IFV Instituut Fysieke Veiligheid

EUROPEAN FIRE SAFETY ALLIANCE

Fatal residential fires - part 2

An inventarisation of next research steps

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Introduction

Background

Since 2008 the Fire Service Academy (IFV) has been conducting research into fatal residential fires in the Netherlands. Figure 1 shows a model, based on scientific research, that describes four factors that influence fire safety (Fire Service Academy, 2018). These factors are related to human characteristics, building characteristics, fire characteristics and intervention characteristics. The model has been operationalized in (among other things) a questionnaire about fatal residential fires in the Netherlands. After ten years of research, the model has been proven robust and provides useful information for policy makers concerned with fire safety.

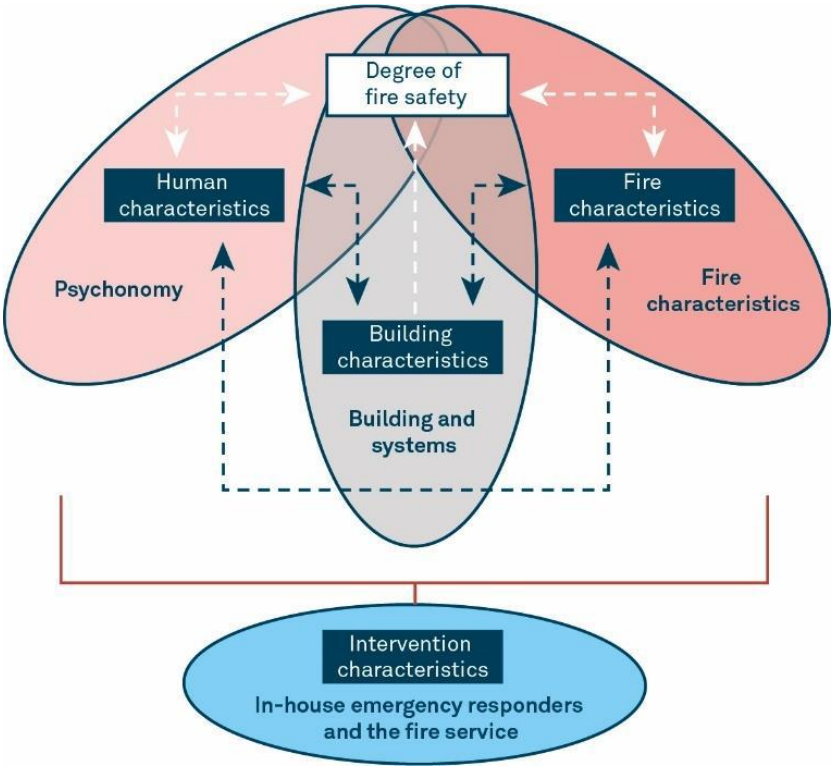

Figure 1: Model of influencing factors regarding the degree of fire safety

The European Fire Safety Alliance (EuroFSA) requested the Fire Service Academy to explore if information exists at a European level about fatal residential fires. This has resulted in a list of relevant databases and contact persons who can provide access to the data in the databases. Furthermore, (scientific) reports about residential fires in Europe have been collected, in which sometimes notions are made of residential fire victims. Based on this information, the research report *Fatal residential fires in Europe*. *A preliminary assessment of risk profiles in nine European countries* has been written and was published in November 2018. This report can be considered as the first step towards a better

understanding of fatal residential fires in Europe. In order to get a more reliable picture of fatal residential fires, the following four steps need to be considered:

1. Replacing the main characteristics by risk factors.
2. Working towards an analysis of the relationship between factors (crosslinks) to provide a better insight in causes and effects of fatal residential fires.
3. Collecting European-wide data.
4. Conformity in data collection (conformity in periods)

The first three steps will be discussed in this report. Conformity in data collection is a step that will be cared for in the follow-up research. The European Fire Safety Alliance (EuroFSA) asked the Fire Service Academy to *prepare* the taking of those steps, by making an overview of relevant objectives.

Objective

The objective of this report is to write a proposal for a follow-up research on fatal residential fires in Europe, which will focus on a number of specified risk factors and the relationship between these risk factors (crosslinks) in various countries. This report provides the following overviews:

> Overview of the characteristics necessary to form risk factors.
> Overview of which crosslinks are needed and why these are needed.
> Overview of preferred countries to be included in a follow-up research.
> Overview of our existing international network, and steps that need to be taken in order to strengthen and enhance this network.

1 Risk factors

So far, a variety of studies has been conducted in European countries that analyse the causes of, and identify risk factors for, fatal residential fires.

When identifying risk factors, their context should be considered. When the collected statistics are compared to other available data, for example national statistics or the total of non-fatal residential fires, and the data show a relatively high chance of being involved in a fatal residential fire, they can be called a risk factor. Incomparable data are main characteristics of fatal residential fires. In the next chapter, it will be explained per risk factor to what it should be related to. A combination of risk factors is called a risk profile. In this report, we will elaborate on risk factors in order to form a risk profile in the follow-up study.

In our last research (Fire Service Academy, 2018) we were able to identify age (the elderly) and gender (males) as risk factors in nine European countries, by comparing data of fatalities to the overall age and gender distribution. When it comes to *fire characteristics,* fires caused by smoking, fires originating in the living room and bedroom, and fires originating in furniture and clothing were significantly more often associated with fatal fires than non-fatal fires. Also in some European countries, living in an apartment is a significant risk factor.

Transforming the main characteristics defined in our previous research into risk factors will be the next step. A full list of identified main characteristics can be found in the research report *Fatal residential fires in Europe* (2018). By making use of governmental reports on national statistics, some new risk factors can be identified. Comparing data on fatal residential fires to data on non-fatal fires is also a way of identifying risk factors.
In the next three sections, the risk factors that we want to research are listed and clarified.

1.1 Risk factors: Human characteristics

- **Age and gender** of the fatality have already been identified as risk factors in our previous research. As all studied European countries collect information about age and gender of their population as well as of their fire fatalities (Fire Service Academy, 2018), comparative analyses can be conducted. It is of value to take into account the impact age and gender have on fatal residential fires.
- **Mobility, vision and hearing (disabilities).** International research indicates that people with an impairment of vision and/or hearing have a higher risk of dying in a residential fire, as they are less likely to discover signs of ignition in time and to adequately respond to the alarm of a smoke detector. Furthermore, people with impaired mobility have a small chance of escaping a residential fire safely without the aid of a physically fit person (Brandweeracademie & Nederlandse Brandwonden Stichting, 2015; Bryant & Preston, 2017). It will be worth exploring whether

disabilities, which might also be related to the age of the victim, can be identified as a risk factor in fatal residential fires on a European level. The results of such a study might have important implications for the development of fire prevention and detection and evacuation measures. For this analysis, data on the physical condition of fatalities and overall disability statistics are required.

- **Living situation; number of people at home.** Living alone is identified as a risk factor for fatal residential fires in the Netherlands. Here, almost 50% of the fatalities lived in a single household, and about two third of the fatalities was alone at home when a fatal fire ignited (Brandweeracademie, 2018). It could be valuable to find out by comparing national statistics on household composition to the living situation of fire fatalities, if people living alone are also overrepresented in international statistics on fatal residential fires.
- **Consumption of alcohol and drugs** significantly reduces the cautiousness and alertness of residents, making them less aware of risky situations and signs of a starting fire (Gilbert & Butry, 2016). Furthermore, (scientific) studies indicate that 'drugged' people might struggle with their orientation and physical coordination, making it more difficult to escape a burning house quickly. However, presently information on the alcohol and drug consumption of fire fatalities is only available for a limited number of European countries (see Fire Service Academy, 2018). It is our purpose to expand that limited number and to possibly indicate alcohol and drugs consumption as a general risk factor.

1.2 Risk factors: Building characteristics

- **Type of dwelling**. Our previous research on fatal residential fires in Europe indicates that in some countries, people living in apartments have a higher risk of dying in a fire than people living in other dwelling types (Fire Service Academy, 2018). To be able to draw any conclusions on 'type of dwelling' as a risk factor, housing and fire statistics from a larger sample should be analysed.
- **Special use of the house/dwelling**. In addition to the type of dwelling, about 50% of the European countries included in our previous research, collect information on any special use of the house, such as room rental, 24-hour care or home care. In the Netherlands, fatal residential fires occur more often at dwellings with special care (34%), while only 10% of the citizens get special care. 'Special use of the dwelling' can be considered as a risk factor in the Netherlands. We want to explore if the same applies for other European countries.
- **Number of smoke detectors.** Almost all countries included in our previous research collect data on the presence of a (working) smoke detector. In the Netherlands, the average number of households or homes with smoke detectors can be calculated and possibly also in other European countries. A follow-up research could address the question whether countries with a low number of households with working smoke detectors experience higher numbers of fatal residential fires per year. We expect this information to generate important implications for national laws and regulations on smoke detectors in residential buildings.

1.3 Risk factors: Fire characteristics

- **Smoking as a cause of fire**. So far, we have identified smoking as a risk factor for fatal residential fires in comparison to non-fatal fires in nine European countries (Fire Service Academy, 2018). It would be interesting to compare this again in the follow-up study in order to enhance previous statements.

1.4 Conclusion

We are aware that not all of these (possible) risk factors can be identified as such, as the required data might not all be available in Europe. Nevertheless, the above mentioned enumeration, summarized again below, provide the most realistic risk factors that can likely be identified. We would like to include these factors in our follow-up research:

- Age
- Gender
- Disabilities
- Living situation
- Consumption of alcohol and drugs
- Type of dwelling
- Special use of the dwelling
- The presence of working smoke detectors
- Smoking as a cause of the fire

2 Relationship between factors (crosslinks)

In this section, crosslinks are discussed. Crosslinks are combined risk factors that can provide more insight into the relationship between the causes and effects of fatal residential fires. In order to create a crosslink, two or more risk factors (including their categories) are linked to each other and their statistics compared.
In the next section, a list of crosslinks is provided. This list is arranged according to the characteristics belonging to the model mentioned in the introduction (Figure 1). The crosslinks in the list below are difficult to obtain. The list consists of the crosslinks that would be interesting to find, regardless of their chance to be found. One of the goals of the follow-up study is to fill in the blank cells in the tables with the crosslinks (see below) with the percentage of victims linked to that particular combination of factors.

2.1 Crosslinks between human characteristics

Fire response performance and type of household. The fire response performance is measured by ‘adequate’ and ‘inadequate’. Which classification the victim of the fatal fire gets, will be determined by the victim’s alertness (asleep or awake and influenced by or not influenced by drugs/alcohol) and the victim’s mental and physical ability to leave the house independently.
The type of the household consists of a ‘single’ composition and ‘other’. Single composition means that the victim lived alone.
It would be interesting to investigate if the combination of living alone and having an inadequate fire response performance result in a higher risk of being involved in a fatal residential fire.

Table 1: Crosslink between the factors ‘fire response performance’ and ‘type of household’

		Type of household	
		Single	Other
Fire response performance	Adequate		
	Inadequate		

Fire response performance and age. The age is divided into three categories, the first being 0-12 years, because we expect this group of age to have a limited ability to escape from a burning building without assistance. This also applies to the group of age 65 years and older. The third group consists of victims between the age of 13 and the age of 64.

Table 2: Crosslink between the factors 'fire response performance' and 'age'

		Age		
		0-12 years	13-64 years	65+ years
Fire response performance	Adequate			
	Inadequate			

2.2 Crosslink between building characteristics

The presence of a working smoke detector combined with the position of the inner door and fire response performance.
The presence of a smoke detector, as well as its functioning, is listed by 8 out of 9 countries. Unfortunately at this moment, the factor 'position of the inner door' is only collected by the Netherlands. In the follow-up research, we aim to collect data from more than 9 countries, thereby increasing the chance of finding more data about the position of the inner door of the room where the fire originates. As has been mentioned before, these factors partly determine the chance of being involved in fatal residential fire. Consequently, combining these risk factors can contribute to our understanding of fatal fires.

Table 3: Crosslink between the factors 'smoke detector and position of inner door' and 'fire response performance'

		Fire response performance	
		Adequate	Inadequate
Smoke detector and inner door	Present and closed		
	Present and open		
	Absent and closed		
	Absent and open		

2.3 Crosslinks between fire characteristics

Location of fire and location of victim.
The factor 'location of fire' is measured by the room where the fire originated. In the previous research from 2018, we found that 7 countries collect these data. The categories are determined by the previous results, namely the rooms in where the fire most often ignited. Also, the room where the victim was found (i.e. location of the victim) is registered by five countries. The reason for creating this crosslink is that it would be useful to know if there is a bigger chance of dying in a fire when being present in the same room as where that fire had started. That would indicate that the victim was not able or willing to flee the room with the fire.

Table 4: Crosslinks between the factors 'location of fire' and 'location of victim'

		Location of victim				
		Livingroom	Bedroom	Kitchen	Hallway	Storage
Location	Livingroom					
of fire	Bedroom					
	Kitchen					
	Hallway					
	Storage					

Cause of the fire and object of origin.
The relation between what caused the fire (for example, human behaviour- smoking) and in what object the fire started (for example the clothes of the victim) can enlighten us in understanding different causes of fatal residential fires.
The categories are determined by the most common causes and objects of fatal residential fires found in the last 10 years in the Netherlands (Brandweeracademie, 2018). Note that the categories should be interpreted broadly. A sofa is covered by 'chair or couch' and a toaster is covered by 'technical appliances'.

Table 5: Crosslinks between the factors ‘the cause of fire’ and ‘the object of origin’

		Object of origin				
		Chair or couch	Clothing or textile	Electrical appliances	Bed or matrass	Pan or fryer
Cause of fire	Human behaviour – smoking					
	Human behaviour – cooking					
	Human behaviour – open fire/candles					
	Technical failure					
	Explosion					

3 European sample

Our previous research is based on nine European countries, of which only four provided us with current data on fatal fires. As a result, most of our information is based on a small sample from Northern and Western Europe. To be able to create a more extensive, European wide risk profile, it would be necessary for countries in Southern and Eastern Europe to collect and share data on risk factors. In the next sections, we explain how we choose the sample size and plan to acquire representative data.

3.1 Sample size

Determining the appropriate sample size depends on the questions that need to be answered. Since it is our intention to summarize statistics collected by European countries, an educated guess of the sample size will suffice. This would not be the case if the study would also include statistical analyses. The number of collected data should be more or less in accordance with the size of the region they originate from. A minimum required sample size (with a confidence coefficient of 99%) would be 15% of the population. The population in this case is the population of Europe. To get to a sample size of at least 15% of the population, two or three countries per region would be sufficient.

3.2 Representative data

A first criterium for collecting representative data is that the intended country collects the data we are interested in. Secondly, the data that are most reliable and qualified.
Our aim is to collect data that represent European fire statistics. Consequently, we will look into two variables: the population density of a given country and its percentage of elderly (65 years and over). Our dataset in the follow-up study should be more or less similar to the mean per region. In other words: the measured variation within the countries should relate to the actual variation.
In order to collect representative data of Europe they should be collected equally from among the four areas of Europe, as defined by the UN (‘World Population Prospects’ 2019). The UN has categorized European countries into four main regions, based on their geographic position: Eastern, Western, Northern and Southern Europe. As has been said before, the aim is to include countries from all four geographic regions, as the location of countries might reflect cultural and metrological differences that affect fire statistics.
In the next section, a table is included that lists all countries in Europe, and countries of interest for our research underlined. We will actively contact them, hoping to gain insight into their fire statistics.

3.3 Countries of interest

Based on the criteria mentioned in the previous section, European countries of interest for our intended research are listed in table 6 below. Countries marked with an asterisk (*) have actively participated in our previous research by providing data on their fatal residential fires. These countries are also underlined in the table, as we would express our hopes that they will do so again in the future. Other underlined countries (but without the asterisk) can, in our opinion, contribute to the required sample size of 15% per region. As shown in the table, the region of northern Europe contains more than 3 underlined countries, due to the fact that all of these countries have delivered data to our research before, and will be contacted during the follow-up study again. There is some uncertainty about the participation of the United Kingdom, due to the possibility of Brexit. A withdrawal of the UK from the European Union will probably have consequences for our follow-up research. Their participation will have to be reviewed when the situation is clarified.

Table 6: European countries, sorted per region by the UN, with population percentage of the region, estimated population density and percentage of elderly citizens.

Region and country	Population of the region (%)	Est. population density 2019	Percentage of aged 65+
Eastern Europe	**100%**	**16,3**	**16,8%**
Belarus	3,22%	46,6	15,6%
Bulgaria	2,39%	64,5	21,5%
Czech	3,64%	138,4	20,1%
Hungary	3,30%	107,0	20,2%
Poland*	12,91%	123,7	18,7%
Republic of Moldova	1,38%	123,1	12,5%
Romania	6,60%	84,1	19,2%
Russian Federation	49,71%	8,9	15,5%
Slovakia	1,86%	113,5	16,7%
Ukraine	14,99%	75,9	16,9%
Northern Europe	**100%**	**62,1**	**19,0**
Channel Islands	0,16%	906,6	17,9%
Denmark*	5,46%	136,0	20,2%
Estonia*	1,25%	31,3	20,4%
Faroe Islands	0,05%	34,9	Unknown

Finland*	5,23%	18,2	22,6%
Iceland	0,32%	3,4	15,6%
Ireland	4,62%	70,9	14,6%
Isle of Man	0,08%	148,4	Unknown
Latvia	1,80%	30,7	20,7%
Lithuania	2,61%	44,0	20,6%
Norway*	5,09%	14,7	17,5%
Sweden*	9,49%	24,5	20,3%
United Kingdom*	63,85%	279,1	18,7%
Southern Europe	**100%**	**117,7**	**21,4**
Albania	1,89%	105,1	14,7%
Andorra	0,05%	164,1	Unknown
Bosnia and Herzegovina	2,17%	64,7	17,9%
Croatia	2,71%	73,8	21,3%
Gibraltar	0,02%	3370,1	Unknown
Greece	6,87%	81,3	22,3%
Holy See	0,00%	1815,9	Unknown
Italy	39,72%	205,9	23,3%
Malta	0,29%	1376,2	21,3%
Montenegro	0,41%	46,7	15,8%
North Macedonia	1,37%	82,6	14,5%
Portugal	6,71%	111,7	22,8%
San Marino	0,02%	564,3	Unknown
Serbia	5,75%	100,3	19,1%
Slovenia	1,36%	103,2	20,7%
Spain	30,66%	93,7	20,0%
Western Europe	**100%**	**180,2**	**20,8%**
Austria	4,58%	108,7	19,2%

Belgium*	5,90%	381,1	19,3%
France	33,31%	118,9	20,8%
Germany	42,71%	239,6	21,7%
Liechtenstein	0,02%	237,6	Unknown
Luxembourg	0,31%	237,7	14,4%
Monaco	0,02%	26150,3	Unknown
Netherlands*	8,74%	507,0	20,0%
Switzerland	4,39%	217,4	19,1%

4 Strengthening the network

For strengthening the network, we will maintain contact with the respondents of our earlier study. Following this report and in the follow-up, we will kindly request our existing network to provide additional statistical data on fatal residential fires in their country. As for the new contacts, we will explain them the importance of our work and what our goals are. This way, we hope to acquire them as new contacts who can provide us with fire statistics. New contacts can be gained by acquisition, meetings of the European Commission (FIEP) or through other international networks. Table 6 shows our existing network.

Table 6: List of existing network, per country and organisation the respondent is related to.

Index	Country		Organisation
1	Belgium	Jan De Saedeleer	FOD Binnenlandse Zaken
2	Denmark	Steen Hjere Nonnemann	Danish Emergency Management Agency
		Britt Løwe Nyborg	Danish Emergency Management Agency
3	Estonia	Tarvi Ojala	Estonian Rescue Board
		Mari Tikan	Siseministeerium
4	Finland	Johannes Ketola	Pelastusopisto (emergency services academy)
		Esa Kokki	Pelastusopisto (emergency services academy)
		Brita Somerkoski	University of Turku
5	France	Shane Lyons	Ei Electronics + French Residential Fire and Gas Manufacturers and Installers association GIFSID
6	Ireland	Susan Fitzgerald	Department of Housing, Planning and Local Government
8	Norway	Magne Sten Bjerkseth	Direktoratet for samfunnssikerhet og beredskap
		Reidun Mo	Direktoratet for samfunnssikerhet og beredskap
		Frode Folkedal	Direktoratet for samfunnssikerhet og beredskap
11	Scotland	Catrina Hamill	Scottish Fire and Rescue Service

12	Spain	Antonio Galán Penalva	Seguridad contra Incendios (PCI)
13	Sweden	Colin McIntyre	Swedish Civil Contingencies Agency, MSB
		Mikael Malmqvist	Swedish Civil Contingencies Agency, MSB
		Morgan Asp	Swedish Civil Contingencies Agency, MSB
14	Switzerland	Francesco Ferraro	Risk&Safety AG
15	United Kingdom	Deborah Lader	Home Office Incident Recording System (IRS)

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