different risks [39], the readiness to acquire preparedness measures to respond to dangers remains low, even in high-risk regions [40].

1.2. Building's fire safety and evacuation

The vital aspect of a building's safety is the availability of a safe escape. An essential precondition is that fire safety plans and equipment in the building ensure the building's occupants' independent and adequate fire response actions [3]. The higher the level of the perceived risk, the faster the occupants' evacuation response [41]. One other occurrence implies that occupants exhibit passive behavior with the low threshold of the perceived risk, pretending that the situation does not pose a threat [42]. This concludes that the perceived risk is strongly correlated with the response time and taking action. Once the decision on evacuation has been made, the time of escape is determined by the occupants' selection of the exit route and the evacuation speed. The evacuation speed relies not only on the degree of mobility but also on the perceived risk level [43].

Building fire safety includes providing fire extinguishing equipment, such as fire extinguishers, smoke detectors, fire alarms, sprinklers, and the knowledge of occupants on fire service contact numbers and their technical know-how to operate the equipment and activate the alarm system. Generally, the safety indicator in a building is the existence of fire exits that are easily accessible for evacuation in the event of fire [44]. The literature reports that occupants felt smoke or heard an alarm in the early moments of the fire but reacted with a delay. At the very beginning, the person does not assess that they are in danger, ignores the situation, or seeks an explanation for that phenomenon [45]. The total fire protection concept in buildings can be achieved by improving the passive construction of fire protection buildings, implementing active fire protection systems, and managing fire safety [46]. Fire protection legislation should be implemented, whereas building occupants should undergo regular training on fire safety, fire disaster first aid, and evacuation procedure [44].

Moreover, studies conducted by Ref. [47] show that it should not be expected that only activating the alarm will alert all occupants, encourage them to take urgent action, initiate an evacuation and provide enough time to escape the facility safely. Additions such as voice messages, staff instructions, completed training, and a well-designed and implemented fire protection plan significantly increase the likelihood of a proper and timely response to an emergency [47]. Hahm and associates [48] found that people already familiar with fire risk situations (either as victims or firefighters) have a relatively straightforward perception of potential fire risks [49]. found that recognizing fire threats and the effectiveness of fire protection measures did not imply the installation of safety devices in practice.

The use of a fire protection system aims to maintain the temperature in the building below a critical level during the fire to ensure that electrical installations and the construction itself are not endangered, while on the other, the system aims to prevent fire from spreading from the sector where it broke out [50]. Fireproof materials are highly recommended to be used on the roof, exterior walls, and areas such as decks, porches, and patios [51]. In Germany, 'Smoke Detector Day' was established to raise people's awareness of the importance of smoke detectors aimed at warning them of fires and pointing out the benefits of early fire detection for reducing property damage [9]. In the USA, the frequency and severity of fires have instigated agencies to encourage residents in at-risk communities to protect their homes, property, and communities by adopting Firewise recommendations [52].

1.3. Gender and age

A large corpus of research deals with how the different genders perceive fire threats and defines the difference in risk perception between men and women [53–55]. A consensus exists among analysts that women show greater concern about disaster risks. Some of the possible accounts that support this view are related to the social role of a female both in daily activities and society in general (e.g., the role of a caregiver who deals with general health and safety and environmental issues is usually attributed to women) [56]. Often, women have fewer household resources and often feel more vulnerable to their possible loss. The reduced ability to respond adequately to disasters [57] and their physical vulnerability increases sensitivity and concern [58]. On the other hand, male disaster victims considered disasters less life-threatening and less likely to cause greater financial losses. Therefore, the feeling of fear was significantly lower than in female fire victims [58]. In their study of the differences in peoples' response to fire between genders, Bryan et al. [59] reported that men were more focused on firefighting activities, whereas the immediate reaction of women was to evacuate and call the fire service. The first reaction of men was to find the source of fire, whereas women were focused on the evacuation of family members [60]. found that females are more concerned about the threat of fire to life.

The elderly are most at risk due to poor mobility, rapid fatigue, confusion, and impaired vision or hearing. In addition, older people often refuse to evacuate [61]. The research into the non-fatal fire injuries suggest that young people (aged 20–34) are at greatest risk, accounting for 25% of injuries, a relative risk being 1.2 times higher than the general public [62–65]. The elderly over the age of 65 [66, 67], as well as children under the age of five [68,69], were identified as categories at increased risk. A study of the influence of different sociodemographic factors such as age, education level, gender, or earlier experiences with fire and fire risk perception revealed a significant correlation between age group and education level, on the one hand, and fire risk perception and knowledge of the phenomenon, on the other [70].

1.4. Household ownership and disability

The investigation carried out by Ref. [60] confirmed a strong correlation between household ownership in terms of the perceived threat of fire. The study revealed that the seriousness of understanding the threat grows with the ownership of a household. In that vein, the household owners perceive fire threats more seriously than renters who, accordingly, may not be interested in any investment for fire prevention. This may consequently imply that rented apartments or houses are more vulnerable to fires. Additionally [71], found that citizens living in their own real estate are more ready to react to disasters than those who are in rented dwellings. The results of one of the surveys conducted by Ref. [72] imply that the respondents believe that people with impaired hearing, and mentally disabled persons, are most likely to fail during the evacuation from an endangered facility, as they are mostly unaware of the danger.

1.5. Knowledge and training

Disaster education, which involves education on disaster risks, mitigation, and preparedness strategies, aimed to reduce adverse impacts of disasters, has become increasingly important [73,74–76]. The analysis performed by Ref. [70] demonstrated that the knowledge of using a fire blanket, calling the correct emergency phone number, unplugging unused electrical appliances, and not using water to extinguish electrical fires improved immediately after the intervention [70]. The latest fire prevention and extinguishing devices can be installed in the building. However, suppose occupants ignore the warning signals, have no technical knowledge on how to operate these devices, and are unfamiliar with the desirable behavior model, exposing them to even greater danger. In that case, even the latest technology will not be helpful or valuable in fire situations [77]. Results of some studies suggest that people never forget what they had learned at an early age, which highlights the necessity that disaster prevention and risk reduction methods are acquired in childhood [76,78–81]. Some studies showed a significantly lower use of preventative measures or practices amongst individuals with a lower educational level [82,83].

The three critical aspects of fire protection management are as follows: the education and training of occupants in high-rise apartment buildings; the implementation of protection and rescue and evacuation programs; and providing clear signalization pointing to fire exits and the firefighting equipment locations [84]. One study [77] focused on the effectiveness of fire response training and occupants' response, suggesting the decisive role of fire protection training as it provides knowledge of how different types of fires occur and the skills needed to fight and extinguish them [49]. found that the majority of the respondents did not undergo any firefighting training. In the survey [85], more than half of the respondents were not trained to handle firefighting tools and equipment and most of the respondents indicated that the inadequate response in case of danger was due to the lack of training and poor orientation in the building. Citizens should obtain instruction on the use of fire extinguishers, according to Refs. [86,87]; to increase their safety and preparedness for fire.

1.6. Previous experience

Hodsoll and associates [49] found that having previous experience with house fires did not necessarily increase respondents' awareness in taking precautionary measures. In their study [88], emphasize that personal experience with fire and trust had a major influence on risk perception, whereas cultural and individual factors such as media coverage, age, gender, education level, income, etc., were not major factors but served only as mediators of the main causal links between experience, trust, perception and willingness to take protective actions. A study showed that humans cannot predict the rate of fire spread and tend to overestimate the time available [89]. Additionally, the onset of mental confusion among people, the phenomenon known as "disaster personality", needs to be overcome by 'experiencing the disaster situation in advance' [90]. According to Ref. [91]; a past fire in a residence was predictive of the presence of a fire extinguisher but not of other fire protection measures. In some research, there is a positive association between prior experience and a greater rate of prevention measures being taken [92]; however, in others, there is no statistically significant relationship [93].

1.7. Risk perception

At a national level, the differences in risk perception and the very meaning of risk are partly based on exposure to certain risks due to specific technological, social, geographical, and climate conditions [48]. Ethnic minorities have been found to perceive higher risks [48]. Additionally, as the level of fire risk significantly correlates with population density and mass, vulnerable populations can demonstrate a considerable increase in fire risk perception [94]. In addition to nation-specific characteristics of people and the differences among individuals, the attributes of the potential hazard itself are essential for explaining the perceived fire risk [48]. [95] emphasize social knowledge on facts and events shared in a group, e.g., dealing with the risk, and knowledge about dangerous aspects, as an integral part of different social representations, which is essential for members of a society when assessing and managing emergencies. As reported in the study, the sound of the fire alarm and the detection of fire smoke increased the perception of risk and prompted the occupants to evacuate accordingly. Understanding the correlation between the perceived risk and the evacuation outcomes may allow facility managers to pass on additional information that may affect the risk perceived by an individual during the different stages of fire evacuation and thus improve evacuation efficiency [72].

1.8. Socio-economic status and income level

Areas with more significant socio-economic disadvantage (older houses, lower income, lower employment rates, prevalence of vacant dwellings) are at a higher risk of fire [96–99]. Despite the high-risk exposure, people of low socio-economic origin are the least prepared and informed about disasters. In addition, the lack of housing affordability and low literacy are typical of this group of people [100]. People of low social status live mostly in informal settlements (known as slums, districts, ghettos) where fires often occur

[101–104]. The extent to which such settlements are endangered was shown in a study [103] conducted in South Africa, where it was reported that in 33 min, 42 dwellings were affected by fire, while in one other fire, a total of 2194 informal apartments were destroyed and over 9700 people displaced [101]. Socio-economic status affects the way individuals interpret dangerous events [105], as well as their potential adaptive capacities and preparedness for disasters [106], and the way they deal with risks accordingly [95]. In addition to the established correlation between socio-economic status and premature deaths [107], we cannot overlook numerous fires that seriously affect the individuals experiencing them. Although they do not end in fatalities, they may induce lifelong suffering in terms of physical and mental health, along with the loss of property. Furthermore, owing to low socio-economic status, higher risk perception was observed in females [48]. Additionally, larger households are more likely to experience fires than smaller ones [98].

2. Methods

This study, which involves quantitative research, examined the fire safety behavior model in residential buildings in Serbia (Fig. 1). The purpose of this study was to determine the degree and influence of specific demographic and socioeconomic factors on the fire safety behavior model in Serbian residential buildings. The research was conducted using a questionnaire that was administered online to 540 people in April 2021 by using the snowball sampling method. The central hypothesis focuses on the extent to which education and gender may predict the fire safety behavior model (individual preparedness, personal security, fire risk, fire prevention knowledge) in residential buildings in Serbia.

2.1. Study area

The Republic of Serbia, which spans an area of 88,499 km², is situated at the crossroads of central and south-eastern Europe in the Southern Pannonian Plain and the central Balkans. It is bordered on the north by Hungary, the northeast by Romania, the southeast by Bulgaria, the south by North Macedonia, the southwest by Montenegro, and the west by Croatia and Bosnia and Herzegovina [108] (Fig. 2). In Serbia, there is an increasing trend in the number of fires, as well as the number of dead and injured people (Table 1). Based on the official data obtained from the Emergency Situations Department of Serbia, the number of fires in 2017 increased by 50% compared to the same period in the previous year. Also, according to the Records of the Directorate for Fire-Rescue Units of the Sector for Emergency Situations, in the period from 2012 to 2022, there were 38,279 residential fires in Serbia in which 665 people died, 1747 were injured and 2134 were rescued. Compared to the years in the mentioned period, the situation was as follows (number of fires/deaths): 2012 (946/7), 2013 (836/6), 2014 (887/8), 2015 (827/5), 2016 872/10), 2017 (899/18), 2018 (842/14), 2019 (796/10), 2020 (842/23), 2021 (828/21). According to the National Strategy for Protection and Rescue ("Official Gazette of RS", No. 86/2011 of November 18, 2011), during 2003–2011, about 134,686 fires were recorded in Serbia. In 2020, 51 people died in fires that broke out in housing units throughout Serbia. Based on the Ministry of Interior data, fire and rescue services had above 4000 interventions, of which more than 3000 were fires.

The largest number of residential buildings in Serbia was built in the capital of Belgrade. For that reason, it is important to point out that in 2016, about 3643 fires were recorded in Belgrade, whereas in 2018, the number increased to 5142 [109]. In 1980, 888 fires were recorded, whereas in 1990, the number of fires tripled (2434). In 2000, there were 3858 fires in Belgrade. There was no increase over 2000–2015, during which the number of fires ranged between 3000 and 4000 annually. In 2016 and 2017, 3643 and 5412 fires were reported in the city of Belgrade, respectively (resource: <https://zis.beograd.gov.rs/index.php> accessed on September 17, 2021).

The Ministry of the Interior, within its scope, performs activities necessary for the implementation of fire protection. The ministry performs activities related to planning, organizing and implementing fire protection measures; preventive measures to prevent fire outbreaks and mitigate the consequences of fires; supervision over the application of the provisions of this law and the regulations adopted on the basis thereof; fire protection plans and other acts related to fire protection; the professional training of the members of fire and rescue units; education and training of persons for performing fire protection activities; the development of the strategy; the cooperation with other subjects of fire protection; and other activities in the field of fire protection determined by law (Article 17,

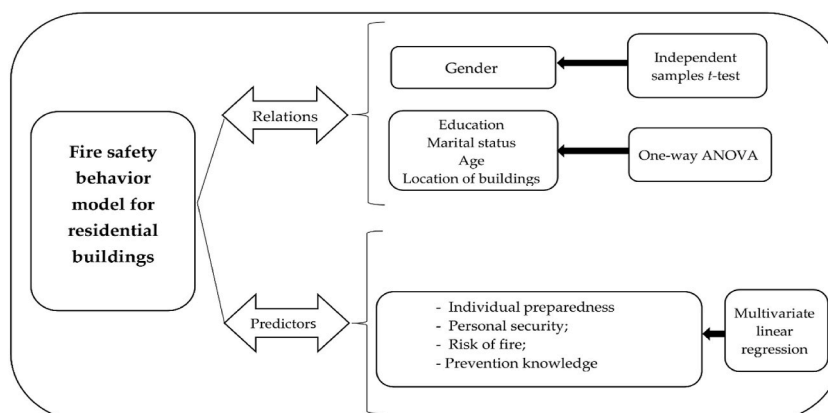


Fig. 1. Research design.



Fig. 2. Study area. Location of Serbia (a); counties of Serbia (b). Source: [108].

Table 1

Review of the number of fires and consequences for the period from 2010 to 2012. Source: Records of the Directorate for Fire-Rescue Units of the Sector for Emergency Situations [21].

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Number of fires and explosions	11,762	14,892	19,313	15,097	14,702	17,886	28,581	24,493	21,613	17,308	31,936	35,757
Number of dead in fires and explosions	68	84	94	89	94	89	86	93	86	81	85	95
Number of injured in fires and explosions	184	165	199	223	236	257	316	307	232	277	370	421

“Official Gazette of RS”, No. 111/2009, 20/2015, 87/2018 and 87/2018—other laws).

2.2. Socio-economic and demographic characteristics

A total of 690 people (85.50%) were offered to participate in the study (590 agreed and 100 refused to participate). Out of the total number of respondents who agreed to participate in the survey, 540 respondents completed the survey questionnaire, whereas the remaining 50 respondents failed to fill it in (the completion rate was 91.52%). With 30 years of age as an average, the sample included 44.4% of males and 55.5% of females (entire nation's population is 51.3% and 48.7% female and male, respectively—resource: Statistical Office of the Republic of Serbia, 2020). The age of the respondents was as follows: 42.41% (aged 18–30), 30.31% (aged 31–45), 18.15% (aged 46–64), and 8.33% (over the age of 65). Some 33.36% of the respondents were married, whereas 39.3% of respondents were single. The majority of the respondents (55.2%) were employed, 50.56% had secondary education, 79.3% had no children, 76.7% were not household owners, 50.37% lived in a house, 81.1% lived on the outskirts, and 58.1% rated their health as excellent (Table 2).

2.3. Questionnaire design

Several published survey approaches [40,41,43,45,77,110,111] were examined and modified to the demographic and socio-economic realities of Serbia (Appendix A). An evaluation of the understandability and efficacy of the questionnaire was carried out in March 2021 in Belgrade, Central Serbia, involving 35 participants. In order to develop the structured questionnaire, questions of a

Table 2

Basic socio-economic and demographic information of respondents (n = 540).

Variable	Category	(f)	%
Gender	Male	240	44.44
	Female	300	55.56
Age	18–30	229	42.41
	31–45	168	31.11
	46–64	98	18.15
	65+	45	8.33
Marital status	Single	212	39.3
	In connection	36	6.7
	Married	180	33.36
	Divorced or widow	108	20
Education	Secondary Sch. (grade 8–9)	273	50.56
	High school (grade 11–12)	110	20.37
	Undergraduate	112	20.74
	Master/doctorate	45	8.33
Employment status	Yes	298	55.2
	No	242	44.8
Number of children	Yes	112	20.7
	No	428	79.3
Owner of a residential building	Yes	126	23.3
	No	414	76.7
Type of property	Flat	268	49.63
	House	272	50.37
Location of the residential building	Centar	102	18.9
	Periphery	438	81.1
Assessment of health status	Very good	220	40.7
	Good	314	58.1
	Bad	4	0.7
	Very bad	2	0.4
Regulated military service	Yes	80	14.8
	No	460	85.2
Income ^a	Low income ($\geq 50,000$ RSD)	315	58.33
	High income ($\leq 50,000$ RSD)	225	41.67
TOTAL		540	100

^a Considered below and above the national monthly average net salary. Retrieved from: <http://publikacije.stat.gov.rs/G2018/PdfE/G20181260.pdf>, accessed on September 2021.

closed and five-point scale were utilized (1 = very strongly disagree with 5 = strongly agree). As an initial offer to participate, an online questionnaire was posted on social media (social networking sites such as Facebook, Twitter, and LinkedIn, etc.) and an online survey platform (google.doc) because of the extraordinary circumstances of the COVID-19 pandemic such as the restriction of movement and the need for social distance. The sample was convenient but not necessarily representative of the Serbian population.

The first section of the questionnaire included a research question about the participants' socioeconomic and demographic characteristics, whereas the second one encompassed issue questions about (a) individual preparedness; (b) personal security; (c) fire risk; and (d) fire prevention knowledge. Our quantitative analysis was consistent with the Helsinki Declaration [112], which established guidelines for socio-medical research involving human participants. Participants provided their informed consent to participate in the study. The research protocol was approved by the committees of the Institutional Review Board of the Scientific–Professional Society for Disaster Risk Management and the International Institute for Disaster Research (protocol code 001/2022, January 18, 2022).

2.4. Analyses

Descriptive statistics for the main socioeconomic and demographic features of the participants were calculated in this research. In order to study the correlation between predictors and the fire safety behavior model for residential buildings in Serbia, *t*-tests [113], one-way ANOVA [114], Pearson's correlation and multivariate linear regression were used [115,116]. Given that the initial homogeneity test for variance indicated a breach in the assumption of homogenous variance, the results of the two tests—Welsh and Brown–Forsythe—that are resistive to the breach of the assumption were used. The preliminary analysis showed that the same test was used. Each test was two-tailed, with a significance of $p < 0.05$. For statistical analysis, SPSS statistics were utilized (IBM SPSS Statistics, Version 26, New York, NY, USA). The reliability of the overall questionnaire in terms of Cronbach's alpha coefficient is 0.813. The internal consistency of Likert scales for the individual preparedness subscale (six items) is good, with a Cronbach's alpha of 0.80. A multivariate regression analysis was used, identifying the extent to which the total scores of the main dependent variables (individual preparedness, personal security, fire risk, prevention knowledge) were associated with eight demographic and socio-economic variables: gender, age, education level, marital status, children, owner, employment, and monthly income (Table 2). We tested the central hypothesis of how education and gender are the predicting variables in the fire safety behavior model for residential buildings. Earlier studies in the residual diagram [116] suggested that normality, linearity, multicollinearity nature ($r = 0.79$), and variance homogeneity assumptions (NPSP and scatterplot) were not disproved. The Scientific–Professional Society for Disaster Risk Management and

the International Institute for Disaster Research, ID-2009202, have accepted this research protocol.

3. Results

Based on the methodological framework and study design above, the results were divided into three groups:

- 3.1 The predictors of the fire safety behavior model for residential buildings;
- 3.2. The results of descriptive statistics and the correlations between the variables and the fire safety behavior model for residential buildings;
- 3.3. The gender perspective of the fire safety behavior model for residential buildings.

3.1. The predictors of the fire safety behavior model for residential buildings

The multivariate regression analyses showed that education level, ownership, and monthly income did not significantly affect individual preparedness, personal security, fire risk, and fire prevention knowledge. On the other hand, the major predictor of individual preparedness is gender ($\beta = 0.359$), explaining 11.15% variance in the score, followed by having children ($\beta = -0.123$, 0.8%), age ($\beta = -0.108$, 0.7%), and employment ($\beta = 0.104$, 0.8%). This individual preparedness model ($R^2 = 0.18$, Adj. $R^2 = 0.17$, $F = 14.58$, $t = 17.47$, $p = 0.000$) with all the mentioned independent variables explains the 17% variance in individual preparedness for fires in residential buildings (Table 3 and Fig. 3).

The multivariate regression analyses revealed that the critical predictor of personal security is gender ($\beta = 0.202$), which explains the 3.53% variance in the score, followed by age ($\beta = 0.180$, 1.90%) and marital status ($\beta = -0.136$, 1.44%). This personal security model ($R^2 = 0.094$, Adj. $R^2 = 0.080$, $F = 6.63$, $t = 16.29$, $p = 0.000$) with all the mentioned independent variables explains the 8% variance in personal security regarding fires in residential buildings. In addition, we found that the most important predictor of fire risk perception is having children ($\beta = 0.279$), explaining 4.20% variance in the score, followed by gender ($\beta = 0.193$, 3.24%), explaining 3.24% variance in the score, followed by having children ($\beta = -0.123$, 0.8%), marital status ($\beta = 0.132$, 1.36%), and employment ($\beta = -0.111$, 0.9%) (Table 3 and Fig. 3).

The fire risk perception model ($R^2 = 0.088$, Adj. $R^2 = 0.074$, $F = 6.13$, $t = 8.64$, $p = 0.000$) with all the mentioned independent variables explains the 7% variance in personal security regarding fires in residential buildings. The most important predictor of prevention knowledge is gender ($\beta = 0.237$), which explains 4.88% variance in the score, followed by employment ($\beta = -0.135$, 1.32%). This fire prevention knowledge model ($R^2 = 0.115$, Adj. $R^2 = 0.101$, $F = 8.26$, $t = 22.18$, $p = 0.000$) with all the mentioned independent variables explains the 10% variance of fire prevention knowledge (Table 3 and Fig. 3).

3.2. Results of descriptive statistics and the correlations between the variables and the fire safety behavior model for residential buildings

The examination of the level of preparedness for residential fires found that the majority of respondents believe that they are not prepared to respond to the residential threat of fire and that their local community is not prepared for fire threat situations. On the other hand, a narrow majority of respondents believe that the state is prepared to respond in fire threat situations. Aside from that, it was found that slightly less than half of the respondents believe that the competent authority such as the Sector for Emergency Situations is prepared to respond to the threat of fire (Fig. 4).

Further results showed that the majority of respondents believed that there was no likelihood of a fire caused by a thrown cigarette butt. On the other hand, the majority of respondents believed that there was a likelihood of fire caused by an explosion of faulty devices, rather than because of an unquenched heat body (Fig. 5).

When asked if it is safer to wait during fire until they are sure that the fire reaches their dwelling or evacuate immediately, the majority of respondents said that it is safer to evacuate immediately, whereas the minority think that it is safer to wait until they are sure that the fire reaches their place of dwelling. Based on experiences that demonstrate that a large number of people are to blame for endangering their own lives during a fire in the attempt to protect property from being destroyed, the respondents were asked whether

Table 3

Results of a multivariate regression analysis concerning subscales (individual preparedness, personal security, fire risk, knowledge of prevention) for the fire safety behavior model ($n = 540$).

Predictor Variable	Individual Preparedness			Personal Security			Fire Risk Perception			Fire Prevention Knowledge		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Gender	0.713	0.085	0.359 **	0.394	0.089	0.202 **	0.379	0.089	0.193 **	0.425	0.080	0.237 **
Age	-0.252	0.122	-0.108 *	0.415	0.126	0.180 *	0.202	0.128	0.087	-0.327	0.115	-0.155 *
Education level	0.030	0.083	0.015	0.174	0.086	0.091	0.027	0.087	0.014	-0.156	0.078	-0.089
Marital status	-0.140	0.089	-0.071	-0.263	0.092	-0.136 *	0.257	0.093	0.132 *	-0.104	0.084	-0.059
Children	-0.291	0.128	-0.123 *	0.048	0.133	0.021	0.651	0.135	0.279 **	0.116	0.121	0.054
Owner	0.092	0.104	0.040	0.019	0.108	0.008	-0.028	0.109	-0.012	0.016	0.098	0.008
Employment	0.200	0.090	0.104 *	0.126	0.094	0.066	-0.212	0.095	-0.111 *	-0.234	0.085	-0.135 *
Monthly income	0.069	0.174	0.016	0.233	0.181	0.056	0.166	0.182	0.040	0.717	0.164	0.188
Adjusted R^2	0.17			0.94			0.07			0.10		

* $p \leq 0.05$; ** $p \leq 0.01$; B: unstandardized (B) coefficients; SE: std. Error; β : standardized (β) coefficients. Note: males, young (<30), single-headed households, secondary school respondents, one child, low income ($\leq 50,000$ RSD) and owners have been coded as 0; 1 has been assigned otherwise.

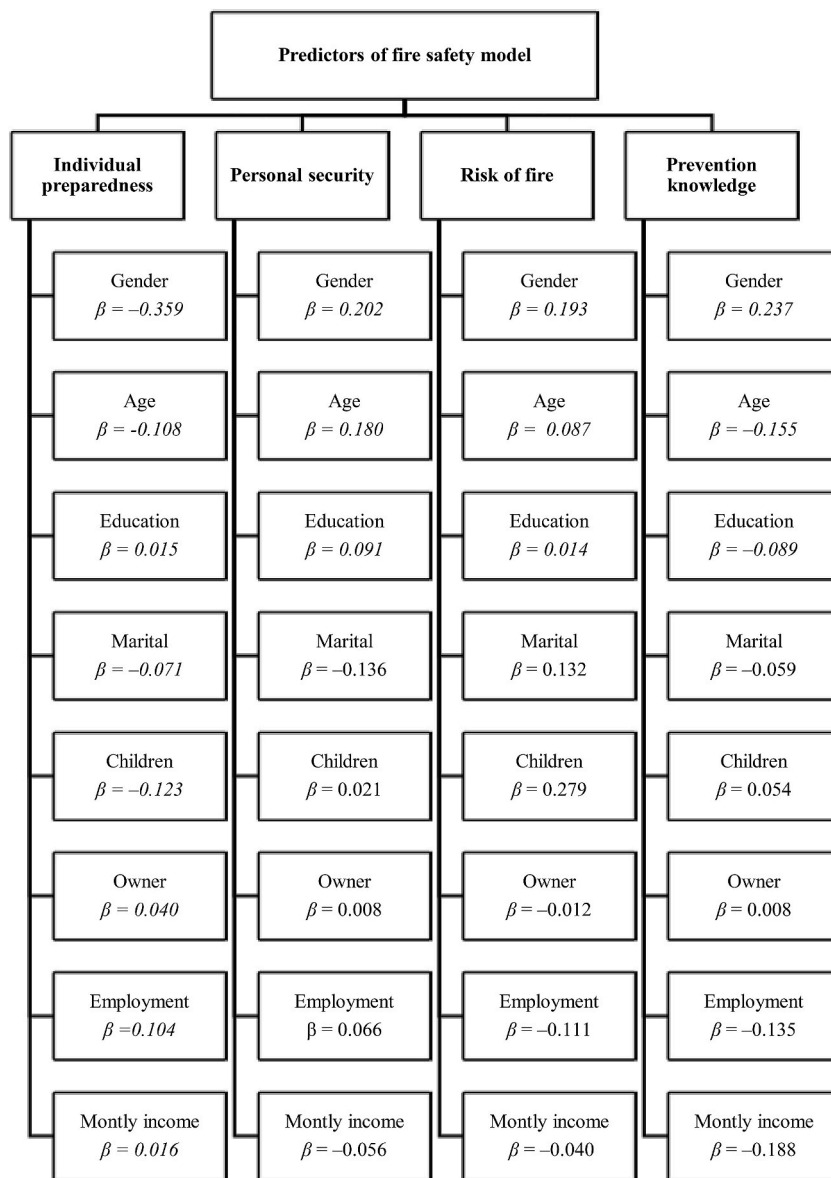


Fig. 3. The predictors of the fire safety model.

they would remain in their homes in order to protect their property despite assessing that fire risk is high; the majority answered in the negative, whereas a minority stated that they would remain in their homes to protect their property despite their assessment that the fire threat is high. Furthermore, the majority of respondents would not wait for the fire and rescue services to instruct them on what to do and that people in fire-induced disasters rely on fire and rescue services to defend their property (Table 4).

Aside from that, it was found that the majority of respondents feel insecure about possible fire-threatening situations; said that fire is unlikely to happen in their household; believe that there is no risk of death or injuries due to fire; use non-flammable building materials such as tiles, slate, stone, etc.; did not know how to turn off any of the switches/valves; have a fear of fire; and would evacuate with their families down the stairs to protect their family if a fire broke out on their floor. On the other side, a minority of respondents have a fear of fire; believe that they are well informed about fire threats; believe that a fire is unlikely to destroy or damage their property; have fire response plans; volunteered in the community to help clean and remove flammable materials (e.g., brush, litter) or have organized fire education programs in the community; knew how to turn off electricity switches, water and gas valves; would not leave the apartment, thereby ensuring that all the doors and windows are closed, then, would jump out the window, hide in the bathroom and pour water; and two respondents would evacuate using the elevator (Table 4).

As for planning to improve the fire safety measures for possible fire threats, the majority considered providing a fire extinguisher, then a smoke detector, a fire cover, a first aid kit, and supplies. However, the most significant number of respondents did not consider

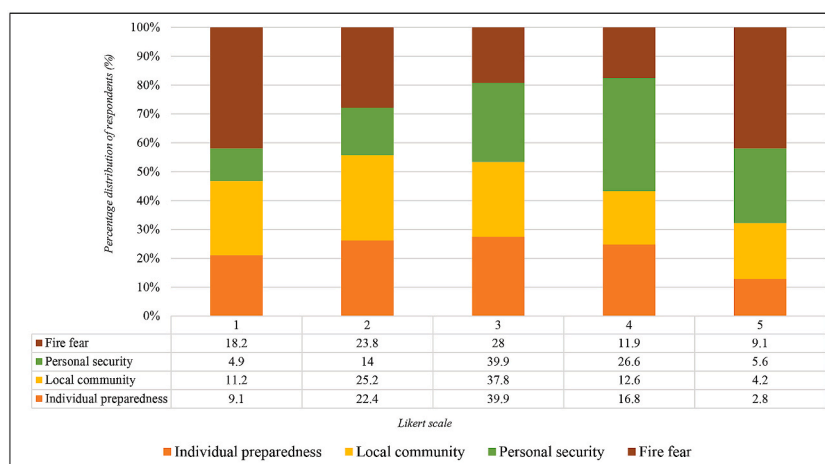


Fig. 4. Public opinion of fire safety.

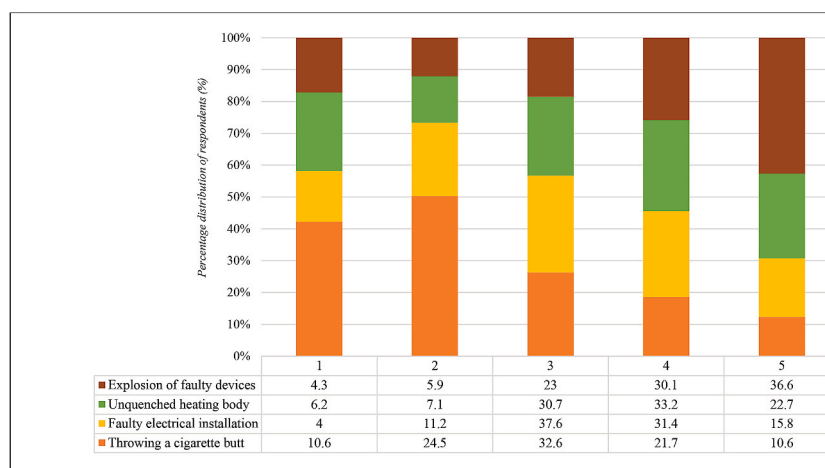


Fig. 5. Respondents' attitudes to possible causes of fire.

providing fire safety measures for their households. The majority of respondents do not share information on various aspects of fire risk with their acquaintances. As for the completed training in giving emergency first aid, the majority of respondents were trained, and said they behave sensibly during a fire, whereas the minority assess themselves as panic-stricken in fire disasters. Regarding the issue of safe response to fire in residential buildings, the results indicate that most of the respondents know how to respond safely, although others cannot predict their response (Table 4).

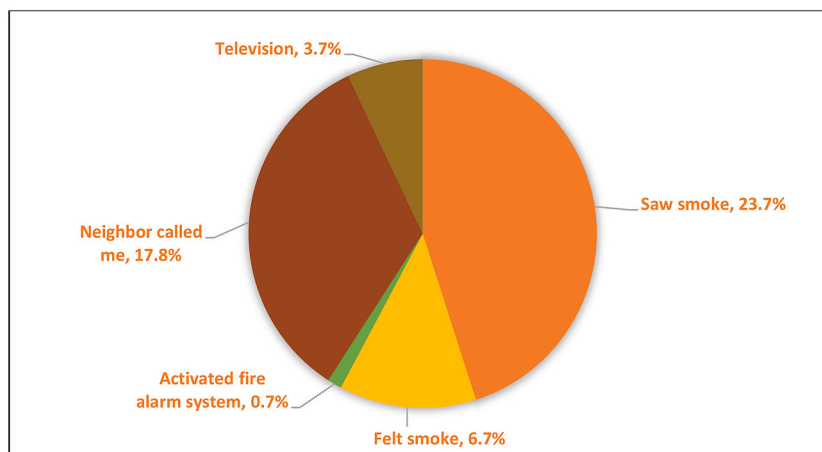
To assess the knowledge and perception of the respondents about the main cause of death during a fire, they were asked whether burns are the main cause of death during a fire. The majority of respondents responded negatively, whereas one-third of respondents shared the opinion that burns are the leading cause of fatalities in a fire. Asked to evaluate the usefulness of preventive measures and knowledge about fires in residential buildings, most respondents consider preventive measures and knowledge as extremely useful. In addition, most respondents said they were acquainted with the facility/dwelling place and evacuation routes and were familiar with the location of the fire hydrant in the facility (Table 4). In order to assess the knowledge of the respondents about the method of extinguishing fires of different categories, they were asked how to extinguish fire caused by the combustion of books and paper in general. A slight majority of respondents (50.3%) answered that they would extinguish it with water, and the minority would use carbon dioxide (4.2%). Asked about how they would extinguish an electrical fire, the majority of respondents (30.1%) would choose dry powder, whereas the minority of respondents would use water (3.5%).

Given the subject of the study, the respondents were asked if they or any of their acquaintances had experienced a fire threat. Some 10.5% of respondents confirmed the experience with fire threats at home, 11.2% responded that they had a fire experience, but not at home, whereas 9.8% experienced the fire indirectly, as a witness, bystander, or a first person to respond to a fire threat. Respondents who gave a positive answer to the previous question were asked how they found out about the fire. Bearing in mind the way of finding out about the fire, the majority of respondents saw smoke, whereas the lowest number of respondents stated the activation of the fire alarm system. Furthermore, half of the respondents said that they had no experience with fire threats (Fig. 6).

Table 4

Results of descriptive statistics regarding individual preparedness, personal security, risk perception and knowledge about fire safety.

Variables	Percentage
Health consequences due to the fire experience	49.6
Support or assistance during a fire evacuation	32.6
Burn is the main cause of death during a fire	33
It is safer to wait during fire until I am sure	15.6
I will start evacuation and will not wait	84.4
Stay to defend your property	13.3
Rely on fire and emergency services to defend their property	71.1
People should wait until a firefighter instructs them	49.6
Plan for threatening events	13.3
Familiar with place of dwelling and evacuation routes in fire disaster	44.4
Familiar with the location of the fire hydrant	48.9
Installed extinguishing system in the household	23.7
Discuss fire protection with family members	30.4
Share information on various aspects of fire risk with acquaintances	40
Trained to give emergency first aid	67.4
I behave rationally during a fire	83.7
I am panic-stricken during a fire	16.3
Volunteered or organized community fire education programs	18
Clean roof surfaces/gutters and surrounding vegetation	40.7
Use non-combustible building materials	60.7
I know how to turn off the gas valve	1.5
I know how to turn off the electricity switch	13.3
I know how to turn off the water valve	10.4
Use fire extinguishers as fire protection measures	21.5
Use fire cover as a fire protection measure	0.7
Use a smoke detector as a fire protection measure	1.5
I have a first aid kit	32.6
I have not considered the fire protection measures	43.7
Fear of fire	50.4
Know how to use a hydrant	20
Know how to use a dry powder fire extinguisher	40.7
Know how to use a carbon dioxide-based fire extinguisher	25.2
Carbon monoxide is a poisonous gas	88.1
Fire is the greatest danger to health	14.8
Demolition of a building due to fire is the greatest danger to health	3.0
Negative combustion products are the greatest danger to health	78.5
Know the telephone number of the firefighters	88.1
Fire response training undergone	37
Motivated for a fire response training	83
I would not leave the apartment and close all the windows	12.6
I would start the evacuation with my family using the stairs	69.6
I would evacuate by elevator	0.7
I would hide in the bathroom and pour water on myself	1.5
I would jump out the window	3.7

**Fig. 6.** Method of finding out about the fire.

With the question about whether respondents had undergone training to use firefighting equipment, we found that most of the respondents knew how to use a dry powder fire extinguisher. On the other side, the minority of respondents knew how to use the hydrant network. Moreover, it was found that the majority of respondents know that carbon monoxide is a poisonous gas and believe that products of fire combustion or smoke pose the greatest danger in fires, whereas only the minority consider high temperatures to be the most dangerous. The majority of respondents know the procedure of calling fire and rescue services, have undergone some fire-fighting training, and are willing to take fire training (Table 4). Asked about the available household fire safety measures, the majority of respondents have a fire hydrant in residential buildings and know evacuation routes. The lowest number of respondents have a plan for reacting to situations caused by fires, etc. (Fig. 7).

The majority of respondents said that they had a close relationship with a neighbor, a relative, or a friend who lives in the same town or place which could give them emotional comfort in case of fire or after a disaster caused by a fire. Additionally, 25.3% of respondents stated that a neighbor, a relative, or a friend live in the same town or place, whom they can turn to for advice if they have any difficulties in solving fire-induced problems, whereas 24.5% believed that they could protect themselves or deal with any issue that a fire might cause.

Further analysis showed that the majority of respondents ($X = 2.29$) believe that fire is likely to occur in the next ten years, whereas the lowest number of respondents believe that the fire would occur in the next year ($X = 1.92$) (Fig. 8).

Table 5 below shows the results obtained from the respondents on their motivation to install or provide fire safety equipment for their homes and the main reasons for not taking preventative actions. Results showed that most respondents reported the following reasons for not taking preventative actions: emergency services would provide me assistance and the high cost of the equipment. On the other hand, a minority of respondents believed that taking these measures would not make a significant difference. On the other hand, most respondents are motivated to install some fire safety equipment because of personal safety and the high risk of fire.

In relation to the reliability of the source of information through which citizens are informed about residential fires, the following sources were identified: at the faculty ($M = 3.37$); the internet ($M = 3.27$); books ($M = 3.23$); family ($M = 2.38$); school ($M = 2.36$); television ($M = 2.32$); and radio ($M = 2.02$) (Fig. 9).

One-way ANOVA results showed the correlation between education and the following variables: local community preparedness to fire response ($p = 0.005$); the perception of safety ($p = 0.034$); fire risk ($p = 0.000$); the occurrence of death ($p = 0.000$); family ($p = 0.029$); television ($p = 0.000$); radio ($p = 0.001$); and the Internet ($p = 0.001$). No statistically significant correlation was found with other variables (Table 6).

Further analyses showed that respondents with a secondary school degree gave the highest scores for fire risk perception ($x = 3.24$; $sd = 0.94$), occurrence of death ($x = 1.91$; $sd = 0.91$), and television ($x = 2.46$; $sd = 0.99$). Respondents with university degrees gave the highest scores for the local community's preparedness to respond to fire ($x = 2.73$; $sd = 0.91$), family ($x = 2.83$; $sd = 0.92$), and radio ($x = 2.50$; $sd = 0.51$). Furthermore, respondents with high school degrees gave the highest scores for fire risk ($x = 2.27$; $sd = 1.06$), and the Internet ($x = 3.36$; $sd = 1.13$).

Additionally, a correlation between marital status and the following variables was determined: individual preparedness ($p = 0.000$); the perception of safety ($p = 0.000$); the fear of fire ($p = 0.030$); fire risk ($p = 0.001$); the occurrence of death ($p = 0.000$); the occurrence of injuries ($p = 0.000$); property destruction ($p = 0.003$); school ($p = 0.023$); television ($p = 0.002$); radio ($p = 0.012$); and the Internet ($p = 0.000$) (Table 6).

Further analyses demonstrated that respondents in a relationship gave the highest scores to individual preparedness ($x = 2.80$; $sd = 0.98$), and the occurrence of death ($x = 1.88$; $sd = 0.95$). Married respondents gave the highest scores to the Internet ($x = 3.56$; $sd = 0.96$) and property destruction ($x = 3.12$; $sd = 1.09$). Divorced or widowed respondents gave the highest scores for the perception of safety ($x = 3.78$; $sd = 0.42$), fire risk ($x = 2.01$; $sd = 1.02$), school ($x = 2.48$; $sd = 0.81$), television ($x = 2.60$; $sd = 0.98$), and radio ($x = 2.24$; $sd = 1.03$) (Table 6).

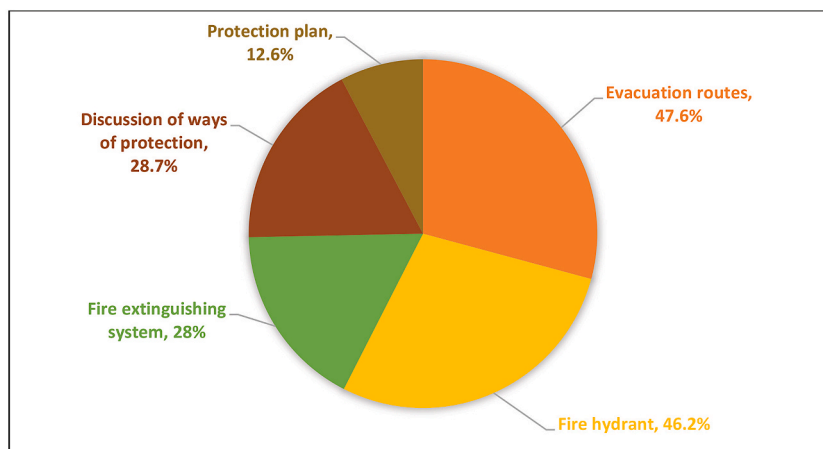


Fig. 7. Respondents' attitudes to specific fire safety measures.

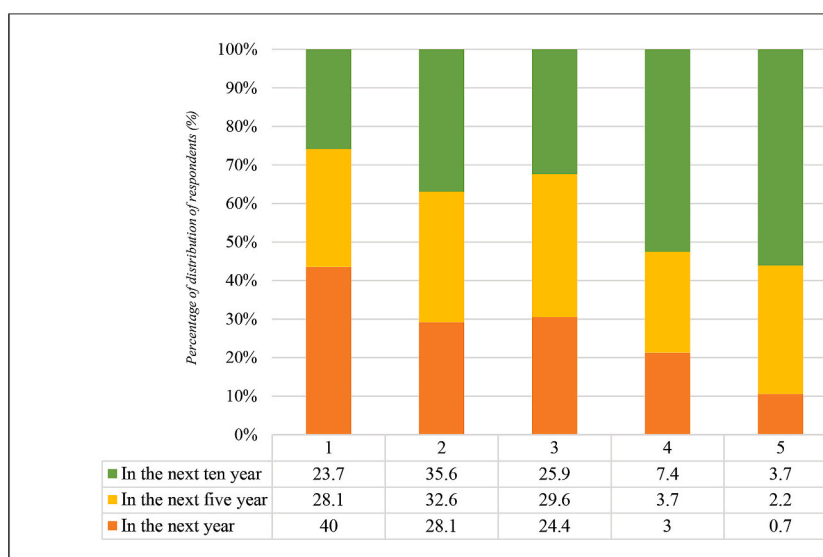


Fig. 8. Respondents' attitudes regarding the likelihood of a residential fire in the future.

Table 5

Reasons for the introduction and for not taking the preventive fire protection measures.

Reasons	Percentage (%)
Personal safety	73.4
Family safety	11.2
Experiences with fire	22.3
Frequent fire situations in recent years	8.5
Conversations with friends	9.8
Education on fire	5.8
Precaution	6.5
High risk of fire	26.5
Fear of fire	13.5
Common fires in residential buildings	18.7
I don't know what I am supposed to do	20.7
I don't have time to prepare	8.1
I don't want to think about it	14.1
High cost	81.5
Emergency services provide assistance	97
It will not make a difference	5.6

A correlation was found between age and the following variables: individual preparedness ($p = 0.006$); local community preparedness ($p = 0.012$); knowledge about fires ($p = 0.000$); the occurrence of death ($p = 0.000$); the occurrence of injuries ($p = 0.000$); property destruction ($p = 0.000$); family ($p = 0.015$); television ($p = 0.023$); radio ($p = 0.004$); and the Internet ($p = 0.001$). Further analyses showed that older respondents gave the highest scores to individual preparedness ($x = 3.15$; $sd = 0.66$), knowledge about fires ($x = 3.15$; $sd = 0.66$), family ($x = 2.54$; $sd = 0.54$), television ($x = 2.62$; $sd = 1.08$), and radio ($x = 2.38$; $sd = 1.15$) (Table 6).

Young respondents gave the highest scores to local community preparedness ($x = 3.07$; $sd = 1.01$), the occurrence of death ($x = 1.77$; $sd = 0.90$), the occurrence of injuries ($x = 2.39$; $sd = 0.98$), and property destruction ($x = 2.79$; $sd = 1.20$), internet ($x = 3.36$; $sd = 1.12$).

With regard to the location of buildings, a correlation was found with the following variables: individual preparedness ($p = 0.000$); the perception of safety ($p = 0.000$); the fear of fire ($p = 0.000$); knowledge of fires ($p = 0.000$); fire risk ($p = 0.000$); the occurrence of death ($p = 0.026$); family ($p = 0.000$); and school ($p = 0.010$) (Table 6).

Further analyses showed that respondents who live in the city/town center gave the highest scores for individual preparedness ($x = 3.29$; $sd = 0.89$), the perception of safety ($x = 3.59$; $sd = 0.85$), knowledge of fires ($x = 3.35$; $sd = 0.91$), fire risk ($x = 2.06$; $sd = 1.19$), family ($x = 2.47$; $sd = 1.18$), and school ($x = 2.59$; $sd = 1.17$). Respondents who live in the outskirts of cities/towns gave the highest scores for fear of fire ($x = 3.18$; $sd = 1.27$) and the occurrence of death ($x = 1.91$; $sd = 1.17$).

More analyses found that there was a slight relationship between age and individual fire preparedness ($r = 0.165$), knowledge of fires ($r = 0.121$), the occurrence of death ($r = -0.263$), the occurrence of injuries ($r = -0.273$), and property destruction ($r = -0.242$) (Table 7). Further analysis of the results shows that with the increase in the age of the respondents, the assessment of individual preparedness for residential fires increases, as well as the knowledge about fires. On the other hand, a negative correlation was found,

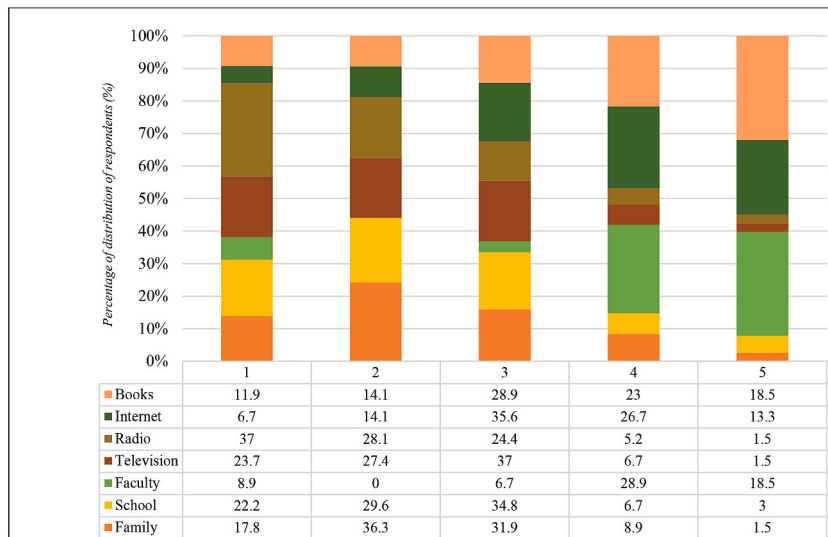


Fig. 9. Respondents' attitudes regarding the information available on residential fires in different entities.

Table 6

One-way ANOVA results of fire safety behavior and education level, marital status, age, and building location.

Variable	Mean	Std. Deviation	Education		Marital Status		Age		Location of Buildings	
			F	P	F	p	F	p	F	p
Individual preparedness	2.80	0.95	1.39	0.24	3.55	0.007 *	5.15	0.006 *	16.47	0.000 **
Local community prep.	2.71	1.00	4.27	0.005 *	1.14	0.333	4.45	0.012 *	2.26	0.080
Perception of safety	3.15	0.94	2.91	0.034 *	6.39	0.000 **	2.24	0.107	7.17	0.000 **
Fear of fire	2.67	1.21	1.86	0.134	2.69	0.030 *	2.78	0.063	7.35	0.000 **
Knowledge of fires	2.96	0.86	2.07	0.102	2.42	0.057	8.22	0.000 **	8.62	0.000 **
Fire risk	1.83	0.94	6.40	0.000 **	4.48	0.001 *	1.16	0.314	6.10	0.000 **
Occurrence of death	1.68	0.85	11.54	0.000 **	5.34	0.000 **	13.36	0.000 **	3.11	0.026 *
Occurrence of injuries	2.30	0.96	2.56	0.054	7.39	0.000 **	15.55	0.000 **	2.21	0.086
Property destruction	2.69	1.19	1.54	0.202	4.16	0.003 *	8.70	0.000 **	.813	0.487
Family	2.38	0.94	3.02	0.029 *	1.12	0.345	4.23	0.015 *	7.89	0.000 **
School	2.36	1.00	.860	0.462	2.86	0.023 *	0.52	0.595	3.82	0.010 *
Television	2.32	0.97	7.51	0.000 **	4.34	0.002 *	3.7	0.023 *	.862	0.460
Radio	2.02	0.99	5.68	0.001 **	3.27	0.012 *	5.52	0.004 *	.462	0.709
Internet	3.01	0.59	1.90	0.001 **	6.36	0.000 **	7.16	0.001 *	2.06	0.104

* $p \leq 0.05$; ** $p \leq 0.01$.

Table 7

Pearson's correlation results for the relationship between fire safety behavior and the age of the respondents.

Variables	Sig.	r
Individual preparedness	0.000 *	0.165
Local community prep.	0.144	0.064
Perception of safety	0.673	0.019
Fear of fire	0.577	-0.025
Knowledge of fires	0.006 *	0.121
Fire risk	0.883	0.006
Occurrence of death	0.000 **	-0.263
Occurrence of injuries	0.000 **	-0.273
Property destruction	0.000 **	-0.242

* $p = 0.05$; ** $p \leq 0.01$.

which shows that with the growth of the age of the respondents, the level of assessment of the occurrence of death, injuries and the assessment of property destruction decreases.

3.3. Gender perspective of the fire safety behavior model in residential buildings

The results of the *t*-test suggest a statistically significant difference between males and females in terms of trust in the legal system

($p = 0.00$); individual preparedness ($p = 0.00$); the perception of safety ($p = 0.00$); the fear of fire ($p = 0.00$); knowledge of fires ($p = 0.00$); fire risk in the household ($p = 0.00$); the occurrence of death ($p = 0.00$); the occurrence of injuries ($p = 0.00$); the destruction of property ($p = 0.00$); family ($p = 0.00$); school ($p = 0.00$); and the Internet ($p = 0.00$) (Table 8).

The results of further analyses infer that males, to a greater extent than females, rate the following variables higher: individual preparedness for residential fires (males $x = 3.01$; females $x = 2.51$); perception of safety (males $x = 2.88$; females $x = 3.01$); knowledge of fires (males $x = 3.19$; females $x = 0.83$); fire risk in the household (males $x = 2.04$; females $x = 1.71$); and family (males $x = 2.68$; females $x = 2.37$) (Table 8).

In contrast, females, to a greater degree than males, rate the following variables higher: the occurrence of death (females $x = 1.79$; males $x = 1.50$); the occurrence of injuries (females $x = 2.43$; males $x = 2.08$); the destruction of property (females $x = 2.89$; males $x = 2.35$); school (females $x = 2.48$; males $x = 2.33$); and the Internet (females $x = 3.48$; males $x = 2.92$) (Table 8).

The obtained chi-square test results suggest a statistically significant correlation with the following variables: previous experience with fire; the method of informing about fire; health consequences; evacuation support; the protection of property from fire; waiting for expert advice; knowledge of evacuation routes; discussing ways to protect against fire; a way of reacting; the awareness of acceptable behavior; the usefulness of preventive measures; knowledge of switches/valves; available accessories and appliances; the introduction of preparedness measures; preparedness barriers; fear of fire; a way to protect the family; the knowledge of using a hydrant network; dry powder fire extinguisher; carbon dioxide fire extinguisher; and training experience (Table 9).

Further analyses of the obtained results demonstrate that women experienced a fire in their house more than men (66.7%). Moreover, women know a person who experienced a fire in an apartment (79.2%). They found out about the fire by seeing smoke (53.1%), from a neighbor (70.8%) or smelling smoke (66.7%). Women also had health consequences due to fire (58.8%); need help during evacuation (84.1%); consider burns to be the leading cause of death during fires (80%); start evacuation and do not wait for the fire to reach the apartment (83.7%); think to a greater degree that they should get advice before they do something (54.7%); have a close relationship with a neighbor that will provide her with emotional comfort during or after the fire (71.4%); discuss fire threatening situations with members of their household (34.9%); are panic stricken during fire (8.2%); find preventive measures useful (92%); know how to turn off the electricity switches (17.4%); know how to turn off the water valves (12.8%); have a smoke detector (2.3%); have first aid kits (39.5%); would undertake evacuation by fire escapes (42%); answered correctly that they would turn off the electrical device with carbon dioxide (19.8%); and point out that the greatest danger in fires is fire and the release of large amounts of heat (10.2%).

To a greater extent than women, men point out that they experienced a fire in someone else's apartment (62.5%); defend their property despite a fire (66.7%); state that they would find it difficult to find someone to help them during the evacuation (66.7%); are able to protect their personal safety and cope with all adversities during a fire (60%); are familiar with evacuation routes (55.1%); have knowledge of giving emergency first aid (73.5%); rationally assess their behavior during fire (91.8%); are extremely well versed in appropriate behavior during fire (8.2%); clean roof surfaces and basements (62.8%); know how to turn off the gas valve (2%); own a fire extinguisher (28.6%); own a fire blanket (2%); want to purchase a fire extinguisher (36.7%); state that they were motivated by security issues (65%); answered incorrectly that they would extinguish flammable liquids with sand (46.9%); know how to use a hydrant network (38.8%); know how to use a fire extinguisher with powder (73.5%) and carbon dioxide (44.9%); say that they are most at risk from harmful combustion products (85.7%); and have undergone specific response trainings (53.1%).

4. Discussion

In this study, the fire safety behavior model for residential buildings in Serbia was investigated, starting from the unexplored level of the fire safety of citizens in residential buildings in Serbia and increasing the number of fires and the severity of their consequences for people and their property. Because of that, this study observes people's behavior during a fire in a building, which can significantly reduce human casualties and material damage. The results of this study showed that gender and age are the main predictors for individual preparedness and personal security, whereas gender is also a predictor for fire prevention knowledge. It is important to point

Table 8
Independent samples' *t*-test results between gender and the variables on fire safety behavior.

Variable	F	<i>t</i>	Sig. (2-Tailed)	df	Male X (SD)	Female X (SD)
Individual preparedness	6.24	9.91	0.000 **	422	3.29 (0.84)	2.51 (0.90)
Local community prep.	0.25	2.92	2.92	518	2.88 (1.01)	2.61 (0.98)
Perception of safety	0.74	4.98	0.000 **	518	3.42 (0.78)	3.01 (0.98)
Fear of fire	1.14	-6.54	0.000 **	518	2.23 (1.06)	2.93 (1.22)
Knowledge of fires	1.08	4.65	0.000 **	518	3.19 (0.83)	2.83 (0.85)
Fire risk in the household	0.33	3.94	0.000 **	518	2.04 (1.06)	1.71 (0.84)
Occurrence of death	10.00	-4.02	0.000 **	46.1	1.50 (0.73)	1.79 (0.89)
Occurrence of injuries	16.31	-4.12	0.000 **	447	2.08 (0.86)	2.43 (1.00)
Destruction of property	3.36	-5.04	0.000 **	518	2.35 (1.03)	2.89 (1.24)
Family	13.56	-0.03	0.000 **	518	2.68 (0.80)	2.37 (1.00)
School	31.23	-0.48	0.000 **	518	2.33 (0.80)	2.48 (1.11)
Television	20.64	0.18	0.854	485	2.31 (0.79)	2.30 (1.05)
Radio	11.07	1.12	0.261	477	2.08 (0.84)	1.99 (1.07)
Internet	18.37	-6.11	0.000 **	458	2.92 (0.93)	3.48 (1.11)

* $p \leq 0.05$; ** $p \leq 0.01$.

Table 9

Chi-square test results correlating gender and the variables on fire safety behavior.

Variables	Sig. (2-Tailed)	df	χ^2
Previous experience with fire	0.000 **	5	31.05
Method of informing about the fire	0.003 *	5	18.16
Health consequences	0.011 *	1	5.64
Evacuation support	0.000 **	1	46.93
Protection of property from fire	0.000 **	1	33.14
Waiting for expert advice	0.002 *	1	9.56
Response plan	0.574	1	0.315
Knowledge of evacuation routes	0.000 **	1	14.15
Fire hydrant location	0.143	1	2.14
Fire extinguishing system installed	1.84	1	1.84
Discuss ways to protect against fire	0.003 *	1	9.13
Knowledge of first aid	0.023	1	5.14
Way of reacting	0.000 **	1	14.92
Awareness of adequate behavior	0.000 **	4	41.52
Usefulness of preventive measures	0.000 **	4	38.33
Volunteering after a fire	0.540	1	1.21
Use of non-combustible materials	0.468	1	0.045
Knowledge of switches/valves	0.000 **	4	24.49
Available accessories and appliances	0.000 **	4	37.75
Introduction of preparedness measures	0.009 *	5	15.32
Preparedness barriers	0.000 **	12	36.24
Fear of fire	0.000 **	2	29.33
A way to protect the family	0.000 **	16	61.88
Knowledge of using a hydrant network	0.000 *	2	68.33
Powder fire extinguisher	0.000 **	2	136.63
Carbon dioxide fire extinguisher	0.000 **	2	62.89
Carbon monoxide	0.115	2	4.32
Area code of firefighters/rescuers	0.142	2	3.89
Training experience	0.000 **	2	34.33
Probability of fire outbreak in the next year	0.123	1	1.41

* $p \leq 0.05$; ** $p \leq 0.01$.

out that the education level, ownership, and monthly income did not significantly affect individual preparedness, personal security, fire risk, and fire prevention knowledge. Aside from that, results showed that marital status is a predictor of personal security; on the other hand, employment status is a predictor of fire prevention knowledge.

By further descriptive analyses, we found that the majority of respondents believe: that they and their local community are not prepared to respond to the threat of residential fire; there is no likelihood of a fire caused by a thrown cigarette butt; there is a greater likelihood of a fire caused by an explosion of faulty devices rather than because of an unquenched heat body; and it is safer to evacuate immediately. On the other hand, the minority think that it is safer to wait until they are sure that the fire reaches their place of dwelling; should not wait for the fire and rescue services to instruct them on what to do; think that people in fire-induced disasters rely on fire and rescue services to defend their property; feel insecure about possible fire-threatening situations; and believe that there is no risk of death or injuries due to fire, etc.

According to the data in this study, gender was a leading variable in predicting the fire safety behavior model in residential buildings in Serbia. A statistically significant difference between males and females was found, which is in accordance with the results of previous research [53–55,117,118]. We found that, to a greater extent than females, males rate the following variables higher: individual preparedness for residential fires; the perception of safety; knowledge of fires; fire risk in the household; and they are informed about residential fires by the family. The fact that males in Serbia are more likely than women to serve in the military, where they get emergency response training, might account for their higher level of preparation [119]. They may be encouraging people to think of themselves as more proactive and ready to participate when the time comes [120]. Research also shows that males are more likely to be injured and killed from fires than females [118], which can be explained by the strong desire among men to tackle the fire themselves [117] or it is possible that women are more realistic when it comes to assessing their own and their families' readiness. Aside from that, we can assume that women who are regarded less favorably than men and marginalized in the family and society are likely to feel less prepared for disasters and more exposed to risk [120].

In contrast, females, to a greater extent than males, rate the following at a higher degree: the occurrence of death; the occurrence of injuries; the destruction of property; and informed about residential fires by school and via the Internet. The obtained results can be explained by observed differentiated roles and responsibilities, skills and capabilities [121], the social role of a female both in daily activities and the society in general [56], fewer household resources, the fact that women feel more vulnerable to their possible loss [57], and the fact that physical vulnerability increases sensitivity and concern [58]. Moreover, women are more at risk of psychosocial reactions [122]. Moreover, in Serbia, women are weakly represented in the disaster planning response and overall decision-making processes [120].

This study has found a positive correlation, albeit a low one, between age and the perception of individual preparedness, whereby the older the person, the better the assessment of individual preparedness to respond to fire. Furthermore, the findings demonstrate

that as respondents' ages rise, so does their appraisal of individual preparation for fires, as well as their understanding of flames. On the other side, a negative correlation was discovered, indicating that as respondents' ages increase, the degree of evaluation of the occurrence of death, injuries, and property devastation falls. These data are anticipated because as people grow old, they come to be more knowledgeable and have more life experience [123], whereas the oldest citizens fear death. The increase in the assessment of individual preparedness for fires with the age of the respondents can be explained by the development of previous experience in such situations [124]. Additionally, certain studies have confirmed that older respondents believed most in community preparedness [125]. Other spheres of life report on similar observations; for example, in traffic, most fatalities occur among young people, and during COVID-19, the older population chooses to be vaccinated more readily than the young [15]. Similarly, in fire prevention, the elderly are expected to take more protection measures [126]. These findings are in agreement with the results of the study conducted by Ref. [127]; which point to the differences in attitudes among different age groups and family structures. Moreover, the study confirmed that the participants were found to lack the knowledge and/or ability to engage in fire prevention, and their firefighting skills were also poor. In their study [128], also found that increasing age, physical disability, and lower education and income were independently and significantly correlated with overall poorer preparedness for disasters. In our study, no significant difference in attitudes was found among the young population, as is the case in a study conducted by Mousavi Shahab Kariminia and Shirin Toghyani [129], where women aged 20–30 had the highest perception of fire risk in buildings.

The results of the study suggest a statistically significant correlation between the level of education of people and the perception of individual preparedness for the threat of fire, thus supporting the results of other empirical studies [9,25,129–131]. Most respondents with the highest education level (doctorate) state that they are prepared to respond to fire threats, whereas those who completed high school are the least prepared to respond to fire situations. Interestingly enough, the respondents with master's and doctoral degrees had the poorest fire probability rate, in contrast to those with high school and secondary school education. Similarly [9], found a significant correlation between the perceived knowledge and the different measures of preparedness for home fires and the predictability of objective knowledge for the preparedness for disasters caused by fires. As for the section of the questionnaire aimed at gathering information about the preparedness of citizens for fire, participants of future questionnaires should be asked to rate the most dangerous aspect of fires (smoke, fire heat, or particulate matter) to examine what aspects of fires citizens recognize as the most dangerous (smoke or other) and what measures they would take following the stated degree of danger [132].

As for the available home fire prevention measures [133], most respondents stated that they possess a first aid kit and fire extinguishers, whereas only four respondents had a smoke detector in their households. Although a large number of respondents did not consider providing fire protection equipment (with high cost being a major reason), those who did entertain the thought of providing fire protection equipment primarily considered purchasing a fire extinguisher, whereas a minimal number of respondents considered providing smoke detectors. In contrast, in a study conducted by Knuth et al. [134], several people who considered purchasing a smoke detector were significantly higher (66%) compared to other fire prevention measures, which can be attributed to legal requirements for smoke detectors in private households in many German states. At present, all these measures can be considered basic fire protection measures; however, they are still implemented at a low rate, and modern, more complex techniques, such as fire barriers to prevent smoke and fire [132], were not even considered by respondents (who might not even know about them, which suggests a low level of safety culture). As taking preventive measures in the household relies on assessing the likelihood of fire in the future, the perception of the probability of the occurrence of fire in the period of one, five, and ten years was examined in the study. The investigation found that citizens estimate fire occurrence as least probable within the next ten years, whereas the likelihood rises over the years, with the highest likelihood being at ten years. A relatively low perception of the probability of fire occurrence was observed for all the three examined periods, confirming the investigation results conducted by Ref. [15].

Furthermore, the results of the chi-square test point to a statistically significant correlation between marital status and individual preparedness to respond to fire disasters. Respondents in a relationship mostly emphasize that they are prepared to respond in fire-threatening situations, in contrast to the ones that are not in a relationship. Similarly, in their study [134], found that married people are more likely to be prepared to respond to fire-threatening situations and consider providing various household fire protection measures, such as fire extinguishers or smoke detectors [135], also confirmed the high probability that couples are better prepared to respond to disasters in their study. The results of their study reveal that married couples perceive preparedness to disaster through a collaborative process between husband and wife; although, in many cases, partners do not share their opinions about the preparations. Regarding the fire protection plan, any disagreement between household members increases the likelihood of a risky outcome for couples or families. In addition, any disagreement or the lack of preparation in this respect may delay or hamper any actions aimed at the effective response to fire disaster and may result in fatalities [136].

The limitations of our study include (1) the impossibility of surveying citizens in different urban areas, face to face; (2) non-conducted fire risk research within the facilities where the respondents live; (3) insufficient representation of respondents from rural areas; (4) an insufficient number of senior citizens over 70 years of age; (5) non-conducted qualitative research in which the shortcomings of the fire protection system in the Republic of Serbia would be elaborated in more detail; and (6) the sample was convenient but not necessarily representative of the Serbian population.

5. Conclusions

Previous unexplored levels and factors influencing fire safety in residential buildings in Serbia have contributed to the design, development and testing of the fire safety behavior model with the aim of better understanding how to improve fire safety. The paper tests the hypothesis that education and gender are predictors in the fire safety behavior model. In this paper, this hypothesis was partially confirmed, bearing in mind that gender is the main predictor, not education. On the other hand, it was found that, in addition

to gender, the most significant influence on the observed model was the age of the respondents. In addition, the results showed that the level of perception of fire safety was lower compared to a larger number of observed dimensions of the mentioned model. In addition, there is not enough confidence in the level of preparedness and efficiency of fire and rescue units to protect them in such situations.

Starting from the importance of appropriate risk perception in the process of improving the preparedness of citizens for fires in residential buildings [137–142], most respondents believe that fire is unlikely to happen in the future and that they would begin the evacuation without waiting for the arrival of professional firefighters or rescue units. All this can be related to the increase in mortality and injuries of citizens in fires in residential buildings in the territory of Serbia. In addition, insufficient training of citizens for proper and timely response, the appropriate use of protective equipment, the use of firefighting equipment, etc., was determined. Among the main reasons for not improving fire safety are the high costs of preventive measures and the view that this is the responsibility of fire and rescue units. On the other hand, citizens mostly think about preventive measures encouraged by taking care of personal safety and assessing high risks of building fires. After the faculty, citizens are mostly informed about various aspects of fires via the Internet, and least of all via radio. The level of knowledge of citizens about various aspects of safety in housing fires is at a lower level, which is very worrying. Few citizens know where they are and how to use appropriate safety valves and switches, fire extinguishers, how to evacuate, etc. An additional problem is the fact that in many buildings there are no properly installed fire protection systems, and there are also no inspections that would identify such deficiencies and require their immediate elimination.

Our results have several significant public fire safety implications: in the shortest possible time, it is necessary to design campaigns and programs that would raise citizens' awareness of the risks (causes and consequences) of fires in residential buildings. It is also necessary to improve the legislation that would explicitly regulate fire safety in residential buildings and provide for regular inspections; design and implement certain evacuation and firefighting exercises with tenants of buildings at the level of housing communities; improve the level of preparedness of women and people with special needs for proper and safe response in situations in which a fire occurs; and to educate citizens through all possible channels of dissemination, but mostly through the Internet and in the education system, which could be realized by introducing the subject of safety culture in primary and secondary schools.

In future research, it is necessary to examine other cultural and socio-economic factors influencing the level of fire safety, as well as to conduct certain qualitative research that would look more deeply at the factors that influence citizens to take or not take preventive measures. The conducted research has undoubted scientific and social implications, which are reflected in the improvement of the theoretical and empirical fund of scientific knowledge in the field of fire safety, but also in helping decision makers to more comprehensively consider different dimensions of fire safety in Serbia.

Author contributions

V.M.C. had the original idea for this study and developed the study design and questionnaire; D.P. and B.J. contributed to the dissemination of the questionnaire; V.M.C. and N.N. analyzed and interpreted the data; V.M.C., A.D. and P.M. made special contributions to drafting the introduction; V.M.C., N.N., B.J. and P.M. drafted the discussion and the conclusions; V.M.C., N.N., A.D., P.M. and D.P. critically reviewed the data analysis and contributed to the content for revising and finalizing the manuscript. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board statement

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of the Scientific–Professional Society for Disaster Risk Management and the International Institute for Disaster Research (protocol code 003/2021, September 15, 2021).

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

1. Circle the gender you are
 - (a) male
 - (b) female
2. How old are you? (please, write the number)

3. Your education is? (please, circle the answer)
(a) primary; (b) secondary higher; (c) high; (d) master; (e) doctorate.
4. What general average did you achieve during high school? (please, circle the answer):
(a) pass; (b) satisfactory; (c) good; (d) excellent.
5. What is your marital status? (please, circle the answer):
(a) not in a relationship; (b) in a relationship; (c) engaged; (g) married; (d) divorced; (f) widower/widow.
6. Do you have any children? (a) yes; (b) no.
7. Are you the owner of a residential building? (a) yes; (b) no.
8. What type of housing do you live in? (a) house; (b) apartment.
9. How do you assess your health condition? (a) very good; (b) good; (c) bad.
10. Is there any damage to your home? (a) minor damage to the house; (b) severe damage; (c) moderate damage; (d) no damage.
11. Has your home been restored, purchased, or built with fire-resistant materials/designs?
(a) yes; (b) no.
12. Are you employed? (a) yes; (b) no.
13. What is your average monthly income? (a) up to 25,000; (b) up to 50,000; (c) up to 75,000; (d) over 90,000.
14. Have you completed military service? (a) yes; (b) no.
15. Do you live in the city center? (a) yes; (b) no.
16. Have you or anyone you know experienced fire? (a) I experienced it at home; (b) I have experienced it, but not at home; (c) yes, a person I know; (d) yes, but only indirectly, as a witness, bystander or first person to react; (e) yes, a person I know, but only indirectly as a witness, bystander or first person to react; (f) no.
17. How did you find out about the fire? (a) I saw smoke; (d) I felt smoke; (c) the fire alarm system was activated; (d) a neighbor called me; (e) I found out on television; (f) I have not had a fire experience.
18. Did you have any health consequences due to the fire experience? (a) yes; (b) no.
19. Do you need support/assistance during a fire evacuation? (a) yes; (b) no.
20. Are burns the main cause of death during fire? (a) yes; (b) no.
21. In your opinion, is it safer to wait during fire until you are sure that the fire will reach your apartment or start the evacuation?
(a) wait; (b) start the evacuation.
22. Would you stay to defend your property although you assess that a disastrous fire hazard may occur? (a) yes; (b) no.
23. Can people in emergency situations in the Republic of Serbia rely on fire and emergency services to defend their property?
(a) yes; (b) no.
24. During a disaster caused by fire, people should wait until a firefighter or someone from the emergency services instruct them on what to do? (a) yes; (b) no.
25. Do you have someone in your environment who would provide you with the necessary assistance during or after a fire disaster?
(a) I have a close relationship with a neighbor, relative or friend who lives in my place and who will provide me with emotional comfort; (b) a neighbor, relative or friend lives in my place to whom I can turn for advice if I have problems solving my problems due to a fire; (c) it would be difficult to find someone who would allow me to stay with them if I had to evacuate my property; (d) I am able to protect my personal safety and to deal with any difficulties that the fire could cause; (e) other.
26. Do you have a plan for threatening events? (a) yes; (b) no.
27. Are you familiar with the dwelling place and evacuation routes in the event of a fire disaster?
(a) yes; (b) no.
28. Are you familiar with the location of the fire hydrant? (a) yes; (b) no.
29. Is there a fire extinguishing system installed in your household or around it? (a) yes; (b) no.
30. Do you discuss fire protection with family members? (a) yes; (b) no.
31. Do you share information on various aspects of fire risk with acquaintances? (a) yes; (b) no.
32. Are you trained to give emergency first aid? (a) yes; (b) no.
33. How do you assess your behavior during an accident? (a) I behave rationally; (b) I am panic stricken.
34. Are you familiar with how to behave during a fire in a residential building? (a) not at all; (b) to some extent; (c) moderately; (d) very; (e) exceptionally.
35. In your opinion, how useful are preventive measures and knowledge about emergency situations in a fire in a household? (a) not at all; (b) to some extent; (c) moderately; (d) very useful; (e) exceptionally.
36. Have you ever volunteered in the community to help clean and remove flammable material (e.g., brush, litter) or in organizing community fire education programs? (a) yes; (b) no.
37. Do you clean roof surfaces/gutters and surrounding vegetation to avoid the accumulation of tree needles, leaves and dead plants? (a) yes; (b) no.
38. Do you use non-combustible building materials such as tiles, slate, stone, etc.? (a) yes; (b) no.
39. Do you know how to turn off gas, electricity or water switches/valves in your home? (a) I know how to turn off the gas valve; (b) I know how to turn off the electricity switch; (c) I know how to turn off the water valve; (d) I know how to turn off all of the above; (e) I don't know.
40. Do you have the following fire protection measures in your household? (a) fire extinguisher; (b) fire cover; (c) smoke detector; (g) first aid kit; (e) none.

41. You have considered introducing the following fire protection measures in your household: (a) fire extinguisher; (b) fire cover; (c) smoke detector; (g) first aid kit; (d) all of the above; (f) I have not considered the fire protection measures
 42. What motivated you to install/provide fire protection equipment for your household? (please, write an answer)
 43. Reasons for not taking fire protection actions? (a) I don't know what I am supposed to do; (b) I do not have time to prepare; (c) I don't want to think about it; (g) high cost; (d) I believe that the emergency services would provide me with the necessary assistance; (f) I believe that it will not make a difference; (e) other.
 44. Do you have a fear of fire? (a) yes; (b) no.
 45. What would you do to protect your family if a fire broke out on your floor? (a) I would not leave the apartment and would close all the doors and windows; (b) I would evacuate with my family down the stairs; (c) I would evacuate by using the elevator; (d) I would hide in the bathroom and pour water; (d) I would jump out of the window; (f) other.
 46. What would you use to put out fire caused by your books and paper? (a) water; (b) foam; (c) carbon dioxide; (g) dry powder; (e) sand.
 47. What would you use to put out an electrical fire? (a) water; (b) foam; (c) carbon dioxide; (g) dry powder; (e) sand.
 48. What would you use to put out fire caused by a flammable liquid, oil or gasoline? (a) water; (b) foam) carbon dioxide; (g) dry powder; (e) sand.
 49. What would you use to put out fire on magnesium-coated metal surfaces? (a) water; (b) foam; (c) carbon dioxide; (g) dry powder; (e) sand.
 50. Do you know how to use a hydrant? (a) yes; (b) no.
 51. Do you know how to use a dry powder fire extinguisher? (a) yes; (b) no.
 52. Do you know how to use a carbon dioxide-based fire extinguisher? (a) yes; (b) no.
 53. Is carbon monoxide a poisonous gas? (a) yes; (b) no.
 54. What is the biggest danger to your health? (a) fire and the release of a large amount of heat; (b) collapse of the building; (c) adverse combustion products (smoke).
 55. Do you know the telephone number of the fire and rescue unit? (a) yes; (b) no.
 56. Have you undergone any fire response training? (a) yes; (b) no.
 57. Would you like to undergo a fire response training? (a) yes; (b) no.
 58. How do you rate your individual preparedness to respond to fire on a scale from 1 to 5? (1—highly unprepared; 5—highly prepared)
- 1 2 3 4 5.
59. On a scale of 1–5 (1—highly unprepared; 5—highly prepared), how do you assess the preparedness of your local community to respond to fires?
- 1 2 3 4 5.
60. How do you assess the readiness of your state to respond to fires on a scale from 1 to 5 (1—highly unprepared; 5—highly prepared)?
- 1 2 3 4 5.
61. How do you assess the readiness of the Emergency Situations Department to respond to fires on a scale from 1 to 5 (1—highly unprepared; 5—highly prepared)?
- 1 2 3 4 5.
62. How do you rate your fire safety on a scale of 1–5 (1—very unsafe; 5—very safe)?
- 1 2 3 4 5.
63. How do you rate your fear of fire on a scale from 1 to 5 (1—very fearless; 5—very frightened)?
- 1 2 3 4 5.
64. How do you rate your knowledge of fires on a scale of 1–5 (1—very badly informed; 5—fully informed)?
- 1 2 3 4 5.
65. How do you assess the risk of fire in your household on a scale from 1 to 5 (1—fully risk-free; 5—highly risky)?
- 1 2 3 4 5.
66. On a scale from 1 to 5 (1—very unlikely; 5—very likely), how do you rate the likelihood that:
 1. You die as a result of a fire 1 2 3 4 5
 2. You get injured 1 2 3 4 5
 3. Your property gets destroyed or damaged 1 2 3 4 5
 67. How do you assess the level of likelihood of fire on a scale from 1 to 5 (1—very unlikely; 5—very likely):
 1. cigarette butt 1 2 3 4 5

2. faulty installation 1 2 3 4 5
3. heater kept on 1 2 3 4 5
4. device explosions 1 2 3 4 5
68. How would you rate information availability on fires in the following entities, on a scale from 1 to 5 (1—widely available; 5—poorly available):
 1. Family 1 2 3 4 5
 2. School 1 2 3 4 5
 3. Faculty 1 2 3 4 5
 4. Television 1 2 3 4 5
 5. Radio 1 2 3 4 5
 6. Internet 1 2 3 4 5
 7. Books 1 2 3 4 5
69. How would you rate the likelihood of a fire on a scale of 1–5 (1—very unlikely; 5—very likely):
 1. In the next year 1 2 3 4 5
 2. In the next five years 1 2 3 4 5
 3. In the next ten years 1 2 3 4 5

References

- [1] M. Kobes, J. Post, I. Helsloot, B. Vries, Fire risk of high-rise buildings based on human behavior in fires, in: *Proceedings of the Conference FSHB 2008*, 2008. Bucharest, Romania, 7–9 May.
- [2] J. Twigg, N. Christie, J. Haworth, E. Osuteye, E. Skarlatidou, Improved methods for fire risk assessment in low-income and informal settlements, *Int. Res. J. Publ. Environ. Health* 14 (2) (2017), 139.
- [3] M. Kobes, I. Helsloot, B. de Vries, J.G. Post, Building safety and human behaviour in fire: a literature review, *Fire Saf. J.* 45 (2010) 1–11, <https://doi.org/10.1016/j.firesaf.2009.08.005>.
- [4] M. Cavallini, M.F. Papagni, F.W.B. Preis, Fire disasters in the twentieth century, *Ann. Burn. Fire Disasters* 20 (2007) 101–103.
- [5] M.A. Chisty, M. Rahman, Coping capacity assessment of urban fire disaster: an exploratory study on ward no: 30 of Old Dhaka area, *Int. J. Disaster Risk Reduc.* 51 (2020) 101878, <https://doi.org/10.1016/j.ijdrr.2020.101878>.
- [6] B.N. Leistikow, D.C. Martin, C.E. Milano, Fire injuries, disasters, and costs from cigarettes and cigarette lights: a global overview, *Prev. Med.* 31 (2000) 91–99, <https://doi.org/10.1006/pmed.2000.0680>.
- [7] J. Cassuto, P. Tarnow, The discotheque fire in Gothenburg 1998: a tragedy among teenagers, *Burns* 29 (2003) 405–416, <https://doi.org/10.1016/s0305-417900074-3>.
- [8] J. Xin, C. Huang, Fire risk analysis of residential buildings based on scenario clusters and its application in fire risk management, *Fire Saf. J.* 62 (2013) 72–78, <https://doi.org/10.1016/j.firesaf.2013.09.022>.
- [9] K. Stumpf, D. Knuth, D. Kietzmann, S. Schmidt, Adoption of fire prevention measures—predictors in a representative German sample, *Saf. Sci.* 94 (2017) 94–102, <https://doi.org/10.1016/j.ssci.2016.12.023>.
- [10] M. Cha, S. Han, J. Lee, B. Choi, A virtual reality based fire training simulator integrated with fire dynamics data, *Fire Saf. J.* 50 (2012) 12–24, <https://doi.org/10.1016/j.firesaf.2012.01.004>.
- [11] M. Runefors, N. Johansson, P. van Hees, The effectiveness of specific fire prevention measures for different population groups, *Fire Saf. J.* 91 (2017) 1044–1050, <https://doi.org/10.1016/j.firesaf.2017.03.064>.
- [12] D. Bruck, I. Thomas, Comparison of the effectiveness of different fire notification signals in sleeping older adults, *Fire Technol.* 44 (1) (2008) 15–38.
- [13] A.H. Buchanan, A.K. Abu, *Structural Design for Fire Safety*, John Wiley & Sons, Hoboken, NJ, USA, 2017.
- [14] J.R. Hall, *High-Rise Building Fires*, The Association, 2000.
- [15] V.M. Cvetković, M. Filipović, Ispitivanje percepcije rizika o požarima u stambenim objektima—demografski i socio-ekonomski faktori uticaja, *Vojno Delo* 70 (2018) 82–98, <https://doi.org/10.5937/vojdelo1805082c>.
- [16] G.A. Tobin, J. Lidstone, Disaster education: where we are and where we should be. *International Perspectives on Teaching about Hazards and Disasters*, *Econ. Geogr.* 73 (1997) 455, <https://doi.org/10.2307/144569>.
- [17] M. Petal, Y.O. Izadkhal, Concept note: formal and informal education for disaster risk reduction, in: *Proceedings of the International Conference on School Safety*, 2008. Islamabad, Pakistan, 17 May.
- [18] R. Shaw, K. Shiwaku, Y. Takeuchi, *Disaster Education*, Emerald Group Publishing, Bingley, UK, 2011.
- [19] V. Cvetković, J. Gačić, Fires as threatening security phenomenon: factors of influence on knowledge about fires, in: *Proceedings of the 10th International Conference "Crisis Management Days"—Security Environment and Challenges of Crisis Management*, Toplice, Croatia, 2017, 25–26 May.
- [20] I. Dzolev, M. Laban, Analysis of fire loads in residential buildings, in: *Book of Proceedings, Proceedings of the Nordic Fire & Safety Days 2018*, Trondheim, Norway, 2018, p. 60, 7–8 June.
- [21] D. Babić, D. Mladan, The analysis of fire and explosion risk indicators with special reference to the Republic of Serbia, *Bezbednost Beogr.* 55 (2013) 117–129.
- [22] N.N. Brushlinsky, J.R. Hall, S.V. Sokolov, P. Wagner, *World Fire Statistics*, Center of Fire Statistics of CTIF, 2012.
- [23] A. Fothergill, Gender, risk, and disaster, *Int. J. Mass Emergencies Disasters* 14 (1996) 33–56.
- [24] D.R. Godschalk, A. Rose, E. Mittler, K. Porter, C.T. West, Estimating the value of foresight: aggregate analysis of natural hazard mitigation benefits and costs, *J. Environ. Plann. Manag.* 52 (2009) 739–756.
- [25] R. Hoffmann, R. Muttarak, Learn from the past, prepare for the future: impacts of education and experience on disaster preparedness in the Philippines and Thailand, *World Dev.* 96 (2017) 32–51.
- [26] A. Hussaini, Environmental planning for disaster risk reduction at Kaduna international airport, Kaduna Nigeria, *Int. J. Disaster Risk Manag.* 2 (2020) 35–49, <https://doi.org/10.18485/ijdrm.2020.2.1.4>.
- [27] M. Lindell, North American cities at risk: household responses to environmental hazards, in: *Cities at Risk*, Springer, Dordrecht, The Netherlands, 2013, pp. 109–130, https://doi.org/10.1007/978-94-007-6184-1_7.
- [28] R.M. Mano, A.T. Kirshenbaum, C. Rapaport, Earthquake preparedness: a social media fit perspective to accessing and disseminating earthquake information, *Int. J. Disaster Risk Manag.* 1 (2019) 19–29, <https://doi.org/10.18485/ijdrm.2019.1.2.2>.
- [29] P. Olawuni, O. Olowoporoku, O. Daramola, Determinants of residents' participation in disaster risk management in lagos metropolis Nigeria, *Int. J. Disaster Risk Manag.* 2 (2020) 1–18, <https://doi.org/10.18485/ijdrm.2020.2.2.1>.

- [30] D. Xu, Z. Yong, X. Deng, Y. Liu, K. Huang, W. Zhou, Z. Ma, Financial preparation, disaster experience, and disaster risk perception of rural households in earthquake-stricken areas: evidence from the Wenchuan and Lushan earthquakes in China's Sichuan Province, *Int. J. Environ. Res. Publ. Health* 16 (2019) 3345.
- [31] J.-C. Gaillard, C.C. Liamzon, J.D. Villanueva, 'Natural' disaster? A retrospect into the causes of the late-2004 typhoon disaster in Eastern Luzon, Philippines, *Environ. Hazards* 7 (2007) 257–270.
- [32] J. Mercer, I. Kelman, K. Lloyd, S. Suchet-Pearson, Reflections on use of participatory research for disaster risk reduction, *Area* 40 (2008) 172–183, <https://doi.org/10.1111/j.1475-4762.2008.00797.x>.
- [33] S.M. van Manen, Hazard and risk perception at Turrialba volcano (Costa Rica); implications for disaster risk management, *Appl. Geogr.* 50 (2014) 63–73, <https://doi.org/10.1016/j.apgeog.2014.02.004>.
- [34] V. Cvetković, S. Pavlović, B.D. Janković, Private security preparedness for disasters caused by fire, *NBP, Nauka Bezbednost Pol.* 26 (2021) 35–59.
- [35] D.K. Robinson, Understanding Firewise Investment: Examining Social and Biophysical Factors Related to Mitigation Engagement, Master's Thesis, North Carolina State University, Raleigh, NC, USA, 2012.
- [36] T. McGee, Public engagement in neighbourhood level wildfire mitigation and preparedness: case studies from Canada, the US and Australia, *J. Environ. Manag.* 92 (2011) 2524–2532, <https://doi.org/10.1016/j.jenvman.2011.05.017>.
- [37] R. Ojerio, C. Moseley, K. Lynn, N. Bania, Limited involvement of socially vulnerable populations in federal programs to mitigate wildfire risk in Arizona, *Nat. Hazards Rev.* 12 (2011) 28–36, [https://doi.org/10.1061/\(asce\)nh.1527-6996.0000027](https://doi.org/10.1061/(asce)nh.1527-6996.0000027).
- [38] H.G. Goersch, U. Werner, Empirische Untersuchung der Realisierbarkeit von Maßnahmen zur Erhöhung der Selbstschutzzfähigkeit der Bevölkerung, in: Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, 2011. Bonn.
- [39] G. Perez-Fuentes, E. Verrucci, H. Joffe, A review of current earthquake and fire preparedness campaigns: what works?, in: Proceedings of the International Conference on Dynamics of Disasters, Kalamata, Greece, 2016, 29 June–2 July.
- [40] H. Joffe, H.W.W. Potts, T. Rossetto, C. Doğulu, E. Gul, G. Perez-Fuentes, The Fix-it face-to-face intervention increases multihazard household preparedness cross-culturally, *Nat. Human Behav.* 3 (2019) 453–461, <https://doi.org/10.1038/s41562-019-0563-0>.
- [41] M.T. Kinatader, E.D. Kuligowski, P. A. Reneke, R.D. Peacock, Risk perception in fire evacuation behavior revisited: definitions, related concepts, and empirical evidence, *Fire Sci. Rev.* 4 (2015) 1–26, <https://doi.org/10.1186/s40038-014-0005-z>.
- [42] E. Kuligowski, Predicting human behavior during fires, *Fire Technol.* 49 (2013) 101–120, <https://doi.org/10.1007/s10694-011-0245-6>.
- [43] M. Choi, S. Lee, M. Park, H.-S. Lee, Effect of dynamic emergency cues on fire evacuation performance in public buildings, *J. Infrastruct. Syst.* 24 (2018), 04018029, [https://doi.org/10.1061/\(asce\)is.1943-555x.0000449](https://doi.org/10.1061/(asce)is.1943-555x.0000449).
- [44] O.I. Adeleye, Fire disaster preparedness of public buildings in Ibadan metropolis, Nigeria, *Open For. Sci. J.* 5 (2020), <https://doi.org/10.23954/osj.v5i2.2249>.
- [45] M. Tancogne-Dejean, P. Lacleme, Fire risk perception and building evacuation by vulnerable persons: points of view of laypersons, fire victims and experts, *Fire Saf. J.* 80 (2016) 9–19, <https://doi.org/10.1016/j.firesaf.2015.11.009>.
- [46] W.K. Chow, Aspects of fire safety in ultra highrise buildings, *Int. J. Eng. Perform. -Based Fire Codes* 6 (2004) 47–52.
- [47] G. Proulx, Why Building Occupants Ignore Fire Alarms, Institute for Research in Construction, National Research Council of Canada, Ottawa, ON, Canada, 2000.
- [48] S. Hahm, D. Knuth, D. Kehl, S. Schmidt, The impact of different natures of experience on risk perception regarding fire-related incidents: a comparison of firefighters and emergency survivors using cross-national data, *Saf. Sci.* 82 (2016) 274–282, <https://doi.org/10.1016/j.ssci.2015.09.032>.
- [49] K. Hodsoll, U. Nayak, The perception of fire risk by older people and its impact on relevant fire safety education, *Int. J. Consum. Prod. Saf.* 6 (1999) 159–168, <https://doi.org/10.1076/1076-1076.6.3.159.7539>.
- [50] K. Mróz, I. Hager, K. Korniejenko, Material solutions for passive fire protection of buildings and structures and their performances testing, *Procedia Eng.* 151 (2016) 284–291, <https://doi.org/10.1016/j.proeng.2016.07.388>.
- [51] E.A. Wolters, B.S. Steel, D. Weston, M. Brunson, Determinants of residential firewise behaviors in central Oregon, *Soc. Sci. J.* 54 (2017) 168–178, <https://doi.org/10.1016/j.soscij.2016.12.004>.
- [52] E. Wolters A., B. Steel S., D. Weston, M. Brunson, Determinants of residential Firewise behaviors in Central Oregon, *Soc. Sci. J.* 54 (2) (2017) 168–178.
- [53] M.R. Greenberg, D.F. Schneider, Gender differences in risk perception: effects differ in stressed vs. Non-stressed environments, *Risk Anal.* 15 (1995) 503–511, <https://doi.org/10.1111/j.1539-6924.1995.tb00343.x>.
- [54] C.R. Harris, M. Jenkins, Gender differences in risk assessment: why do women take fewer risks than men? *Judgm. Decis. Mak.* 1 (2006) 48–63.
- [55] J.L. Hitchcock, Gender differences in risk perception: broadening the contexts, *Risk* 12 (2001) 179.
- [56] P.E. Gustafson, Gender differences in risk perception: theoretical and methodological perspectives, *Risk Anal.* 18 (1998) 805–811, <https://doi.org/10.1111/j.1539-6924.1998.tb01123.x>.
- [57] A. Holgersson, D. Sahovic, B.-I. Saveman, U. Björnstig, Factors influencing responders' perceptions of preparedness for terrorism, *Disaster Prev. Manag. Int. J.* 25 (2016) 520–533, <https://doi.org/10.1108/dpm-12-2015-0280>.
- [58] M.C. Ho, D. Shaw, S. Lin, Y.C. Chiu, How do disaster characteristics influence risk perception? *Risk Anal. Int. J.* 28 (2008) 635–643.
- [59] J. Bryan L., et al., Behavioral response to fire and smoke, in: Philip DiNenno (Ed.), The Society of Fire Protection Engineers (SFPE) handbook of Fire Protection Engineering, Society of Fire Protection Engineers, 2002, pp. 315–341.
- [60] G. Fernandez, A.M. Tun, K. Okazaki, S.H. Zaw, K. Kyaw, Factors influencing fire, earthquake, and cyclone risk perception in Yangon, Myanmar, *Int. J. Disaster Risk Reduc.* 28 (2018) 140–149.
- [61] P. Jenkins, S. Laska, G. Williamson, Connecting future evacuation to current recovery: saving the lives of older people in the next catastrophe, *Generations* 31 (2007) 49–52.
- [62] J.D. Flynn, Characteristics of Home Fire Victims, National Fire Protection Association, Quincy, MA, USA, 2010.
- [63] A.P. Harpur, K.E. Boyce, N.C. McConnell, An investigation into the circumstances surrounding fatal dwelling fires involving very young children, *Fire Saf. J.* 61 (2013) 72–82, <https://doi.org/10.1016/j.firesaf.2013.08.008>.
- [64] H. Tran, I. Lambie, C. Best, A. Krynen, Naked flames: university students' peer norms about unsafe fire behavior, *Fire Saf. J.* 102 (2018) 11–17, <https://doi.org/10.1016/j.firesaf.2018.10.001>.
- [65] L. Warda, M. Tenenbein, M.E.K. Moffatt, House fire injury prevention update. Part I. A review of risk factors for fatal and non-fatal house fire injury, *Inj. Prev.* 5 (2) (1999) 145–150.
- [66] M.F. Ballesteros, M.L. Jackson, M.W. Martin, Working toward the elimination of residential fire deaths: the centers for disease control and prevention's smoke alarm installation and fire safety education (SAIFE) program, *J. Burn Care Rehabil.* 26 (2005) 434–439, <https://doi.org/10.1097/01.bcr.0000176966.94729.80>.
- [67] S.-W. Chien, G.-Y. Wu, The strategies of fire prevention on residential fire in Taipei, *Fire Saf. J.* 43 (2008) 71–76, <https://doi.org/10.1016/j.firesaf.2007.04.004>.
- [68] T. Squires, A. Busuttil, Can child fatalities in house fires be prevented? *Inj. Prev.* 2 (1996) 109–113, <https://doi.org/10.1136/ip.2.2.109>.
- [69] L. Chernichko, L.D. Saunders, S. Tough, Unintentional house fire deaths in Alberta 1985–1990: a population study, *Can. J. Public Health* 84 (1993) 317–320.
- [70] E.Y.Y. Chan, H.C.Y. Lam, P.P.W. Chung, Z. Huang, T.K.C. Yung, K.W.K. Ling, C.P. Chiu, Risk perception and knowledge in fire risk reduction in a dong minority rural village in China: a Health-EDRM Education Intervention Study, *Int. J. Disaster Risk Sci.* 9 (2018) 306–318.
- [71] J.-P. Mullis, T.S. Duval, K. Bovalino, Tornado preparedness of students, nonstudent renters, and nonstudent owners: issues of PrE theory, *J. Appl. Soc. Psychol.* 30 (2000) 1310–1329, <https://doi.org/10.1111/j.1559-1816.2000.tb02522.x>.
- [72] M. Choi, S. Lee, S. Hwang, M. Park, H.-S. Lee, Comparison of emergency response abilities and evacuation performance involving vulnerable occupants in building fire situations, *Sustainability* 12 (2020) 87, <https://doi.org/10.3390/su12010087>.
- [73] V.A. Johnson, K.R. Ronan, D.M. Johnston, R. Peace, Evaluations of disaster education programs for children: a methodological review, *Int. J. Disaster Risk Reduc.* 9 (2014) 107–123, <https://doi.org/10.1016/j.ijdrr.2014.04.001>.

- [74] F. Kagawa, D. Selby, Ready for the storm: education for disaster risk reduction and climate change adaptation and mitigation, *J. Econ. Sustain. Dev.* 6 (2012) 207–217.
- [75] K.R. Ronan, E. Alisic, B. Towers, V.A. Johnson, D. Johnston, Disaster preparedness for children and families: a critical review, *Curr. Psychiatr. Rep.* 17 (2015) 1–9, <https://doi.org/10.1007/s11920-015-0589-6>.
- [76] K. Shiwaku, R. Shaw, R.C. Kandel, S.N. Shrestha, A.M. Dixit, Future perspective of school disaster education in Nepal, *Disaster Prev. Manag. Int. J.* 16 (2007) 576–587.
- [77] O. Nyankuru, S. Omuterema, N. Nyandiko, Evaluating the effectiveness of fire safety training on occupants' response to fire in selected public buildings in Nairobi county, Kenya, *Int. J. Sci. Basic Appl. Res.* (2017) 166–173.
- [78] J. Collymore, Disaster management in the Caribbean: perspectives on institutional capacity reform and development, *Environ. Hazards* 10 (2011) 6–22, <https://doi.org/10.3763/ehaz.2011.0002>.
- [79] V. Cvetković, J. Martinović, Upravljanje U Nuklearnim Katastrofama (Nuclear Disaster Management), Naučno-Stručno Društvo za Upravljanje Rizicima u Vanrednim Situacijama, Belgrade, Serbia, 2021.
- [80] V.M. Cvetković, K. Andrić, Edukacija građana o smanjenju rizika od katastrofa korišćenjem multimedijalnih sadržaja-društvene igre, kompjuterske igrice i simulacije [Educating citizens about disaster risk reduction by using multimedia content—board games, computer games and simulations], *Vojno Delo* 71 (2019) 122–151.
- [81] K. Shiwaku, G. Fernandez, Roles of school in disaster education, in: *Disaster Education*, Emerald Group Publishing Limited, Bingley, UK, 2011.
- [82] M.A. Durand, J. Green, P. Edwards, S. Milton, S. Lutchmun, Perceptions of tap water temperatures, scald risk and prevention among parents and older people in social housing: a qualitative study, *Burns* 38 (2012) 585–590, <https://doi.org/10.1016/j.burns.2011.10.009>.
- [83] H. Roberts, K. Curtis, K. Liabo, D. Rowland, C. DiGiuseppi, I. Roberts, Putting public health evidence into practice: increasing the prevalence of working smoke alarms in disadvantaged inner city housing, *J. Epidemiol. Community Health* 58 (2004) 280–285, <https://doi.org/10.1136/jech.2003.007948>.
- [84] T. Prashant, L. Tharmarajan, *The Essential Aspect of Fire Safety Management in High Rise Buildings*, Faculty of Civil, 2007.
- [85] F.J.M. Sierra, J.C. Rubio-Romero, M.C.R. Gámez, Status of facilities for fire safety in hotels, *Saf. Sci.* 50 (2012) 1490–1494, <https://doi.org/10.1016/j.ssci.2012.01.006>.
- [86] V. Cvetković, Upravljanje Rizicima U Vanrednim Situacijama [Disaster Risk Management], Naučno-Stručno Društvo za Upravljanje Rizicima u Vanrednim Situacijama, Belgrade, Serbia, 2020.
- [87] V. Cvetković, Taktika Zastite i Spasavanja u Katastrofama, Naučno-Stručno Društvo za Upravljanje Rizicima u Vanrednim Situacijama, Beograd, Serbia, 2022.
- [88] G. Wachinger, O. Renn, C. Begg, K. Kuhlicke, The risk perception paradox-implications for governance and communication of natural hazards, *Risk Anal.* 33 (2013) 1049–1065, <https://doi.org/10.1111/j.1539-6924.2012.01942.x>.
- [89] K. Fridolf, D. Nilsson, People's subjective estimation of fire growth: an experimental study of young adults, *Fire Saf. Sci.* 10 (2011) 10–161.
- [90] J.K. Kim, D.-H.A. Han, Study of introducing virtual reality for fire disaster preparedness training, *J. Conver. Cult. Technol.* 4 (2018) 299–306.
- [91] V. Allareddy, C. Peek-Asa, J. Yang, C. Zwerling, Risk factors for rural residential fires, *J. Rural Health* 23 (2007) 264–269, <https://doi.org/10.1111/j.1748-0361.2007.00100.x>.
- [92] A.K. Donahue, C. Eckel, R. Wilson, Ready or not? How citizens and public officials perceive risk and preparedness, *Am. Rev. Publ. Adm.* 44 (2014) 89S–111S, <https://doi.org/10.1177/0275074013506517>.
- [93] V. Basolo, L.J. Steinberg, R.J. Burby, J. Levine, A.M. Cruz, C. Huang, The effects of confidence in government and information on perceived and actual preparedness for disasters, *Environ. Behav.* 41 (2009) 338–364, <https://doi.org/10.1177/0013916508317222>.
- [94] Y. Yue, K. Dong, X. Zhao, X. Ye, Assessing wild fire risk in the United States using social media data, *J. Risk Res.* 24 (2019) 972–986, <https://doi.org/10.1080/13669877.2019.1569098>.
- [95] M. Schmidt, Investigating risk perception: a short introduction, Ph.D. Thesis, in: M. Schmidt (Ed.), *Loss of Agro-Biodiversity in Vavilov Centers, with a Special Focus of Genetically Modified Organisms (GMOs)*, 2004. Vienna, Austria.
- [96] P. Chhetri, J. Corcoran, R.J. Stimson, R. Inbakaran, Modelling potential socio-economic determinants of building fires in south East Queensland, *Geogr. Res.* 48 (2010) 75–85, <https://doi.org/10.1111/j.1745-5871.2009.00587.x>.
- [97] C.R. Jennings, Social and economic characteristics as determinants of residential fire risk in urban neighborhoods: a review of the literature, *Fire Saf. J.* 62 (2013) 13–19, <https://doi.org/10.1016/j.firesaf.2013.07.002>.
- [98] I. Lambie, C. Best, H. Tran, J. Ioane, M. Shepherd, Risk factors for fire injury in school leavers: a review of the literature, *Fire Saf. J.* 77 (2015) 59–66, <https://doi.org/10.1016/j.firesaf.2015.07.004>.
- [99] D. Shai, Income, housing, and fire injuries: a census tract analysis, *Publ. Health Rep.* 121 (2006) 149–154, <https://doi.org/10.1177/003335490612100208>.
- [100] M. Teo, A. Goonetilleke, A. Ahankob, K. Deilami, M. Lawie, Disaster awareness and information seeking behaviour among residents from low socio-economic backgrounds, *Int. J. Disaster Risk Reduc.* 31 (2018) 1121–1131, <https://doi.org/10.1016/j.ijdrr.2018.09.008>.
- [101] C. Kahanji, R.S. Walls, A. Cicone, Fire spread analysis for the 2017 Imizamo Yethu informal settlement conflagration in South Africa, *Int. J. Disaster Risk Reduc.* 39 (2019) 101146, <https://doi.org/10.1016/j.ijdrr.2019.101146>.
- [102] S. Löffel, R. Walls, Development of a full-scale testing methodology for benchmarking fire suppression systems for use in informal settlement dwellings, *Int. J. Disaster Risk Reduc.* 45 (2020) 101451, <https://doi.org/10.1016/j.ijdrr.2019.101451>.
- [103] N.F. Quiroz, R. Walls, A. Cicone, M. Smith, Fire incident analysis of a large-scale informal settlement fire based on video imagery, *Int. J. Disaster Risk Reduc.* 55 (2021) 102107, <https://doi.org/10.1016/j.ijdrr.2021.102107>.
- [104] S. Stevens, L. Gibson, D. Rush, Conceptualising a GIS-based risk quantification framework for fire spread in informal settlements: a Cape Town case study, *Int. J. Disaster Risk Reduc.* 50 (2020) 101736, <https://doi.org/10.1016/j.ijdrr.2020.101736>.
- [105] Y. Jiang, S. Zilioli, J. Rodriguez-Stanley, K.M. Peek, M.P. Cutchin, Socioeconomic status and differential psychological and immune responses to a human-caused disaster, *Brain Behav. Immun.* 88 (2020) 935–939, <https://doi.org/10.1016/j.bbi.2020.05.046>.
- [106] I.A. Rana, A. Jamshed, Z.I. Younas, S.S. Bhatti, Characterizing flood risk perception in urban communities of Pakistan, *Int. J. Disaster Risk Reduc.* 46 (2020) 101624, <https://doi.org/10.1016/j.ijdrr.2020.101624>.
- [107] I.T. Elo, Social class differentials in health and mortality: patterns and explanations in comparative perspective, *Annu. Rev. Sociol.* 35 (2009) 553–572, <https://doi.org/10.1146/annurev-soc-070308-115929>.
- [108] V.M. Cvetković, N. Nikolić, A. Ocal, J. Martinović, A. Dragašević, A predictive model of pandemic disaster fear caused by coronavirus (COVID-19): implications for decision-makers, *Int. J. Environ. Res. Publ. Health* 19 (2022) 652, <https://doi.org/10.3390/ijerph19020652>.
- [109] V.M. Cvetković, Risk perception of building fires in Belgrade, *Int. J. Disaster Risk Manag.* 1 (2019) 81–91.
- [110] D. Tong, D. Canter, The decision to evacuate: a study of the motivations which contribute to evacuation in the event of fire, *Fire Saf. J.* 9 (1985) 257–265, <https://doi.org/10.1016/0379-711290036-0>.
- [111] W.-N. Wu, K. Chang, Y.E. Tso, If only we knew what we know: factors for mobilizing citizen participation in community-based emergency preparedness, *Chin. Publ. Adm. Rev.* 7 (2016) 77–109.
- [112] G. Tyeckhan, Declaration of Helsinki: The ethical cornerstone of human clinical research, *Indian J. Dermatol. Venereol. Leprol.* 69 (3) (2003) 245–247.
- [113] T.K. Kim, T test as a parametric statistic, *Kor. J. Anesthesiol.* 68 (2015) 540–546, <https://doi.org/10.4097/kjae.2015.68.6.540>.
- [114] R.M. Heiberger, E. Neuwirth, One-way ANOVA, in: M. Richard, E.N. Heiberger (Eds.), *R through Excel*, Springer, New York, NY, USA, 2009, pp. 165–191.
- [115] M. Yuan, A. Ekici, Z. Lu, R. Monteiro, Dimension reduction and coefficient estimation in multivariate linear regression, *J. R. Stat. Soc. Ser. B Stat. Methodol.* 69 (2007) 329–346, <https://doi.org/10.1111/j.1467-9868.2007.00591.x>.
- [116] B.G. Tabachnick, L.S. Fidell, J.B. Ullman, *Using Multivariate Statistics*, fifth ed., Pearson, Boston, MA, USA, 2007.
- [117] D. Wales, O.F. Thompson, Human behaviour in fire: should the fire service stop telling and start listening? *Int. J. Emerg. Serv.* 2 (2013) 94–103, <https://doi.org/10.1108/ijes-07-2012-0030>.
- [118] S.W. Gilbert, D.T. Butry, Identifying vulnerable populations to death and injuries from residential fires, *Inj. Prev.* 24 (5) (2018) 358–364.

- [119] Baćanović, V. Gender Analysis of the Impact of the 2014 Floods in Serbia. Organization for Security and Cooperation in Europe (OSCE). Available online: <https://www.osce.org/serbia/135021?download=true> (accessed on 4 December 2018).
- [120] V.M. Cvetković, G. Roder, A. Ocal, P. Tarolli, S. Dragičević, The role of gender in preparedness and response behaviors towards flood risk in Serbia, *Int. J. Environ. Res. Publ. Health* 15 (2018) 2761, <https://doi.org/10.3390/ijerph15122761>.
- [121] E. Obcarskaite, Women in civil protection: gender equality and gender mainstreaming—towards prosperity in the Baltic sea region, in: E. Obcarskaite, A. J. Olsson (Eds.), *Handbook on: Gender in Civil Protection*, KOPA Publishing: Karmelavos sen, Lithuania, 2014, ISBN 978-91-981257-8-8.
- [122] F.H. Norris, J.L. Perilla, G.E. Ibañez, A.D. Murphy, Sex differences in symptoms of posttraumatic stress: does culture play a role? *J. Trauma Stress* 14 (2001) 7–28.
- [123] M. Ramzan, A. Ansar, S. Nadeem, Dengue epidemics: knowledge perhaps is the only key to success, *J. Ayub Med. Coll. Abbottabad* 27 (2015) 402–406.
- [124] A.K. Donahue, C.C. Eckel, R.K. Wilson, Ready or not? How citizens and public officials perceive risk and preparedness, *Am. Rev. Publ. Adm.* 44 (4) (2014) 89S–111S.
- [125] V. Cvetković, K. Ronan, R. Shaw, M. Filipović, R. Mano, J. Gačić, V. Jakovljević, Household earthquake preparedness in Serbia: a study of selected municipalities, *Acta Geogr. Slov.* 59 (2019) 27–42, <https://doi.org/10.3986/ags.5445>.
- [126] A. Hasofer, I. Thomas, Analysis of fatalities and injuries in building fire statistics, *Fire Saf. J.* 41 (2006) 2–14, <https://doi.org/10.1016/j.firesaf.2005.07.006>.
- [127] R. Nakao, R. Kawasaki, M. Ohnishi, Disaster preparedness of hillside residential area in Nagasaki city, Japan: evaluations regarding experiences related to a fire, *J. Rural Med.* 14 (2019) 95–102, <https://doi.org/10.2185/jrm.2997>.
- [128] T.M. Al-Rousan, L.M. Rubenstein, R.B. Wallace, Preparedness for natural disasters among older US adults: a Nationwide survey, *Am. J. Publ. Health* 104 (2014) 506–511, <https://doi.org/10.2105/ajph.2013.301559>.
- [129] S.Y. Mousavi, S. Kariminia, S. Toghyani, Explaining the relationship between demographic characteristics and risk perception (RP) to reduce the fire hazards (case study: Office high-rise buildings in Tehran), *Environ. Manag. Hazards* 5 (2018) 1–15, <https://doi.org/10.22059/jhsci.2018.249646.319>.
- [130] R. Muttarak, W. Pothisiri, The role of education on disaster preparedness: case study of 2012 Indian ocean earthquakes on Thailand's and andaman coast, *Ecol. Soc.* 18 (2013) 16, <https://doi.org/10.5751/es-06101-180451>.
- [131] H. Setyawan, A.M. Nugraheni, S. Haryati, I. Qadrijati, R. Fajarani, T.L. Wardani, T.B. Atmojo, I. Sjarifah, The correlation of fire knowledge toward disasters response and preparedness practice among hospital nurse Klaten Central Java, Indonesia, *IOP Conf. Ser. Earth Environ. Sci.* 724 (2021), 012041, <https://doi.org/10.1088/1755-1315/724/1/012041>.
- [132] J.R. Littlewood, M. Alam, S. Goodhew, G. Davies, The 'safety gap' in buildings: perceptions of Welsh fire safety professionals, *Energy Proc.* 134 (2017) 787–796.
- [133] L. Warda, M. Tenenbein, M.E.K. Moffatt, House fire injury prevention update. Part. I. A review of risk factors for fatal and non-fatal house fire injury, *Inj. Prev.* 5 (1999) 145–150, <https://doi.org/10.1136/ip.5.2.145>.
- [134] D. Knuth, S. Schulz, D. Kietzmann, K. Stumpf, S. Schmidt, Better safe than sorry—emergency knowledge and preparedness in the German population, *Fire Saf. J.* 93 (2017) 98–101, <https://doi.org/10.1016/j.firesaf.2017.08.003>.
- [135] L.-S. Hung, Gender, intra-household dynamics, and household hurricane preparedness: an exploratory study employing a dyadic interview approach, *Int. J. Disaster Risk Sci.* 9 (2018) 16–27, <https://doi.org/10.1007/s13753-018-0158-9>.
- [136] M. Tyler, P. Fairbrother, Power within households: gender inequality and wildfire preparedness, in: *Wildfire and Power*, Routledge, London, UK, 2018, pp. 145–160.
- [137] Behavioral response to fire and smoke, in: J.L. Bryan, P.J. DiNenno, D. Drysdale, C.L. Beyler (Eds.), *SFPE Handbook of Fire Protection Engineering*, The Society of Fire Protection Engineers, Gaithersburg, MA, USA, 2020, pp. 315–341.
- [138] M. Kobes, *Zelfredzaamheid Bij Brand: Kritische Factoren Voor Het Veilig Vluichten Uit Gebouwen*, Boom Juridische Uitgevers, 2018.
- [139] J.M. Kihila, Fire disaster preparedness and situational analysis in higher learning institutions of Tanzania, *J. Disaster Risk Stud.* 9 (2017) 1–9, <https://doi.org/10.4102/jamba.v9i1.311>.
- [140] G.T. Kyle, G.L. Theodori, J.D. Absher, J. Jun, The influence of home and community attachment on firewise behavior, *Soc. Nat. Resour.* 23 (2010) 1075–1092, <https://doi.org/10.1080/08941920902724974>.
- [141] O. Renn, Risk perception and risk management, in: *Proceedings of the 14ème Congrès de la Conférence Mondiale de l'énergie*, Montréal, QC, Septembre 1989, pp. 17–22. Canada.
- [142] S.W. Gilbert, D.T. Butry, Identifying vulnerable populations to death and injuries from residential fires, *Inj. Prev.* 24 (2017) 358–364, <https://doi.org/10.1136/injuryprev-2017-042343>.