

Risk Perception of Building Fires in Belgrade

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Abstract: Starting from the frequency and seriousness of fire in residential buildings in the area of Belgrade, this paper presents the results of research on the perception of citizens' risks of fires in residential buildings. A series of 322 face-to-face interviews were conducted at the beginning of 2017 in Belgrade. The results of multivariate regressions of risk perception of building fires show that the most important predictor of perceived risk of building fires is fear, age, employment status, income level, and marital status. The remaining variables (e.g., gender, education level, previous experience) did not have a significant impact. Respondents who have fear, are married, have higher income, and elderly people perceive the higher level of risk in relation to those who have no fear, live alone, have lower incomes and younger persons. The results of the research can be used to improve the level of safety of citizens by raising their awareness of the risks of fires in housing facilities by designing and using appropriate educational programs and campaigns.

Keywords: *fire risk; perception; building fires; Belgrade.*

1. Introduction

The perception of the risk of fires in residential buildings is a significant and determining dimension of the process of planning the protection and rescue of people. Lack of awareness about the level of probability and possible consequences of fire can result in a high level of non-taking preventive measures by citizens. According to official data obtained from the RS Emergency Situations Department, the number of fires in 2017 increased by 50 percent compared to the same period in the previous year. For example, while in 2016 about 3,643 fires were recorded in the area of Belgrade, two years later, in 2018 the number of fires increased to 5,142 (Secretariat for Administration - Statistics Division). In order to reduce the level of risk from the occurrence of material and non-material consequences of fire, it is necessary to continuously improve the level of

preparedness that implies possession of appropriate knowledge on combustion processes, methods of fire fighting, preventive measures; written or oral response plans in such situations; evacuation plan; fire alarm devices and fire extinguishers, etc.

The risk of a fire incident implies potential direct or indirect losses on social entities or the system, and the risk can be expressed in the form of a mathematical formula for the probability of the emergence of economic, social or environmental consequences in a given period of time (Cardona, 2004). On the other hand, understanding risk includes a lot of uncertainty, and terms such as risk assessment, risk assessment, and risk analysis are used mixed in the description of techniques and processes in risk management (Frosdick, 1997). In theory, the concepts of hazards and risks are intertwined and risk is taken as a synonym for danger, although the risk besides danger implies additional elements (Smith & Petley, 2009). In the literature, three main questions about risk are also mentioned (Garrick, 2008): What can go wrong?; How likely is that to happen? What are the consequences if this happens? The first question, what can go wrongly refers to possible scenarios of the event, "risk scenarios". The second question relates to testing the likelihood of such scenarios, while the third focuses on the possible consequences of such scenarios. The meaning of the word "risk" is conditioned by diverse cultural and ethnic characteristics. For example, Arabic "risq" means everything that is given from the Lord and from which the lesson can be learned (Kedar, 1970).

In Latin, "risicum" describes the specific scenario facing the sailor in trying to avoid dangerous reefs. It is usually used with a negative meaning (Alexander, 2013). Slovic (1993) points out that people react to extraordinary situations that perceive, and if such perceptions are wrong, then their actions will most likely be misguided. Kirkwood (1994) emphasizes that there is a difference between an objective and a scientific risk assessment from one and perceiving the public about risks on the other. A wider and unprofessional public does not possess sufficient expertise to comprehend and understand the risks of emergencies. Scientists use established risk assessment methodologies and are able to rationally, impartially and objectively identify and assess risks. That is precisely why there is no matching of subjective assessments of the risk of emergencies that have a wider public and objective estimates that are alluded to by experts.

2. Literary review

In the literature, there are a number of papers in which the level of readiness of citizens to respond to disasters and their perceptions of risk is examined (Cvetković, 2017, Cvetković & Filipović, 2017a, 2017b, 2018, Khan, 2008, Kumar

& Newport, 2007; Simpson, 2008). The results of a certain number of studies show that there is a link between risk awareness and preventive measures (Cvetković & Filipović, 2018, Murphy, 2007, Olympia, Rivera, Heverley, Anyanwu, & Gregorits, 2010 Anyanwu & Gregorits, 2010; Paton 200). In a very interesting study, Wachinger et al. (2013) explain why some studies on disasters did not find a connection between risk perception and protective action: occupants perceive high risks but do not decide to engage in protective action; instead, they believe the authorities will help them; do not think they have enough resources to engage in protective actions. Also, there are a lot of theoretical models related to risk perception and human behavior in emergency situations caused by fires: heuristic-systematic models, model of transactional stress, model of decision action, models of reasoned actions, model hazard chain action, security motivation system etc. (Kinateder, Kuligowski, Reneke, & Peacock, 2014). In literature, there are different results related to which factors have the impact on the perception of risk as poorly designed alarm systems may not induce a high enough perceived risk (Kuligowski, 2011) and visibility or vertical vs. horizontal distance may be important confounding factors (Kinateder et al., 2014). The results show that men have lower awareness of risks than women (Cvetković, Roder, Öcal, Tarolli, & Dragičević, 2018; Firing, Karlsdottir, & Christian Laberg, 2009; Slovic, 2010; Weber, Blais, & Betz, 2002). When the age is concerned, the results show that older adults are better at risk assessment than younger adults since they have to practice risk-related decisions more frequently in their daily lives (Kinateder et al., 2014; McLaughlin & Mayhorn, 2014; Wilson, Gott, & Ingleton, 2013). Previous experience is one of the most important predictors; however, in certain situations, previous experience without personal injuries can reduce the level of risk perception (Wachinger, Renn, Begg, & Kuhlicke, 2013). Also, in the results of various studies, the correlation of perception of risk with the emotional state was confirmed (Mathews & MacLeod, 1985) and knowledge (Cvetković et al., 2019; Lindell & Whitney, 2000).

3. Methods

In the creation of the questionnaire, a detailed analysis of the results of a large number of previous research on fires began (Gandit, Kouabenan, & Caroly, 2009; Merino, Caballero, Martínez-de Dios, Ferruz, & Ollero, 2006; Slovic, 1987; Taylor & Daniel, 1984). As a part of general work, questions were given regarding demographic and socioeconomic characteristics of citizens: gender (male or female), age (younger, middle-aged or older), level of education (secondary, higher or college), marital status, married or single) and employment status (employed or unemployed), while in the second part there was a question regarding the

assessment of the level of risk of fire in the residential objects. In the course of 2017, 322 citizens were surveyed by multi-point random sampling. In the first phase, several buildings were selected in the central parts of Belgrade in which the survey will be conducted. Then, it was decided to conduct interviews with two household members in apartments (odd numbers). Household members were selected according to the gender criteria (one female and one male), fulfilled the condition of adulthood. Compared to the structure of the sample, women are more represented (59.3%) than men (40.7%). However, if we look at the full structure of the population, where women are also more represented, it can be said that the sample is representative. By analyzing the age of the respondents in the sample, it is noted that the youngest respondents (55.9%) are the most frequent ones. Compared to the level of education, those with secondary education (57.7%) are mostly represented. Respondents who were not related were more represented (43.5%) than those who were in a relationship (27.9%) or married (27.9%). Regarding the status of employment, there are relatively more non-employed respondents (53.4%) (Table 2).

Table 2. Basic demographic and socio-economic information about respondents (n = 322).

Variables	Category	N	%
Gender	Men	131	40.7
	Women	191	59.3
Age	Younger (18-38)	180	55.9
	Middle-aged (39-59)	80	24.8
	Older (преко 59)	62	19.2
Level of education	Secondary School	186	57.7
	College	73	22.6
	Faculty	63	19.5
Marital status	Not in relationship	140	43.5
	In relationship	90	27.9
Employment status	Married	92	28.5
	Yes	150	46.5
	No	172	53.4

After completion of the entry, preliminary analyses and data checks were carried out in order to eliminate the technical errors that occurred during the data entry. During the first step, basic descriptive statistical analyses were conducted with the aim of testing the frequency of individual responses. Multivariate regression analysis and Pearson correlation were used to identify the extent to

which the perceived risk was associated with the next demographic and socio-economic variable.

4. Results

When questioned whether they knew or were aware of the risks of fires in residential buildings, 320 respondents answered with an average rating of $M = 1.84$, $SD = .363$. Out of the total number of respondents, 84.5% pointed out that there is no risk of a fire in relation to 15.5% who say the opposite. With a goal to test the central hypothesis of which different factors is predictive variable in the perception of building fires, a multivariate regression analysis was used to identify the extent to which perceived risk was associated with the following demographic and socioeconomic variables: gender, age, education level, income level, marital status, employment, previous experience and level of fear. According to Table 2 categories, males, young, low-income people, married, people with fear and previous experience, have been coded as 1; 0 have been assigned otherwise. Previous analyses showed that the assumptions of normality, linearity, multicollinearity, and homogeneity of variance had not been violated. The results of the multivariate regressions (Table 2) of risk perception of building fires show that the most important predictor is fear ($\beta=.370$), and it explains 37% variance, then age ($\beta=-0.253$), it explains 25.3% variance, employment status ($\beta=-0.183$), it explains 18.3% variance, than income level ($\beta=-0.169$), it explains 16.9% variance, income level ($\beta=-0.169$), it explains 16.9% variance, marital status ($\beta=-0.152$), it explains 15.2% variance of risk perception of building fires. The remaining variables (e.g., gender, education level, previous experience) did not have significant effects. This model ($R^2=0.182$, $Adj. R^2=.163$, $F=9.59$, $t=25.6$, $p=0.000$) with all mentioned independent variables explains the 16.3% variance of risk perception of building fires.

Table 2. Multivariate regression analysis results in risk perception of building fires (N=322).

Predictor variable	Risk perception of building fires			
	B	SE	β	Sig.
Gender	-.040	.046	-.055	.379
Age	-.244	.085	-.253	.004*
Education level	.067	.040	.091	.095
Income level	-.124	.040	-.169	.002**
Marital status	-.111	.039	-.152	.004*
Employment	-.169	.079	-.123	.052
Previous experience	.020	.50	.022	.691
Level of fear	-.277	.042	-.370	.000**

* $p < .05$. ** $p < .01$.

A further correlation between risk perception of building fires and age, income level, marital status and level of fear was also investigated using the Pearson linear correlation coefficient. Preliminary analyses are carried out to further satisfy the assumptions about the normality, linearity, and homogeneity of variance. The results obtained show that there is a correlation between the marital status ($r = .180$, $n = 322$, $p < .001$), level of fear ($r = .308$, $n = 322$, $p < .000$), income level ($r = -.198$, $n = 322$, $p < .000$), and age ($r = .250$, $n = 322$, $p < .000$). Respondents who have fear ($M = 1.93$, $SD = .255$) are more likely to perceive the risks of fire compared to those who do not ($M = 1.70$, $SD = .320$). Further analysis of the results obtained shows that respondents who are in a married ($M = 2.35$, $SD = .189$) are more likely to perceive the risks of fire in residential buildings than non-married respondents ($M = 1.78$, $SD = .219$). Respondents with lower incomes ($M = 1.76$, $SD = .329$) perceive less than the respondents with a higher level of income ($M = 1.90$, $SD = .389$). Compared to the age of the respondents, it was found that older respondents, in relation to younger respondents, perceived the risks of fires in residential buildings.

5. Discussion

In the research perception of building fires, the hypothesis that perception of risk is influenced by certain demographic and socioeconomic factors pointed out by the results of previous research (Cvetković et al., 2019; Kineder et al., 2014; Lindell & Whitney, 2000 Mathews & MacLeod, 1985; McLaughlin & Mayhorn, 2014; Wachinger et al., 2013; Wilson et al., 2013). The obtained results show that the perception of the risk of fire in residential buildings is influenced by fear, the age of respondents, income level, marital status, while gender, level of education and previous experience are not. The most important predictor of perception of risk are fears of disasters that have a decisive importance in the process of risk assessment (Cvetković, Öcal, & Ivanov, 2019). It can be assumed that respondents who have real fears from the consequences of fire are more informed and aware of the risk of the occurrence of such events. For this reason, fears can be a serious driver of people in taking preventive measures to protect their lives and property (Lerner & Keltner, 2001). Of course, additional research is needed in terms of the motivation of people who do not feel fear of fire in residential buildings, in order to understand the nature of their motivational factors better.

The results showed that respondents in the marital community are more likely to perceive the risks of fires in residential buildings than those who are not in a marital union. It can be assumed that respondents who are married care about the risks and safety of their close person. In addition, it can be pointed out that respondents who are married discuss such topics more often, which contributes to a higher level of perception of risk. Further research needs to be carried out to deepen the nature of the relationship between marital status and the perception of risk. Compared to the age of the respondents, the results obtained are in agreement with the results of previous studies (Kinatered et al., 2014; McLaughlin & Mayhorn, 2014; Wilson et al., 2013). It can also be assumed that older people, due to their limitations in speed and efficiency of movement, lower physiological resistance, and rich experience, perceive the risks to a greater extent in order to be adequately prepared for responding to such situations. Further research needs to be carried out and examined which are the prevailing factors of the risk perception difference in young people and the elderly. In the end, one should not forget the very interesting results of the research, according to which respondents with lower incomes are less likely to perceive the risks of fire. It can be assumed that they are burdened with existential issues and that they are not able to pay attention to other security issues. Of course, in the next research, it is necessary to examine the more detailed nature and the way of the impact of the level of income on the perception of risk.

6. Conclusions

Understanding the perception of the risk of fire in residential buildings is a prerequisite for effective disaster risk management and for improving the safety of citizens. If citizens do not have awareness of the risks of a fire, it is simply impossible to expect a high level of their willingness to react in such situations. The results of the survey clearly show that respondents who have fear, are married, have higher income, and older people are more likely to perceive the level of risk compared to those who have no fear, live alone, have lower incomes, and younger people. In accordance with the results obtained, it is necessary to devise and implement certain educational programs and campaigns that would primarily target citizens who live alone, have lower incomes and younger ones. Naturally, given the generally low level of awareness among all citizens of such risks, it is necessary to undertake various activities in order to change the situation in a positive way. The survey that was conducted in 2017 also had its limitations that looked at the random selection of respondents in several dozen endangered buildings from the city of Belgrade. In future research, it is necessary to include housing facilities in different parts of the city so that the sample of the respondents would be even more representative. The scientific implications of the research are reflected in the creation of a solid empirical and theoretical knowledge fund that allows the results to be compared with other similar research carried out in different social and cultural circumstances and ambiances. The importance of research for improving the safety of citizens is very high and it is necessary to undertake certain proactive activities in a shorter period of time in order to educate and train citizens in time to react in such situations.

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