

Abstract

In the paper a statistical analysis of fire data results is introduced. The data come from the territory of the Slovak Republic and are analysed for the period 2004 – 2013. They are analysed from 3 principal points of view: fire numbers, fire losses and fire casualties. The results show that the trends related to fire numbers, fire losses and casualties are not linear. The relation to the rate of fires in the natural environment is dependent in particular on meteorological situation, however their rate increases also in the spring season due to grass burning in the countryside. The reason for the gradual increase of fire rate in industry and dwellings is probably the usage of new materials, as in industrial technology and furniture situated in dwellings. The increase/decrease of fire rate is relatively closely related to the trend of fire-fighter interventions, which is also introduced in the paper. The fire losses depend mostly on prompt sightings, announcing the fire and intervention of fire-fighters.

Keywords: fire, statistical analysis, fire number, fire losses, fire casualties

Introduction

The statistical analysis of fire incident data in Slovakia is possible to provide based on data collected, updated and summarized by the responsible persons that is to say the fire investigators, who are situated in the particular District and Regional Directories of Fire and Rescue Corps and Fire Research Institute of the Ministry of Interior, itself. They provide their activities in relation to several law regulations. Among the laws regulating the fire investigation field belong:

Act no. 314/2001 Coll. on Fire Protection, as amended.

This law imposes a state administration authority for fire protection (Ministry of Interior SR, Regional Headquarters and District Headquarters of Fire and Rescue Corps) which performs investigation of fires during the implementation of the state fire inspection. Whereas, the investigation of fires in particularly serious cases is imposed directly by the Ministry of the Interior, respectively to the Fire Research Institute of the Ministry

of Interior SR, and in severe cases to Regional Headquarters of Fire and Rescue Corps. Besides this it authorizes the state fire authorities performing fire supervision to enter the premises and facilities of a legal entity or natural person for the purpose of fire investigation and to request necessary cooperation from managers and other employees of a legal entity and natural person or company. It also allows penalties of any legal entity or natural person business owner, if he does not give notice of every fire that occurred on the premises, spaces and on equipment under his ownership, under his management or use to the competent District Headquarters without delay. To a natural person it allows for a reprimand or a penalisation if he does not give notice of a fire that occurred in a dwelling he owns or uses to the competent District Headquarters of Fire and Rescue Corps without delay, or does not allow the state fire authorities performing fire supervision to carry out necessary actions in investigating the causes of fires.

- Regulation of the Ministry of Interior SR no. 121/2002 Coll. on Fire Prevention, as amended.

This regulation writes in its fourth section, § 41 “Fire investigation,” further elaborates the provisions of Act no. 314/2001 Coll., which concerns the fire investigation. It establishes that if in any fire there is detected the cause of its origin, on the basis of data and knowledge a report can be drawn up on any action, expert review or fire expertise. It specifies the content of the expert review and fire expertise and their use, which is mainly in determining the fire prevention measures and statistical analyses of fires.

- President of FRC SR Instructions no. 60/2002 on identifying the causes of fires, on the processing of documentation and statistical monitoring and analysis of fires, as amended in the Instruction no. 25/2005.

It provides methodical guidelines to govern the Regional and District Headquarters in investigating the causes of fires, processing documentation on fires and statistical monitoring and drawing up analyses of fires. It coordinates the activities among the Presidium of the Fire and Rescue Corps, Regional and District Headquarters of Fire and Rescue Corps and the Fire Research Institute of the Ministry of Interior, the institutions which are responsible for fire investigation in Slovakia.

Material and methodology

The data on fire incidents have been collected, summarized and evaluated at the Fire Research Institute of the Ministry of Interior of the Slovak Republic since 1996. The data are collected and summarized from all the District and Regional Headquarters of the Fire and Rescue Corps of the Slovak Republic. Those data represent a type of input data required to complete the form describing the fire brigade interventions in the CoordCom environment that are used for operational management of fire and rescue activities.

The data, after collection at the Fire Research Institute, are processed and analysed in STATZPP software environment. The core of this program is a database of fire incidents, on which it is possible to provide statistical analyses. This program is mostly used to produce the fire statistics, which is annually published in the form of print publication by the Institute.

Results related to fire numbers, causes, losses and casualties

Number of fires

Number of fires in Slovakia over the past decade has had a fluctuating trend (Figure 1). Most fires occurred in 2012 (14 413 fires) and in 2007 (14 366 fires). At least fires occurred in 2010 (9 851 fires). Table 1 gives an overview on fires and response activities of Fire and Rescue Corps (FRC) in tabular form.

Figure 1. Number of fires in Slovakia in period 2004 – 2013 (Source: Author)

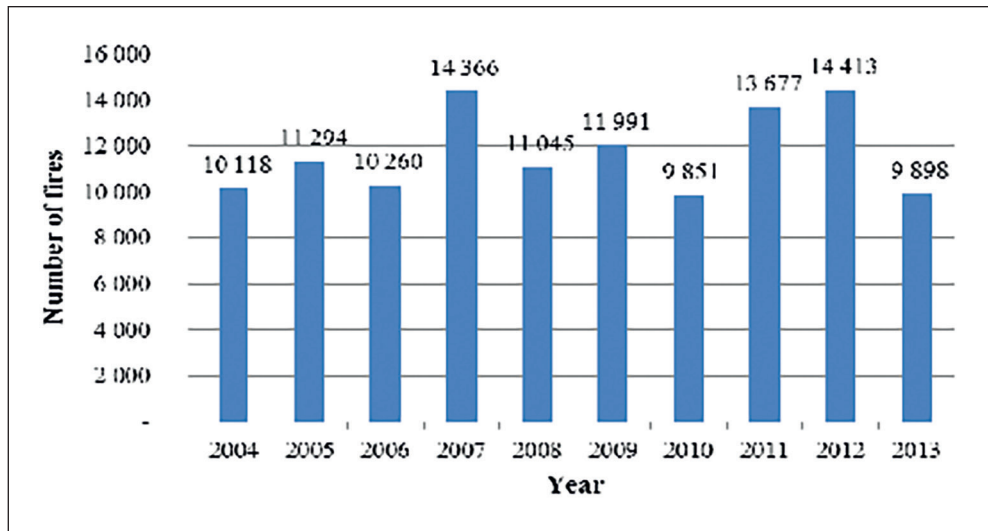


Table 1. Fires in general (Source: Author)

Year	Population	Overall number of fire-fighter interventions		Overall number of fires		Number of fires a year per 1,000 inhabitants
		Number of fire-fighter interventions	[%]	Number of fires	Percentage share of fires in the overall number of fire-fighter interventions [%]	
2004	5 384 822	29 834	100	10 118	2004	5 384 822
2005	5 389 180	29 099	100	11 294	2005	5 389 180
2006	5 393 637	27 652	100	10 260	2006	5 393 637
2007	5 400 998	33 535	100	14 366	2007	5 400 998
2008	5 412 254	31 075	100	11 045	2008	5 412 254
2009	5 424 925	31 970	100	11 991	2009	5 424 925
2010	5 435 273	35 654	100	9 851	2010	5 435 273
2011	5 404 322	35 115	100	13 677	2011	5 404 322
2012	5 410 836	33 520	100	14 413	2012	5 410 836
2013	5 415 949	30 323	100	9 898	2013	5 415 949

From the overall information on fire-fighter interventions and number of fires we can see that the highest share of fire interventions was reached in 2007 and 2012 (43 %). The lowest share was reached in 2010 (28%). The average percentage share of fire interventions in the overall number of fire-fighters interventions is 37% for the period 2004 – 2013. Every one thousand inhabitants has from 2 to 3 fires a year. Table 2 gives information on the size of fires.

In Slovakia we do not use any classification system of fires based on their extent, in terms of fire site extent or damages amount expressed in EUR, however this information is registered. Therefore, the information on small and medium fires is introduced as a total number of fire incidents, from which the number of large fires, where the damage reached the value of 300,000 EUR or where more than 10 people were hurt or at least 3 people died, was counted off.

The average number of large fires which occurred in the last ten years was set to 13 fires. As it is evident from Table 2, the relatively highest number of large fires occurred

Table 2. Size of fires (Source: Author)

Year	Overall number of fires		Small and medium fires (S&MF)		Large fires (LF)	
	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]
2004	10 118	100	10 104	99.86	14	0.14
2005	11 294	100	11 281	99.88	13	0.12
2006	10 260	100	10 245	99.85	15	0.15
2007	14 366	100	14 353	99.91	13	0.09
2008	11 045	100	11 030	99.86	15	0.14
2009	11 991	100	11 978	99.89	13	0.11
2010	9 851	100	9 838	99.86	13	0.14
2011	13 677	100	13 666	99.92	11	0.08
2012	14 413	100	14 401	99.92	12	0.08
2013	9 898	100	9889	99.91	9	0.09

in 2006 and 2008 (15 fires), however those years do not show the highest number of fire incidents in the analysed period. The lowest number of large fires occurred in 2013 (9 large fires).

It is necessary to mention that the number of large fires in particular years of the period represent only the fires that occurred in dwellings or in industry and where the expert group of the Fire Research Institute used their expertise on establishing the cause of fire.

The registered places of fire occurrence are classified to the following categories: buildings for health, buildings for services and personal care, buildings for education, science and research, buildings for culture, education and physical education, administrative buildings, buildings for common accommodation (hotels, lodging houses, rooming houses), buildings for trade and public catering, buildings for social security, historic and religious buildings and structures, housing stock, family houses, other buildings for permanent housing, buildings for production, energy and water management buildings, transportation and communications buildings, dedicated storage building, buildings for livestock and crop production, facilities for storage of agricultural products, animal feed

and fertilizers, objects outside buildings, buildings for garaging and maintenance of motor vehicles, garages outside buildings (brick, metal, portable, etc.), garages as part of other buildings, agricultural areas and products, forests, other natural environment, landfills and garbage, roads, communications, tunnels and bridges, waterworks and waterways (rivers, embankments, dams, etc.), other unclassified. Table 3 shows five joint main places of fire occurrence in Slovakia and the percentage share of fires in the overall for period 2004 – 2013.

Table 3. Main places of fire occurrence (Source: Author)

Year	Overall number of fires		Natural environment		Landfills and waste		Single, multiply dwellings		Roads, tunnels and bridges		Public facility utilities	
	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]
2004	10 118	100	3 733	37	2 227	22	1 467	15	985	10	301	3
2005	11 294	100	4 611	41	2 389	21	1 502	13	1 083	10	439	4
2006	10 260	100	3 220	31	2 645	26	1 593	16	1 103	11	485	5
2007	14 366	100	6 839	48	3 148	22	1 738	12	1 214	8	477	3
2008	11 045	100	3 522	32	2 907	26	1 749	16	1 189	11	482	4
2009	11 991	100	4 678	39	2 606	22	1 673	14	1 281	11	475	4
2010	9 851	100	3 433	35	2 088	21	1 645	17	1 182	12	445	5
2011	13 677	100	6 338	46	2 664	19	1 763	13	1 248	9	439	3
2012	14 413	100	7 380	51	2 527	18	1 710	12	1 153	8	426	3
2013	9 898	100	3 669	37	2 202	22	1 612	16	1 068	11	356	4

In the analysed period, the fires mostly occurred in the natural environment in about 40% share of the overall number of fire incidents. In the natural environment category are included the fires of agricultural land and products, forest fires and fires in other natural environment, e.g. garden, vineyard, etc. Specified places of fire occurrence show a relatively more even trend in the particular years of the analysed period.

Losses due to fires

In Slovakia, the direct damages caused by fire are registered, and also the salvaged values. In Figure 2, is presented the development of direct fire damage amount expressed in EUR currency for last 10 year period.

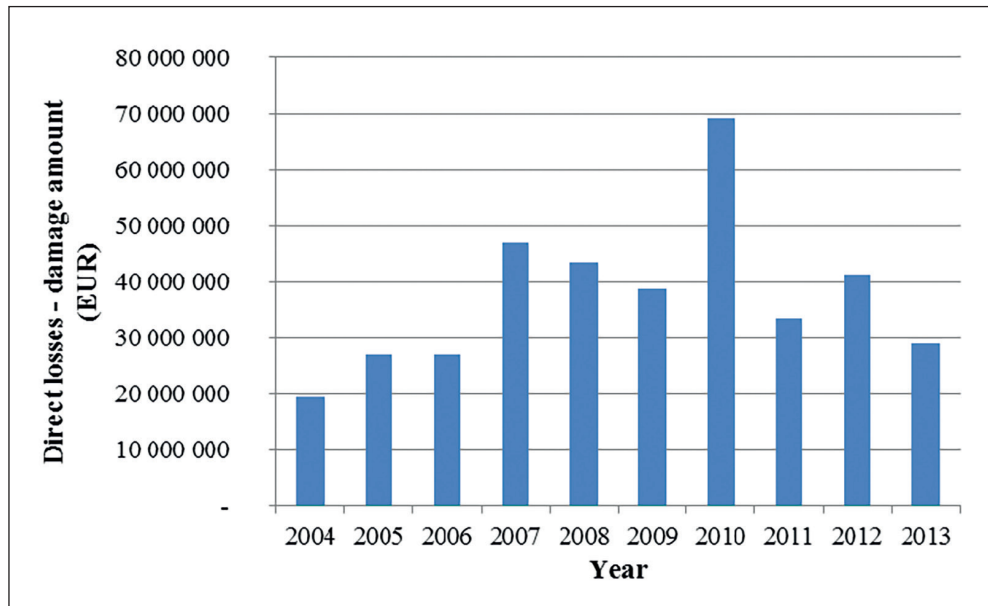


Figure 2. Direct losses development (Source: Author)

It is evident that the highest damages occurred in 2010, however the number of fires was the lowest in relation to the analysed period. The amount of direct losses this year was affected particularly by three major fires. The first one broke out in a goods store and caused fire damage of 6,000,000 EUR. The second fire was in the Institute of Virology of the Slovak Academy of Sciences and caused damage amounting to 15,000,000 EUR. The third largest fire occurred in an industrial plant for production of ammonia. Direct damage caused by the explosion was estimated at 12,000,000 EUR. In comparison to direct losses, there are the salvaged values. They are presented for particular years in Figure 3.

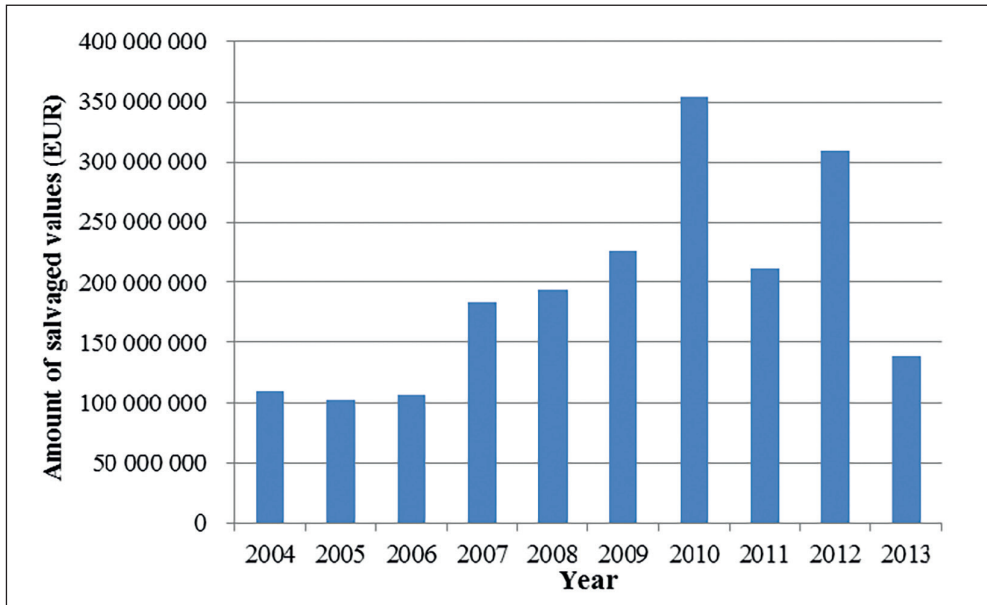


Figure 3. Salvaged values development (Source: Author)

Salvaged values express sum of values of long-term fixed assets and other values salvaged from fire. Table 4 introduces the losses due to fires expressed also as a percentage share of the total gross national product (GNP) value.

Table 4. Losses due to fires (Source: Author)

Year	GNP*		Losses due to fires	
	Amount [mil. EUR]	[%]	Amount [mil. EUR]	[%]
2004	45 161.4	100	19.5	0.04
2005	49 314.2	100	27.0	0.05
2006	55 001.6	100	27.1	0.05
2007	61 449.7	100	46.9	0.08
2008	66 842.4	100	43.5	0.07
2009	62 794.4	100	38.8	0.06
2010	65 897.0	100	69.2	0.11
2011	68 974.2	100	33.6	0.05
2012	71 096.0	100	41.4	0.06
2013	72 134.1	100	29.0	0.04

* GNP – Source: Statistical Office of SR

Causes of fires

From the fire investigation point of view, the Fire Research Institute registers the following groups of causes of fire: intentionally set fire (arson), children and mentally ill persons, negligence and carelessness of adults, failure and inadequate state of heating appliance, flue gas ducting and chimneys, operational or technical failures, spontaneous ignition, explosions followed by fire, other monitored causes, unknown cases. The main causes of fire are introduced in Table 5.

From Table 5 it is evident the significant difference between the percentage share of the negligence and carelessness of adults' fire causes and the other fire causes. The average percentage share in the analysed period reached a value of 64%. The second and third main cases of fire reached the average value of 12% in case of operational and technical failures and 10% in case of intentionally set fires. Solid fuel appliance fires reached the average percentage share value of 5% and the fires caused by failure, inadequate state of heating appliance, flue gas ducting and chimneys are at a value of 4%. The remaining 5% are represented by other groups of fire cause.

In Figure 4 is shown the overall number of fires (for period 2004 – 2013) caused by the most often occurring causes of fires.

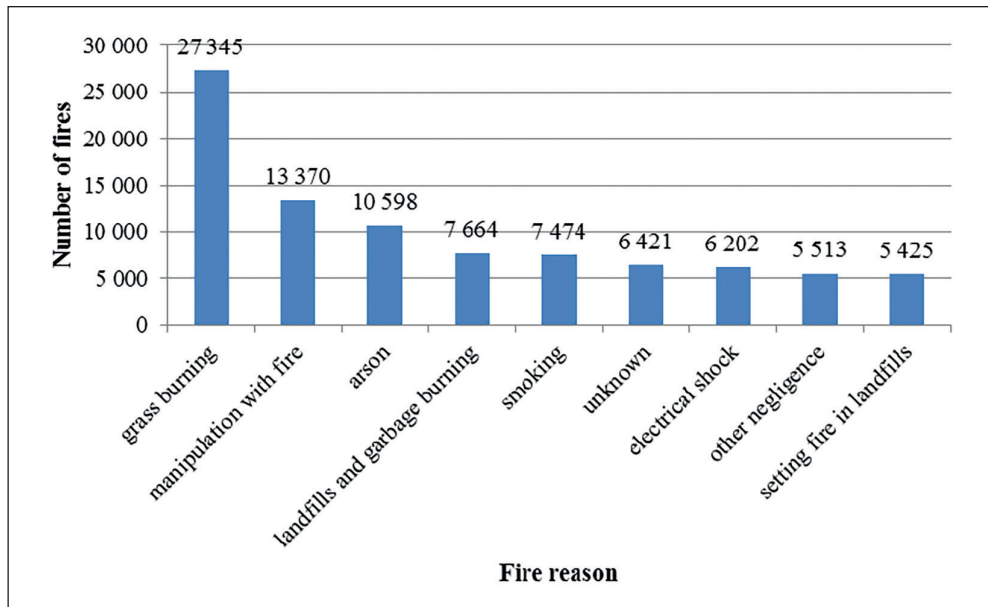


Figure 4. Overall number of fires caused by the most often occurring causes of fires
(Source: Author)

Table 5. Main causes of fire (Source: Author)

Year	Overall number of fires		Negligence and carelessness of adults		Operational and technical failures		Intentionally set fire		Solid fuel appliance		Failure, inadequate state of heating appliance, flue gas ducting and chimneys	
	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]	Number of fires	Percentage share of fires in the overall [%]
2004	10 118	100	6 275	62	1 337	13	976	10	331	3	314	3
2005	11 294	100	7 607	67	1 286	11	866	8	403	4	383	3
2006	10 260	100	6368	62	1 435	14	979	10	467	5	455	4
2007	14 366	100	10 077	70	1 494	10	1 089	8	464	3	455	3
2008	11 045	100	6 903	62	1 439	13	1 173	11	471	4	457	4
2009	11 991	100	7 707	64	1 407	12	1 237	10	533	4	512	4
2010	9 851	100	5 871	60	1 270	13	1 016	10	616	6	586	6
2011	13 677	100	9 109	67	1 335	10	1 137	8	687	5	675	5
2012	14 413	100	9 494	66	1 286	9	1 347	9	720	5	709	5
2013	9 898	100	5 409	55	1 264	13	1 297	13	675	7	673	7

Results introduced in Figure 4 showed that grass burning, assigned to the negligence and carelessness of adults, is still yet the most often occurring cause of fire occurrence. Grass burning fires occur every year during the spring season and often become forest fires, in particular in wildland-urban interface.

Casualties

From the statistical processing of data on fire incidents that are registered in STATZPP software environment, results show the development of the number of fire injured victims and fire deaths (fatalities). This trend was analysed for the last 10 year period.

In Figure 5 is introduced the overview related to the number of fire injured victims and in Figure 6 the number of fire deaths.

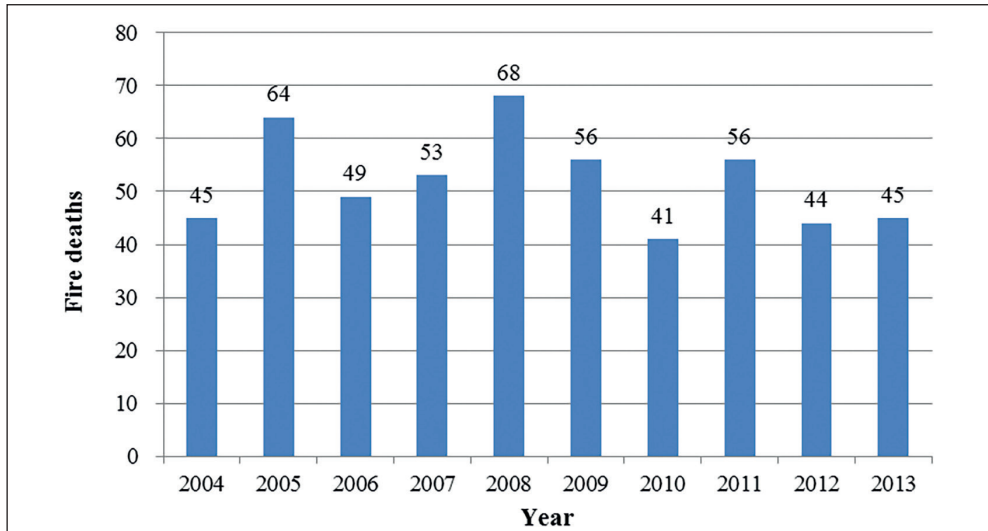


Figure 5. Development of fire deaths number in Slovakia (Source: Author)

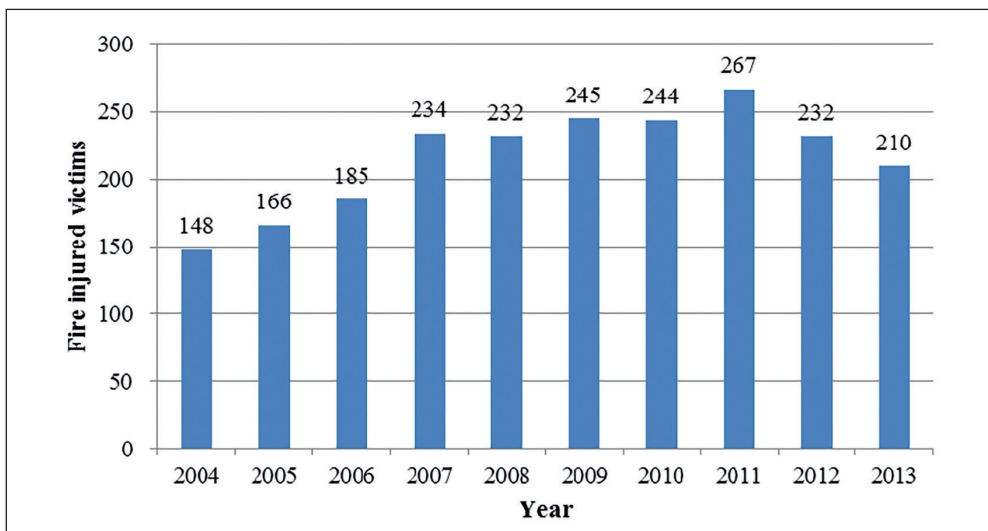


Figure 6. Development of fire injured victim number in Slovakia (Source: Author)

From both figures the results show a relatively high number of injured and victim fatalities of fire. This situation remains despite the information, warnings and previous experience of people. The reason is that people are not sufficiently aware of fire danger and fire impacts.

In Table 6 is introduced the number of fatalities and the fire injured victims. There is introduced information on the number of fire injured victims expressed in terms of overall number of victims, victims per 100,000 inhabitants and victims per 1,000 fires. The same expression is used for fire fatalities.

Table 6. The number of fatalities and the injured (Source: Author)

Year	Population	Overall number of fires	Fire injured victims			Fire deaths		
			Number of victims	Victims per 100 thous. inh.	Victims per 1 thous. fires	Number of victims	Victims per 100 thous. inh.	Victims per 1 thous. fires
2004	5 384 822	10 118	148	3	15	45	1	4
2005	5 389 180	11 294	166	3	15	64	1	6
2006	5 393 637	10 260	185	3	18	49	1	5
2007	5 400 998	14 366	234	4	16	53	1	4
2008	5 412 254	11 045	232	4	21	68	1	6
2009	5 424 925	11 991	245	5	20	56	1	5
2010	5 435 273	9 851	244	4	25	41	1	4
2011	5 404 322	13 677	267	5	20	56	1	4
2012	5 410 836	14 413	232	4	16	44	1	3
2013	5 415 949	9 898	210	4	21	45	1	5

Since 2007, the number of fire injured victims has not decreased under 200. Comparing the number of victims per 100,000 inhabitants, the fire injured victims number was 3-5 times higher than fatalities in number. The highest number of fire injured victims occurred in 2011 (267 victims) and the lowest number in 2004 (148 fatalities). On the other hand, the highest number of fire fatalities occurred in 2008, (68 victims), and the lowest number in 2010, (41 fatalities).

Conclusions

The paper contains a summary of the information on fire incidents rate, complete with information on fire-fighters intervention rate, number of fire losses and casualties in Slovakia in the period 2004–2013. Those data can be further used in fire risk analyses as in the industrial safety sphere as in the civil protection sphere, even in the environment protection sphere.

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Szlovákia tűzeseteinek statisztikai elemzése a 2004–2013 közötti időszakban

ŠTEFAN GALLA

Absztrakt

A cikk tűzre vonatkozó adatok statisztikai elemzését mutatja be. Az adatok a Szlovák Köztársaság területéről származnak 2004 és 2013 közötti időszakból. Három fő szempont szerint kerülnek az adatok elemzésre: tűzesetek száma, tűz által okozott kár és a halálos áldozatok száma. Az eredmények azt mutatják, hogy a három szempont közötti összefüggés nem lineáris. Természetes környezetben a tűzesetek száma különösen függ az időjárástól, de a számuk tavasszal is növekszik az avartüzeknek köszönhetően. Az ipari tűzesetek és a lakástüzek számának fokozatos emelkedése valószínűleg az ipari technológiában és a bútorkészítésben használt új anyagoknak tulajdonítható. A tűzesetek számának emelkedése/csökkenése szorosan kapcsolódik a tűzoltói beavatkozásokban megjelenő irányzatokhoz is, amivel szintén foglalkozik a cikk. A tűz által okozott kár főként a tűz mihamarabbi észlelésétől, tűzjelzéstől és tűzoltói beavatkozástól függ.

Kulcsszavak: tűz, statisztikai elemzés, tűzesetek száma, tűz által okozott kár, tűz halálos áldozatai