The Perception of Socio-Demographic Risk Factors in Residential Fires

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Lund 2022

Title
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Report 5684
ISRN: LUTVDG/TVBB--5684--SE

Number of pages: 85, including appendices
Illustrations: 67

Keywords
Socio-demographic factors, social, factors, residential, fatal fires, inequality, perception

Abstract
In this thesis, it is investigated how the general public and fire safety experts perceive the fire fatality risk of different socio-demographic factors in residential settings. Their perceptions were compared with how the socio-demographic factors correlate with the risk of fatal fires in residents in reality. The purpose of this work was to find out where resources need to be directed and who needs to be educated further to prevent the fire risks connected to these socio-demographic factors. By comparing the real-life socio-demographic factors and the perception of socio-demographic factors, we hoped a broader perspective would be found and thereby enable preventive work against the inequalities in fire safety.

The methods used in the thesis are a literature review, a survey, and an interview study. Through the survey, information about the general public's risk perception was received. The interview study was conducted to investigate how fire safety experts perceive the factors correlated with the risk of fatal fires in residents. This was done by interviewing fire safety consultants and people who work in the rescue service. The literature review was performed to determine how socio-demographics correlate with the risk of fatal fires in residential buildings in reality.

After comparing the perception and reality, the main conclusion is that there are some areas in which the general public and fire safety experts have insufficient knowledge of how the socio-demographic factors impact the fire fatality risk. The general public were knowledgeable about the impacts of smoking, alcohol and old age. Their perception did, however, not match the reality on the following factors: Use of sedatives and antidepressants, children younger than five years old, country of origin, small and rural municipalities, education level, employment status, low income, lives alone and disabilities. The fire safety experts' perception did not match reality on the following factors: Country of origin, use of sedatives and antidepressants and type of municipality. Based on this, the general public and fire safety experts could be educated further on some socio-demographic factors to continue the work on reducing inequalities in fire safety.

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Förord

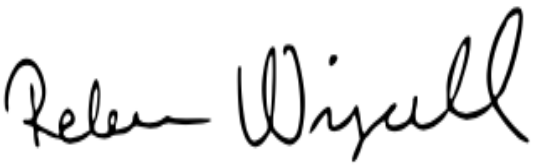
Följande är ett examensarbete för examen till Brandingenjör och Civilingenjör i Riskhantering vid Lunds Tekniska Högskola. Examensarbetet utfördes under höstterminen 2022 och omfattar 30 högskolepoäng.

Vi vill rikta ett stort tack till vår handledare Enrico Ronchi, universitetslektor vid avdelning för brandteknik, för värdefull vägledning och engagemang under arbetets gång.

Tack till alla brandexperter som avsatt tid och engagemang till att besvara våra intervjufrågor, er expertis har varit mycket värdefull.

Slutligen ett stort tack till alla enkätrespondenter som tagit sig tiden att svara på vår enkät, era bidrag har haft stor betydelse för vår studie.

Lund, december 2022



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Sammanfattning

Bostadsbränder är orsaken till ungefär 90 dödsfall i Sverige varje år (Runefors, 2020). Dödsfallen är oproportionerliga i förhållande till befolkningen där några specifika socio-demografiska grupper utgör en större del av dödsoffren (Runefors, 2020). Vissa av de sociodemografiska faktorerna som kan leda till en ökad risk för dödliga bostadsbränder är rökning, ålderdom, funktionsvariationer och alkoholanvändning (Runefors, 2020). Även andra sociodemografiska faktorer som att ha dålig ekonomi, arbetslöshet, en låg utbildning, ensamboende, manligt kön och typ av kommun utgör en större del av dödsfallen (Jonsson, 2018). Andra faktorer kan istället minska risken för dödsbränder. Människor som är födda utanför Norden och kvinnligt kön korrelerar till exempel med en minskad risk för dödsbränder (Jonsson, 2018). De senaste 60 åren har dödsfallen minskat, men vissa sociodemografiska grupper är fortfarande extra utsatta (Nilson & Bonander, 2020). För att fortsätta det förebyggande arbetet med att minska risken i dessa sociodemografiska grupper, kan fokuserade insatser genomföras gällande sociodemografiska faktorer som påverkar risken för att omkomma i bränder.

Syftet med examensarbetet var att undersöka hur allmänheten och brandexperter uppfattar risken med olika sociodemografiska faktorer som kan leda till dödsbränder i hemmet. Uppfattningarna om faktorernas påverkan jämfördes sedan med hur de olika sociodemografiska faktorerna korrelerar i verkligheten. Syftet med detta var att få reda på var resurserna måste riktas och vem som faktiskt måste utbildas för att förebygga brandriskerna kopplat till dessa sociodemografiska faktorer. Genom att allmänhetens och brandexperters uppfattning om de sociodemografiska faktorerna samt de faktiska värdena sammanlänkas skulle ett bredare perspektiv nås och därmed möjliggöra ett förebyggande arbete mot ojämställdhet i brandhändelser.

Metoderna som använts i examensarbetet är en litteraturstudie, enkätstudie och en intervjustudie. Genom enkätstudien samlades information in om hur allmänheten uppfattar att de sociodemografiska faktorerna korrelerar med risken för dödsbränder i hemmet. En intervjustudie genomfördes för att undersöka hur brandexperter ser på de sociodemografiska faktorerna och vilka de ansåg ha störst korrelation med brandrisken. Det gjordes genom semistrukturerade intervjuer där brandkonsulter och personer inom räddningstjänsten intervjuades. Litteraturstudien gjordes för att ta reda på hur de sociodemografiska faktorerna faktiskt korrelerar med risken för dödsbränder i bostäder.

Efter att uppfattningarna jämförts med verkligheten, drogs slutsatsen att det finns vissa områden där allmänheten har otillräcklig kunskap om hur de sociodemografiska faktorerna påverkar risken och där de skulle kunna utbildas vidare. Deras svar på enkäten matchade inte verkligheten för följande faktorer:

- Användning av lugnande och antidepressiva
- Barn yngre än fem år
- Ursprungsland
- Liten eller lantlig kommun
- Utbildningsnivå
- Anställningsstatus

- Låg inkomst
- Ensamboende
- Funktionsvariationer

För brandexperterna fanns det några sociodemografiska faktorer de inte hade tillräckligt mycket kunskap om där de behöver vidare utbildning, dessa var:

- Ursprungsland
- Användning av lugnande och antidepressiva
- Liten eller lantlig kommun

Baserat på detta finns det vissa sociodemografiska faktorer som allmänheten och brandexperter kan utbildas vidare inom för att fortsätta arbetet med att eliminera ojämlikheter inom brandsäkerhet.

Summary

Residential fires are the cause of about 90 deaths in Sweden every year (Runefors, 2020). These fatalities are disproportionate over the population, with a few specific socio-demographic groups constituting a larger part of the victims (Runefors, 2020). Some of the socio-demographic factors that can lead to increased risk are for example smoking, old age, disability, and alcohol (Runefors, 2020). Other socio-demographic risk factors are for example bad economy, unemployment, low education, living alone, being male and type of municipality (Jonsson, 2018). Other factors instead reduce the risk. People who are born outside of a Nordic country are an example of a socio-demographic factor that can reduce the risk, and being female is another (Jonsson, 2018). During the last 60 years, the number of fire fatalities has decreased, but the unevenly distributed fire risk in society depending on some socio-demographic factors is getting even more pronounced (Nilson & Bonander, 2020). Prevention work should therefore be focused on the individuals to whom these factors apply (Nilson & Bonander, 2020).

The aim of the report was to investigate how the general public and fire safety experts perceived the fire fatality risk of different socio-demographic factors in residential buildings. The perceptions were then compared with how the socio-demographic factors correlate with the risk of fatal fires in residents in reality. The purpose of this was to find out where resources need to be directed and who needs to be educated further to prevent the fire risks connected to these socio-demographic factors. By comparing the real-life socio-demographic factors and the perception of socio-demographic factors, we hoped a broader perspective would be found and thereby enable preventive work against the inequalities in fire safety.

The methods that have been used in the thesis are a literature review, a survey, and an interview study. Through the survey, information about the general public's risk perception was received. The interview study was conducted to investigate how fire safety experts perceive the socio-demographic factors correlated with the risk of fatal fires in residents. It was done through semi-structured interviews where fire consultants and people in the rescue service were interviewed. The literature review was done to find out how the socio-demographic factors correlate with the risk of fatal fires in residential buildings in reality.

After comparing the perception and reality, the conclusion could be drawn that the general public has insufficient knowledge of how some of the socio-demographic factors correlate with the risk. Their answers on the survey did not match the reality on the following factors:

- Use of sedatives, antidepressants, and illicit drugs
- Children younger than 5 years old
- Country of origin
- Small and rural municipalities
- Education level
- Employment status
- Low income
- Lives alone
- Disabilities

The fire safety experts had a few socio-demographic factors where they did not have enough knowledge, these were:

- Country of origin
- Use of sedatives, antidepressants, and illicit drugs
- Small and rural municipalities

Based on this, the general public and fire safety experts could be educated further on some socio-demographic factors to continue the work on reducing inequalities in fire safety.

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1 Introduction

This thesis is an investigation into the perception of socio-demographic risk factors in fatal fires in residential settings. The purpose of this chapter is to give some background information on fire safety inequalities, and more specifically socio-demographic factors that can increase fire fatality risk. The aim is also to describe the purpose and goals of this study as well as the delimitations of the thesis.

1.1 Background

Information about the cause of fire is often missing, and 25% of fatal fires have an unknown cause of fire (Runefors, 2020). Of the fire fatality events that have a known fire cause, furniture and clothing are the most common first fuels, often due to smoking or candles (Runefors, 2020). Technical errors are the cause of 13% of fires in residential settings and about eight percent of the fires happen due to stoves or cookers in the kitchen (Runefors, 2020). Seven percent of fires are deliberate (Runefors, 2020). Each of these different categories has different types of victims, where for example an overrepresentation of elderly die due to ignition in clothes, and males affected by alcohol are common victims of fires that start in furniture (Runefors, 2020).

Although the number of fire-related deaths has decreased over the last 60 years, the reduction is not as distinct in all socio-demographic groups, and the unevenly distributed fire risk in society depending on some socio-demographics is getting even more pronounced (Nilson & Bonander, 2020). Mortality in residential fires has for example decreased significantly for children and adults, while only minor reductions for older people have been observed (Nilson & Bonander, 2020). Some socio-demographic groups are not only overrepresented in certain types of fires, as mentioned earlier, but all residential fires that can lead to fire fatalities; generally, fire fatalities are disproportionate over the population, with some specific socio-demographic groups constituting a larger part of the victims (Runefors, 2020). This can lead to socio-demographic inequalities in fire-related fatalities since the victims are unequally distributed (Mulvaney et al., 2009). Some well-known factors are smoking, old age, physical disability, mental illness and alcohol (Runefors, 2020). In Sweden, smoking, for example, is the cause of 32% of the deadly fires (Jonsson et al., 2017), and the median age of victims is 65 years old (Jonsson & Jaldell, 2020). Another risk factor is people with for example bad economy or unemployment. Other socio-demographic factors such as living alone, having low education, and being male are also overrepresented in the statistics on residential fire fatalities (Jonsson, 2018). If combined, these socio-demographic factors are often even larger risk factors. Smoking and people older than 85 years, for example, have a strong synergy where together they can increase the fire fatality risk by about 45 times compared to the risk of the general population (Runefors, 2020).

These socio-demographic factors that can lead to an increased risk of fire are, however, not necessarily overrepresented in non-fatal fires. For example, if someone is born in another country, the risk of a fire that can lead to a fire rescue response is increased, but the risk of a fatal fire is necessarily not increased (Nilson et al., 2015). The same applies to education, where a higher education can lead to an increased risk of small fires that do not need a fire

rescue response (Nilson et al., 2015), as opposed to what was mentioned before that low education can lead to an increased risk of fires with a fatal outcome.

1.2 Aim and objectives

To know where resources and education need to be concentrated to minimize inequality in fire safety, knowledge is needed on where the disconnect is. Does the general population know how different socio-demographic factors correlate with fire risk? Do fire experts know how different socio-demographic factors correlate with fire risk? Is this a question of educating fire safety experts or the general population? Or is it an even larger issue, where everyone knows about the problems and risk factors, but it is still an ongoing issue? To be able to address fire safety inequalities in Sweden, first, we need to know where the problem lies. Therefore, the purpose of the thesis is to investigate how both the general population and fire safety experts, perceive different socio-demographic factors correlated to fire risk in residential buildings. Socio-demographic factors involve various factors that deal with how people relate to each other in society. To be able to investigate if the problem is with the fire safety experts or the general public if either, the purpose of the thesis is also to investigate how the perception of the general public and the fire safety experts matches real life. To be able to compare the perceived factors with real life, previous research was used to find out how the different socio-demographic factors actually correlate with risk. The research questions this thesis revolves around are the following two:

How do the general population and fire safety experts perceive socio-demographic factors correlate with fire risk in residential buildings?

Do the perceived factors of the general public and fire safety experts match the socio-demographic factors in reality?

The goal of the thesis is the development of knowledge about the relationship between perceived and actual socio-demographic factors correlated with fire safety. This would provide an insight into how to move forward with the issue of fire safety inequalities, and hopefully, know who needs to be educated further. Hence, in the long term, this thesis would help policymakers, designers and the general public make informed decisions and hopefully, this can lead to less inequalities in fire safety in residential buildings.

1.3 Scope and delimitation

In this thesis, only residential fire fatalities were studied. How different factors correlate with fire safety in other types of buildings and fires that do not lead to fatality, were not studied. Furthermore, only socio-demographic factors were investigated. Structural, technical, and organizational solutions were not included.

2 Methodology

This chapter presents the thesis methodology, where three different methods were used. During the work, a literature study, a survey study, and an interview study were implemented. The literature study was conducted first and worked as a base to identify factors for the survey and the interviews. The literature review helped to provide a clear definition of the project scope and the survey questions could subsequently be written. After consultation with the thesis supervisor, the questions were sent out to the general public. While the survey was open to the general public, the interview process started. First, relevant questions were identified and suitable people for the interviews were contacted through email. Then the interviews were held and lastly compiled. After the three different approaches had been executed and compiled, the result was compared to determine the relationship between the real-life socio-demographic factors, the general public's perception, and the perception of fire safety experts. The three methodologies are illustrated in a flowchart, see Figure 1.

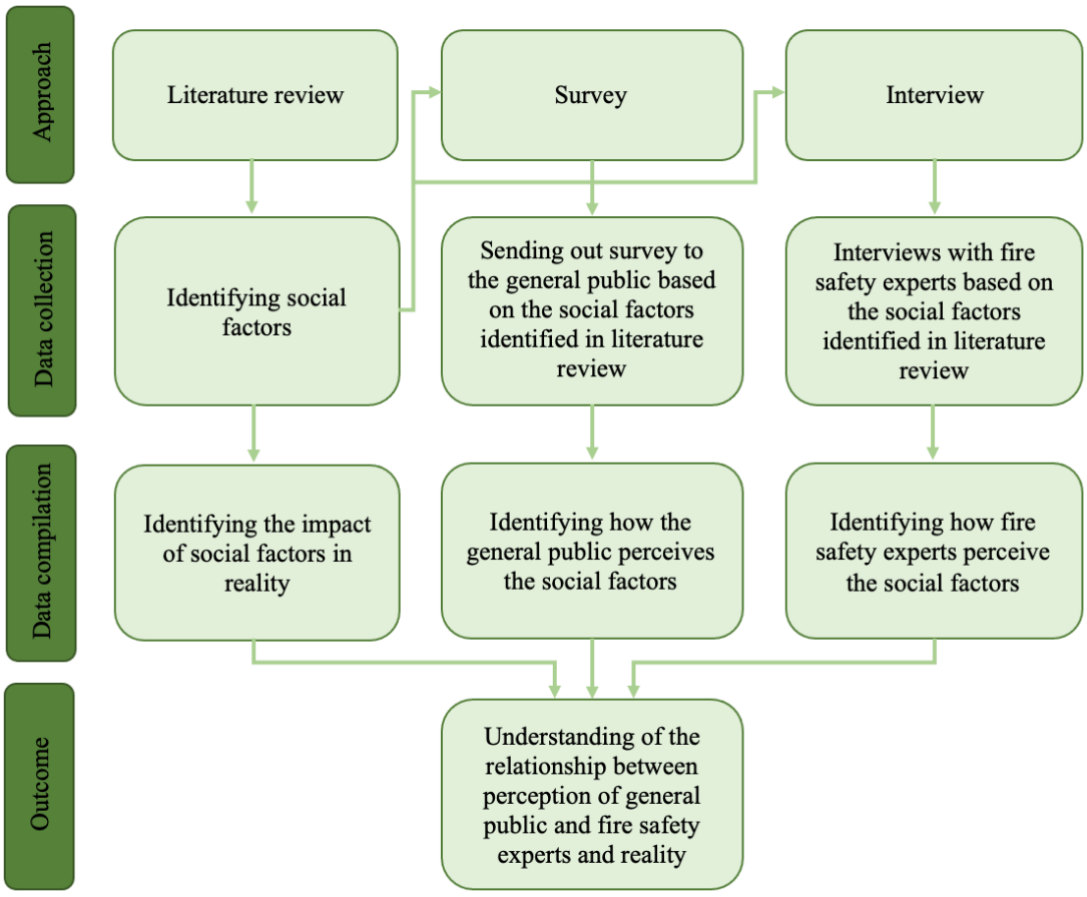

Figure 1: The thesis methodology and the three different approaches are illustrated in a flowchart.

2.1 Literature study

A literature study was implemented to develop knowledge on the subject. The literature review approach enables researchers to put their results in a context and is thereby a good way to find existing knowledge and research within an area and thus gain an understanding of it. This was necessary for the thesis to, in a later stage, be able to distinguish the relationship between perceived and actual socio-demographic factors that correlate with fire safety. The

literature search aimed to lay a basis for the survey study and the interview study. The existing research was used, and a large source of literature was Marcus Runefors' earlier research on fire fatalities in residential buildings (Runefors et al., 2021) and (Runefors, 2020). Other literature was also used to find information about socio-demographic factors linked to fire risk.

Initially, relevant keywords were considered by analyzing Marcus Runefors' literature and discussions between the authors and the supervisor. By clarifying the search terms, literature could be located in various scientific search engines such as Google Scholar and LUBsearch and through the cited references in relevant articles (e.g., so-called snowball approach). Search engines were used instead of scientific databases since they can pick up grey literature. To broaden the result, keywords in both Swedish and English were used. This resulted in some of the reviewed and used material being in both Swedish and English, and the purpose of this was to find more relevant literature. The search words *fatal*, *fire* and *residential* were always included in the search to maintain the right focus and were connected with the word AND. In addition to this, specific socio-demographic factors were included, and otherwise the phrase *social factors* or *socio-demographic* was used. The same search methodology was used in Swedish, and the search words were translated. The keywords used in the search engines can be seen in Table 1.

Table 1: The keywords used in the article search in Google Scholar and LUBsearch.

Language	Keywords
English	Fatal residential fires, fire risk factors, residential fires, socio-demographic factors, socio-demographic, age, children, single parent-households, drug use, education, Sweden
Swedish	Dödsbränder, bostäder, bostadsbränder, bränder, omkomma, riskfaktorer, socio-demographica faktorer, socio-demografi, ålder, barn, ensamstående föräldrar, droger, läkemedel, utbildning, Sverige

To find relevant reports and scientific articles, the titles were first reviewed, and the non-relevant titles were sorted out. The abstract was then reviewed to determine the publication's relevance; if deemed relevant, it was reviewed more thoroughly. The scientific articles and reports that were considered to have relevant literature on the socio-demographic factors were then used further in the survey. All 76 articles were not cited in this study, however, as it would have been too long for the word limitations and scope of this thesis to include all of them. Although this resulted in only 21 articles used in the literature study, all of the 76 articles were reviewed and read through to examine if there were any contradictions between articles that needed to be illustrated in the thesis. This process is illustrated in a flowchart, see Figure 2.

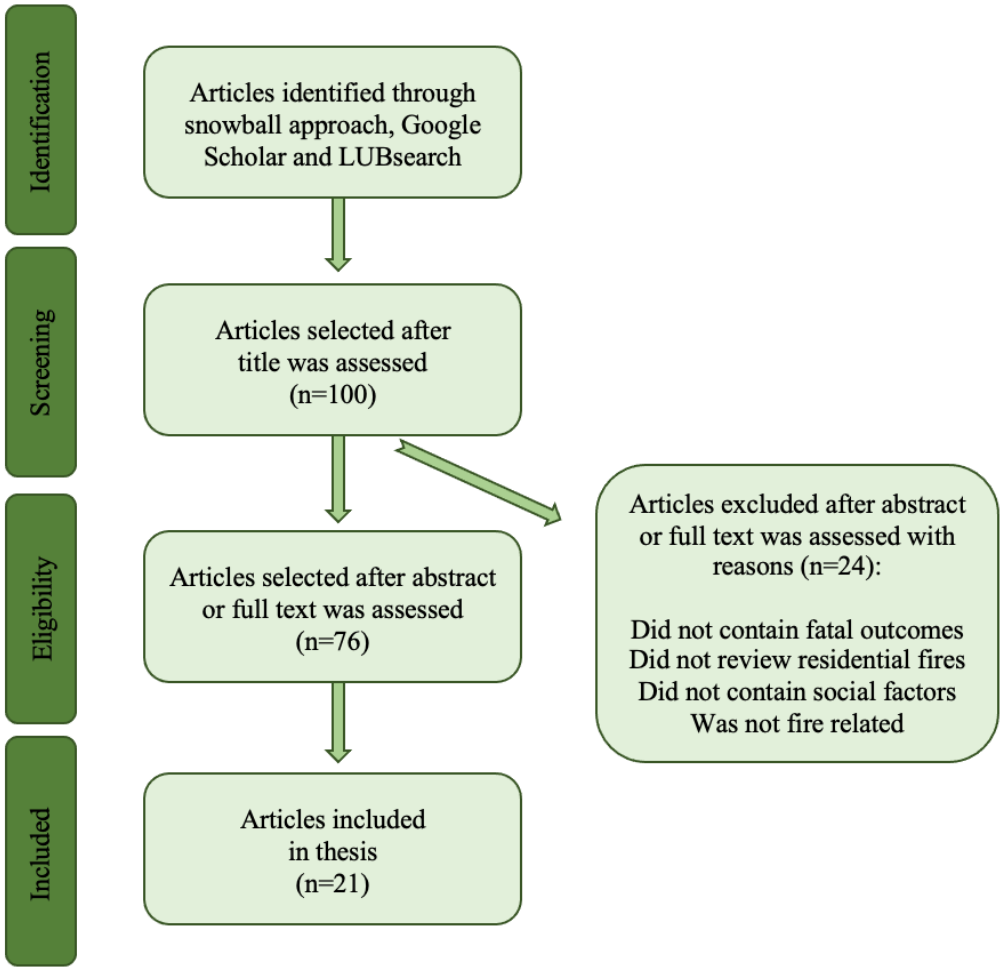

Figure 2: Flowchart that illustrates the different phases of the literature review.

The socio-demographic factors were compiled to determine their correlation with the fire risk. An odds ratio was calculated for each factor to make the factors comparable. The odds ratio gives an indication of how one variable relates to another in a given population. Finding odds ratios to all socio-demographic factors, simplified the process of comparing them since odds ratios made the socio-demographic factors comparable with each other. This was an easier and more quantifiable approach than simply comparing the socio-demographic factors based on qualitative words. Qualitative words can have different meanings, especially when different sources were used for different socio-demographic factors. Another approach that was considered was using relative risk. This approach could not be implemented though, since few of the papers used in the literature review contained information about relative risk. The most suitable approach was therefore to use odds ratios.

To be able to compare the result of the literature review, the survey and the interviews, the odds ratios needed to be described on the same scale as was used in the survey. Depending on the size of the odds ratio, the socio-demographic factors got divided into different categories that spanned between *decrease of fire risk* to *very large increase of fire risk*. The odds ratios for the socio-demographic factors differed between 0.30 and 37.9. Since the odds ratio 1 means that there is no difference between the factor and the general risk of dying in a residential fire, the factors with an odds ratio of 1, are assigned *neither decrease nor increase*

of fire risk. Since an odds ratio below 1 means that the risk is smaller than the general risk of dying in a residential fire, the factors with an odds ratio smaller than 1 were assigned *decrease of fire risk.* An odds ratio larger than 1 means that the risk of dying in a residential fire is larger than the general risk. There is a large distribution of odds ratios above 1 among the socio-demographic factors. Therefore, depending on the number of the odds ratio, they are assigned different qualitative values, see Table 2.

Table 2: Odds ratio converted into assigned qualitative value.

Odds ratio	Assigned qualitative value
$OR < 1$	Decrease of fire risk
$OR = 1$	Neither decrease nor increase of fire risk
$1 < OR \leq 3$	Small increase of fire risk
$3 < OR \leq 6$	Moderate increase of fire risk
$6 < OR \leq 11$	Large increase of fire risk
$11 < OR$	Very large increase of fire risk

2.2 Survey study

To answer the question statement, a survey study was implemented. With the help of the literature study, an opinion was developed about the relevant information to collect via the survey study. The purpose of the survey was to collect information on how the public perceives that socio-demographic factors correlate with fire risk in residential settings. It was done by sending out a survey to the public via social media, more specifically Facebook and Instagram. The survey aimed to reach as many people as possible to get a reliable result, with a lower limit of 100 survey answers. To make the survey clear and with validity, guidelines from the book "Frågor & svar" by Statistiska centralbyrån were used (Persson, 2016). There were multiple reasons why an online questionnaire was used to acquire information on the perception of the general public. To gain enough answerers to be able to draw conclusions, an approach where many people could be reached was of importance. An online survey makes it easy to reach many people since not everyone has to be contacted separately. Moreover, compiling an online survey is faster than analyzing and compiling interviews or telephone or paper-based surveys. It is also cost-effective and reaches many people as it is easy to spread among a large number of people.

When using surveys there is a risk of bias. Especially when it comes to online surveys since they often have a lower response rate (Menachemi, 2011). Social media was used to reach the general public, which made it difficult to estimate the response rate. It is therefore also difficult to know if the survey had a low response rate or not and thereby find out how large the non-response bias was. Otherwise, the survey was constructed in a certain way to try to reduce or at least minimize the response bias and below some of these attempts are described.

An attempt was made to use simpler sentences in the survey to avoid misunderstanding by the respondents and thereby reduce dissent bias. An introduction about the thesis and information about the authors were presented at the beginning of the survey to enable the respondents' understanding of the thesis, the purpose of the survey, and the importance of the responses collected. This hopefully reduced the risk of the respondents not understanding what the

survey was for and the importance of their answers to also minimize the risk of dissent bias and neutral responding. To minimize the risk of survey fatigue and to simplify the compilation process, the questions were mostly multiple choice, and an attempt was made to construct as few questions as possible, while still including all necessary content in the survey. An internal ethical assessment in accordance with the thesis supervisor was performed to exclude questions that may be considered ethically challenging. The survey was conducted anonymously to protect personal data integrity. This was stated at the beginning of the survey to reduce the risk of social desirability bias, where people answer in a socially acceptable way. To investigate whether there was a connection between people's habits and the risk of fire, background questions were asked where the respondents had to answer about, for instance, smoking habits and alcohol habits. Here, it was investigated whether people with these habits believed that the socio-demographic factors correlate with them differently than those without them. An attempt was also made to have the questions in a logical order to avoid question-order bias.

The survey was conducted in the online survey program Google forms, a free program that was considered to have the needed features for the survey dissemination. The program also allowed the survey to be conducted digitally, making it easier to compile the results. The survey was conducted in Swedish as an assessment was made that the majority of respondents have knowledge of the Swedish language and that the target group was people living in Sweden. It was considered to make it easier for most respondents and thus get more people to answer the questions. The targeted group for the surveys was people who live in Sweden and were 18 years or older.

When designing the survey, the questions were sent to the supervisor several times and then to a pilot testing group of four people. This was to investigate whether the questions were asked so that correspondents understood the question correctly and if there were any other ambiguities. The survey went out to the public via social media on the 12th of October 2022 and was then open the following week.

2.3 Interview study

An interview study was conducted to gather information from fire safety experts on how they believed the various socio-demographic factors correlate with fire risk in the home. The study was conducted with semi-structured interviews, which means that the key questions were determined beforehand, but spontaneous follow-up questions and further discussion were allowed (Hedin, 1996). Interviews were chosen as the method for the fire safety experts since it allows the respondent to discuss the questions in another way than in a survey. This provided more reasoning from the respondents since they could say why they thought a specific factor contributed in a certain way. It also allowed them to give some background information, for example, if they had read research about or had a lot of work experience with a specific factor that influenced their perception. This would not have worked in the survey that was used for the general public which mostly had multiple-choice questions. Interviews also allowed the interviewers to ask if something was unclear or ask for the interviewees' interpretation. This back and forth between interviewer and interviewee would not have worked in a survey, and thus provided less analyzed answers. There are, however, some

issues with interviews. The largest issue identified with using interviews in the thesis was the time factor. Interviews are time-consuming compared to for example surveys and to fit into the time plan of the thesis, it was decided to interview about 20 fire safety experts. This is fewer subjects than what could be collected for the data on the general public. This was however deemed acceptable since the data collected is much more in-depth and with more context.

The semi-structured interview approach was chosen by excluding irrelevant interview methods and choosing among the most fitting ones. Focus groups for example were not an option since the risk would have been large that the interviewees would be affected by the other's perceptions; the interviews had to be individual and not a discussion between different fire safety experts. According to Adhabi & Anozie (2017), structured interviews are fully controlled by the interviewer and the interviewee has little impact on the process. They often lead to short answers without discussions or interpretation, which can lead to baseless responses without context. The flexibility is also small for the interviewer who must follow a certain set of questions and cannot improvise. This approach is best fitted for quantitative research. This approach was excluded because we wanted context and the interviewees' arguments, which is not achieved with structured interviews. Unstructured interviews are a more open approach where questions are informally asked and often resemble a conversation (Adhabi & Anozie, 2017). This approach was too qualitative, and clearer answers were needed to be able to compare the fire safety experts' perceptions with the general public's and reality. Semi-structured interviews are a combination of structured and unstructured interviews, which gives it the advantages of both. It is not as rigid as structured interviews and therefore invites discussions (Adhabi & Anozie, 2017). On the other hand, it is more specific than unstructured, since there is a set of guiding questions that are asked, to make sure the interviewee covers all relevant areas (Adhabi & Anozie, 2017). Semi-structured was decided as the best approach since it is flexible depending on the interviewees' background and answers and allows the interviewer to receive answers within all relevant areas.

The interviewees were asked to participate in an email that was sent to different fire consultant agencies and rescue services around Sweden. Some agencies and rescue services were randomly collected, while others were contacts of the authors or suggested by the supervisor. Most of the interviews were held via Zoom or Teams, and one was through a phone call. Each interview lasted approximately 10-20 minutes. The interviews were recorded after the fire safety experts' approval, to give the opportunity to go back through the material if necessary. The interviewees' identity was kept anonymous.

The interview questions were developed through discussions between the authors and the supervisor. The interviews began with a brief background of the thesis and information about the interview process. Standard questions were asked about the interviewee's work field and the experience the person had in the fire safety domain. After this, questions regarding socio-demographic factors were asked. These questions consisted of two parts. The first part was more general, and the interviewees were asked to name different socio-demographic factors that they thought correlated with the number of fire fatalities in residential buildings. For the first part of the interviews, thematic analysis was used, since conclusions could be drawn

from what factors the interviewees chose to bring up early in the interviews and thought were relevant. After the interviewees had named all the socio-demographic factors they could think of, the next part of the interview started. Here, all the factors that were found in the literature review were listed, except for the ones the interviewees had already mentioned. The interviewees were asked to answer if they thought the specific factors could lead to an increase, decrease or neither decrease nor an increase in fire fatality risk in residential buildings. This part was more of a quantitative analysis since the interviewees were specifically asked about the different factors and were asked to grade them. Here conclusions could be drawn from the number of fire safety experts who believed a factor correlated with an increased or decreased risk. See Appendix A – Survey questions for more information about the interview sequence. Afterward, the interviews were transcribed to simplify the compilation process of the interviews and to minimize the risk of missing any significant details.

To learn how to use thematic analysis, two different sources by Peel (2020) and Smedberg et al. (2022) were used. Thematic analysis is an approach that can be used when complex data needs to be simplified. It helps to transform complex data into a simpler alternative and is compiled into categories and themes. To present the data in a comprehensible way, the thematic analysis process includes six steps. The first step is collecting data, which in this case was done by doing interviews. The second step is to engage with the data to become familiarized with it. This was done by listening to the recordings, transcribing the interviews, and reading through the transcribed documents. Notes and comments were also written down at this point to understand the data and to start reflecting on the answers. Step three is coding the extracts from the data, which was done by writing down and highlighting parts of the interviews that were potentially meaningful. Step four is to generate the code categories from the code to condense the data. The list of codes that was made in step three, was used here to identify ideas from the codes and conform them into different categories. The fifth step is conceptualizing the themes from the categorized coded extracts. In this step, themes were developed by searching for meaningful patterns in the data. The data were interpreted and consolidated. The last and sixth step includes contextualizing and representing the data. Here, the data was presented by listing the themes from the interviews in chapter 5 Interview results. Quotes from the interviews were also used to show how the interviewees talked about the subject and to strengthen the themes. These steps are presented in a flowchart, see Figure 3.

Step		Method in thesis
1	Collect the data	Conducted interviews
2	Engaging with the data	Transcribed the interviews
		Read through the transcribed documents
		Wrote notes and comments
3	Code the extracts from the data	Wrote and highlighted relevant parts in the interviews
4	Generate the code categories from the codes	Conformed the ideas from step three into different categories
5	Conceptualise the themes from the categorized coded extracts	Searched for meaningful patterns
		Interpreted data
		Consolidated data
6	Contextualise and represent the findings	Presented the themes
		Added quotes

Figure 3: A flowchart illustrating the approach when analyzing the interviews.

3 Literature study - results

In the present chapter, relevant findings from the literature review are presented. It consists mainly of data and information on how the factors identified impact fire fatality in residential buildings. All possible socio-demographic factors were investigated whether they could lead to a decrease, increase, or no impact on the risk of fatal fires. The purpose of this work was for it to serve as a basis for the interviews and survey. The literature study was also used when investigating the relationship between perception and reality. A total of twelve different socio-demographic factors were identified in the literature and are described here. At the end of this chapter, a compilation of the assigned values of each socio-demographic factor is presented.

Table 3: A short compilation of the different socio-demographic factors.

Factor	Description
Smoking	People who smoke cigarettes with tobacco
Alcohol use	People who regularly drink alcohol
Drug use	People who use sedatives, antidepressants, and illicit drugs
Age	People who are either younger than 5 years old or older than 70 years old
Gender	Female or male gender
Country of origin	People who are born outside of Europe, in Europe or in a Nordic country other than Sweden
Type of municipality	People who live in a small or rural municipality
Education level	People with a low education level (9 years or less)
Employment status	People with a full-time paid job
Income	People with a low income
Living arrangement	People who live alone or households with single parents
Disabilities	People who have a physical or mental disability

3.1 Smoking

Smoking is one of the most common causes of fires in Sweden and one of the most common risk factors that can lead to fatal fires (Runefors, 2020). It significantly correlates with the probability of survival (Runefors et al., 2021). The sequence of events is usually that furniture or clothing ignites when smoking, leading to injuries or death. Many studies, including studies by Runefors (2020) and Jonsson et al. (2017) show that smoking is one of the most significant risk factors in the event of a fire. Data collected by the Swedish Fire Protection Agency shows that 41% of deaths in Sweden were caused by smoking between 1983 and 1994 (Jonsson, 2018). Also, a study done in the state of Alabama showed that smoking was the most common cause of death in a fire. Statistics from fatal fires in Sweden between 1999-2007 show that 32% of all fires were caused by smoking (Jonsson et al., 2017). Between 1988 and 1989 in North Carolina, 31 % of the fatal fires were caused by smoking, which is an odds ratio of 7.7 (Runyan et al., 1993).

3.2 Alcohol use

Studies by Jonsson (2018), Xiong et al. (2015), and Runefors (2020) show there is a clear connection between alcohol and fatality risk. According to Jonsson (2018), alcohol is

common among victims. A study by Xiong et al. (2015) shows that of those who died in fires, 66 out of 117 people had alcohol in their blood, i.e. 56.4%, with an odd ratio of 10.58.

Another study by Runefors (2020) also shows that alcohol increases the risks in the event of a fire. This study shows that 43% of those who died in a residential fire had at least a blood alcohol content of 0.2 per mille, usually even higher. Of those who survived but were injured, 22% had alcohol in their blood.

3.3 Drug use

In a study by Xiong et al. (2015) from Australia, the relationship between drug use and fire risk was investigated. Those who had consumed psychotropic and sedative drugs had a higher fatality risk. In another study from Australia by Lykiardopoulos (2014), the effects of sedatives, antidepressants, and illicit drugs were investigated. Out of 108 victims of fires between the years 1998 and 2007, 31 victims had sedatives in their bodies, 11 had anti-depressants and 4 had some illicit drug. In the general population 1.05% used sedatives, 3.34% used anti-depressants, and 5.5% used illicit drugs. This gave an odds ratio of 37.9 for sedatives, 3.19 for antidepressants, and 0.66 for illicit drugs. The odds ratio on illicit drugs indicates that substance abuse is not a contributing factor to an increase in fire fatalities. This contradicts some other studies, which identify illicit drug use as a risk factor, and is probably an issue of data limitations (Lykiardopoulos, 2014). With another sampling selection, the result might therefore have been different.

3.4 Age

Age can have a significant impact on the likelihood of surviving a fire. Collected data from Sweden shows that people over 65 are the most vulnerable group in the event of a fire (Jonsson, 2018). A study by Xiong et al. (2015) shows that 73 out of 168, i.e. 43% of the fatalities, were over 70 years old. That implies an odds ratio of 13.06. Another study by Elder et al. (1996) shows collected data from Scotland between 1980-1990, where 50.1% of the fatalities were 60 years or older which gives an odds ratio of 4.47.

Previous data from various countries show that young children have a high risk of dying or being seriously injured in fires. For instance, studies by Mulvaney et al. (2009) and Xiong et al. (2015). However, the risk of children dying or being injured in a fire has decreased significantly in Sweden, according to data from Jonsson, (2018). The data shows that children between 0 and 4 years old were one of the most vulnerable age groups in 1952 and the least vulnerable age group in 2013. One reason for this may be due to progress in, for example, childcare in Sweden. A study by Jonsson et al. (2017) shows that 1% of fire fatalities in Sweden between 1999 and 2007 were children between 0-4 years. With statistics from SCB, the odds ratio could be calculated to 0.21.

3.5 Gender

Generally, women are more risk aware and are more likely to estimate a situation as risk full (Enander, 2018). Between 1952 and 2013 in Sweden, 68% of all fatalities were male and 32% of all fatalities were female (Jonsson et al., 2016). A higher fatality percentage for men applied to all ages, except for people over 85 years old, where, in absolute numbers, a majority of women died. Although counting the mortality rate per million people, males were

overrepresented in that age group as well. The odds ratio for each gender relative to all other causes of fatal fires was for males 1.29 and for females 0.78.

3.6 Country of origin

Countries worldwide have different regulations or requirements on fire protection design and how fire safety training is conveyed to the population. When moving to another country, knowledge of the current fire protection can become deficient. A research project from Greater Manchester investigates the diversity of ethnic groups and how culture-related fire risks can arise. Cultural practices can correlate with fire risk. Language is an essential aspect of preventing a fire. If the first language is different from the country in question, there is a risk that information will not reach (Dean et al., 2016). MSB lifts this problem and has worked with targeted communication initiatives in Sweden (MSB, 2021).

In a study by Jonsson and Jaldell (2020), it is investigated how the factor country of origin correlates with fatal fires in residential settings, as opposed to non-fatal fires. Those who are born outside of a Nordic country have a decreased risk of dying from a fire. Those born outside of Europe had an odds ratio of 0.30 compared to the general population, and people from Europe (not the Nordic countries) had an odds ratio of 0.67. People born in Nordic countries other than Sweden have an increased risk of dying in a fire with an odds ratio of 1.64.

3.7 Type of municipality

Municipalities in rural areas and municipalities with few inhabitants have a higher risk of fatal residential fires (Jonsson et al., 2017). Fire protection depends on local taxes and thus a large working population and varies depending on the municipality. The high urbanization rate, especially among young people, has a negative effect on the economy in rural municipalities, which may be one of the reasons why they can have a higher risk of fatal fires (Nilson & Bonander, 2021). The amount of fires is similar in rural areas and cities; it is the number of fatal fires that differs. Between 1999 and 2007 in Sweden, there were 13.2 deathly fires per million people in municipalities with less than 20 000 inhabitants, 9.4 deathly fires per million people in municipalities with 20 000 – 99 999 inhabitants, and 9.6 deathly fires per million people in municipalities with more than 100 000 inhabitants. Sparsely populated municipalities had 21.6 deathly fires per million people and large cities had 10.3 deathly fires per million people (Jonsson et al., 2017). The risk of dying in a fire for people living in a municipality with less than 20 000 inhabitants, has an odds ratio of 1.39. The risk of dying in a fire for people living in a sparsely populated municipality has an odds ratio of 2.1.

3.8 Education level

Although households with a high level of education can have a higher risk of residential fires, households with a low level of education can have an increased risk of fires that lead to fatality or hospitalization (Nilson et al., 2015). A reason why high education households can have an increased risk of fire could be that they often have more technical equipment due to the link between high education and high income (Nilson et al., 2015). Between 1999 and 2007 in Sweden, out of 850 fire fatalities, 90 of the victims had a tertiary education, 323 had a secondary education and 386 had primary education (Jonsson & Jaldell, 2020). Based on this

and statistics from SCB (2022) the odds ratios were 0.29 for tertiary education, 0.75 for secondary education, and 3.30 for primary education.

3.9 Employment status

An individual's employment status can have an impact on the fire risk. Based on a study from Australia between the years 1998 and 2008, those who are not in full-time paying jobs compared to those who are, have an increased risk of dying in a residential fire, with an odds ratio of 5.71 (Xiong et al., 2015).

3.10 Income

There have been multiple studies that show that poverty is a factor that can lead to an elevated risk of fire (Fahy & Maheshwari, 2021). The reason why poverty is a contributing factor could be due to its association with other risk factors such as older houses, language barriers, and crowdedness (Fahy & Maheshwari, 2021). Families who had an income under the fifth percentile between 1999 and 2007 in Sweden had an odds ratio of 2.16. The odds ratio decreased with higher income and those who had an income between the 25^{th} and the 50^{th} percentile had an odds ratio of 1.34. Those who receive social allowance have a significantly higher risk of fatal fires, with an odds ratio of 3.51 (Jonsson & Jaldell, 2020).

3.11 Living arrangement

While there are many different living arrangements, those that were mentioned in the sources found in this literature review, relate to living alone and in single-parent households. These two different subgroups are therefore presented further in this thesis.

Multiple studies show that people who live with someone are better prepared for emergencies (Enander, 2018). They find it easier to take safety measures, such as acquiring smoke alarms and hand-held fire extinguishers (Enander, 2018). Generally, they also consider themselves more informed about risks in the home, than people who live alone do (Enander, 2018). In a study from Australia (Xiong et al., 2015) between 1998 and 2008 that compared fatal fires and survived fires, the odds ratio for dying in a fire was 13.65. In the study, it was mentioned that people living alone are less likely to discover a fire in the residence and that there is nobody there to help with the evacuation. This might serve as another reason why people living alone are at a higher risk of dying in a fire (Xiong et al., 2015). In another study from Copenhagen 1991-1996, fatal outcomes for victims who were alone at the time of the fire had an odds ratio of 12.8 (Leth et al., 1998).

A study (Chen et al., 2011) in the United Kingdom and the United States show that single-parent households can have an increased risk of fire-related injury. This factor may be closely related to socioeconomic since single parents rely on one income (Clare & Kelly, 2017). However, a study from Northern Ireland between the years 1999 and 2009, shows that single-parent households did not correlate with an elevated risk of fire-related fatalities (Harpur et al., 2013). The reason the study in Ireland differs from other studies may originate in the different statistics used. In Northern Ireland, the focus is on residential fires with fatal outcomes, while the other studies show statistics from residential fires in general. According to Runefors (2020) living alone with children increases the risk of fires in general but is not a

contributing factor to fatal fires. By using the Northern Ireland study, since it focused on fatal fires, the odds ratio is 1.

3.12 Disabilities

In a study from Australia between 1998 and 2008, out of 153 fire victims, 70 had some mental illness and out of 171 fatalities, 109 had some physical disability. In this study, they define mental illness as an intellectual disability (Xiong et al., 2015). In another study from Copenhagen between 1991 and 1996, the risk of fire (both fatal and non-fatal) for physically disabled people had an odds ratio of 9.2. compared to those who did not have a physical disability. The odds ratio for people with mental health issues compared to those who did not have mental health issues was 6.0 (Leth et al., 1998). Comparing fatal and non-fatal fires, there can be an increased risk of fatal fires for people with a physical or mental disability (Xiong et al., 2015).

3.13 Assigned qualitative value to the socio-demographic factors

The qualitative value derived from the literature for the socio-demographic factors based on the odds ratio is shown in Table 4 below.

Table 4: The assigned qualitative values to the socio-demographic factors and the references the assigned qualitative value is based upon.

Assigned qualitative value	Socio-demographic factors	References
Decrease of fire risk	- Illicit drugs - Children younger than 5 years - Female gender - Born outside of Europe - Born in Europe (outside of a Nordic country)	- Lykiardopoulos, 2014 - Jonsson et al., 2017 - Jonsson et al., 2016 - Jonsson & Jaldell, 2020 - Jonsson & Jaldell, 2020
Neither decrease nor increase of fire risk	- Single-parent households	- Harpur et al., 2013
Small increase of fire risk	- Male gender - Small municipality - Rural area - Born in a Nordic country other than Sweden	- Jonsson et al., 2016 - Jonsson et al., 2017 - Jonsson et al., 2017 - Jonsson & Jaldell, 2020
Moderate increase of fire risk	- Antidepressants - Low education level - Not full-time paid - Low income/social allowance	- Lykiardopoulos, 2014 - Jonsson & Jaldell, 2020 - Xiong et al., 2015 - Jonsson & Jaldell, 2020
Large increase of fire risk	- Smoking - Alcohol - Physical disability - Mental health issues/cognitive disability	- Runyan et al., 1993 - Xiong et al., 2015 - Leth et al., 1998 - Leth et al., 1998 and Xiong et al., 2015
Very large increase of fire risk	- Sedatives - Old age (70+ - Living alone	- Lykiardopoulos, 2014 - Xiong et al., 2015 - Leth et al., 1998 and Xiong et al., 2015

4 Survey results

The survey consisted of two different sections. The first section was a set of questions on how the respondents thought the different socio-demographic factors correlate with the fire fatality risk in residential buildings. The answer options were decrease of fire risk, neither decrease nor increase of fire risk, and small, moderate, large, and very large increase of fire risk. The second section consisted of background questions. All survey questions are presented in Appendix A. The survey got 202 answers during the week it was open to the public. Since 42 people who answered had experience with fire safety, primarily fire safety engineering students, they were not considered the general public. Hence, the answers of those who worked with, or had an education regarding fire, were excluded. This resulted in 160 usable answers on the survey and is presented in Figure 7 to Figure 27. The 42 responses that were excluded from the result of the general public due to education or work experience in fire safety, are presented in Appendix C. The survey results are published on Zenodo.

4.1 Background information

In the second part of the survey, the respondents answered questions about their socio-demographics. To illustrate who answered the questions and how representative they are of the population, background information about the respondents is presented in this chapter. The average age of the respondents was 34.7 years and a clear majority of the respondents identified as female. Almost three-quarters of the respondents had a university education. Out of the 160 respondents, 159 had lived in Sweden for the majority of their life, and one person had lived in Finland for the majority of their life. 148 respondents were Swedish, nine respondents had two nationalities, with Swedish being one of them, two respondents were Finnish, and one respondent was Danish.

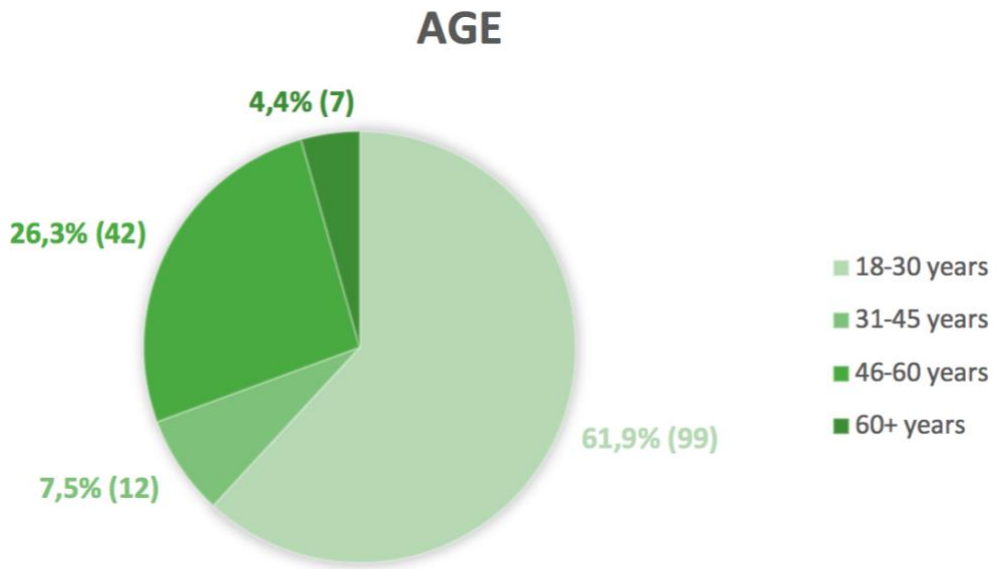

Figure 4: The age distribution of the 160 respondents.

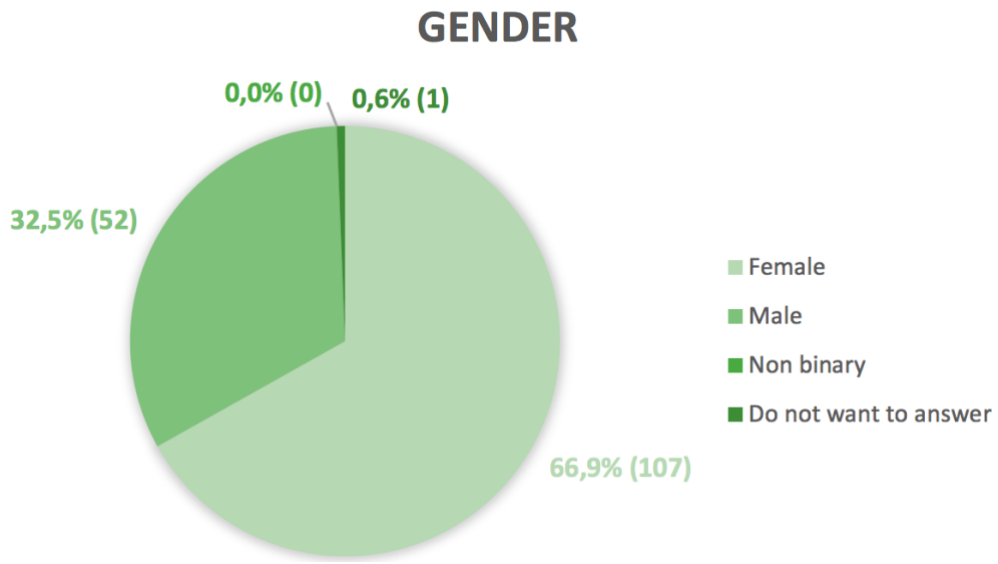

Figure 5: The genders of the 160 respondents.

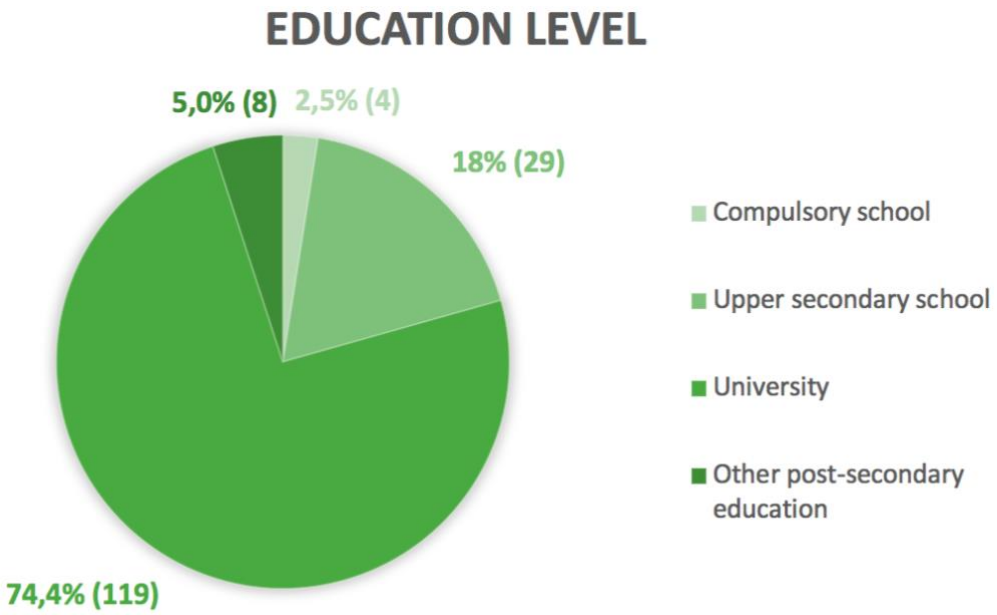

Figure 6: The education level of the 160 respondents.

Table 5: The nationality of the 160 respondents.

Nationality	*Number of respondents*	*Respondents (%)*
Swedish	148	92.5
Finnish	2	0.625
Danish	1	1.25
Swedish/Finnish	3	1.875
Swedish/Polish	1	0.625
Swedish/German	1	0.625
Swedish/Norwegian	1	0.625
Swedish Palestinian	1	0.625
Swedish/Russian	1	0.625
Swedish/Italian	1	0.625

4.2 Results

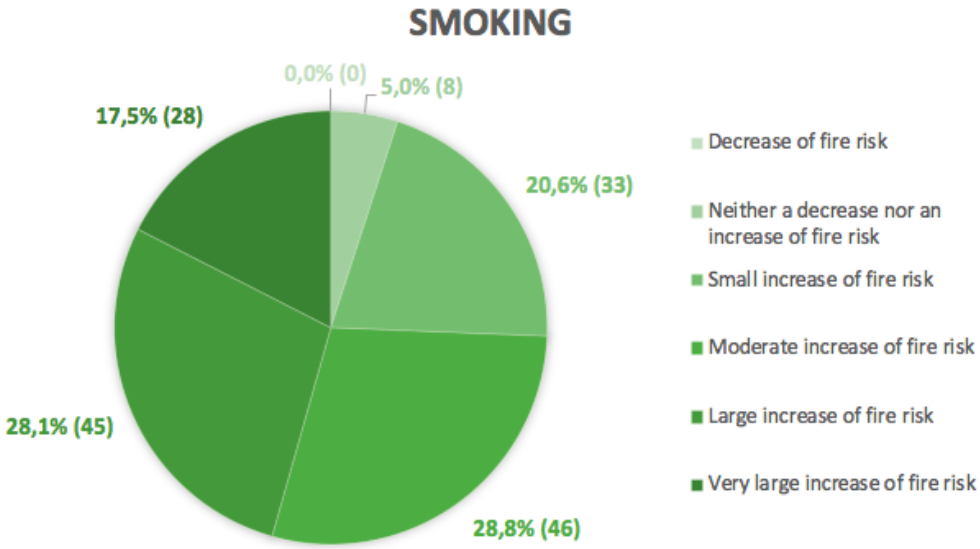

Figure 7: A pie chart illustrating, based on the results from the survey, how the general public believed smoking affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of the presence of people smoking?* 95% of the respondents answered that it was an increase in fire risk, 5% thought it was neither a decrease nor an increase and nobody believed smoking led to a decrease in fire risk. How large the increase was perceived to be, however, differed; a similar number of respondents thought the increase was either small (20.6%), moderate (28.8%), large (28.1%), or very large (17.5%).

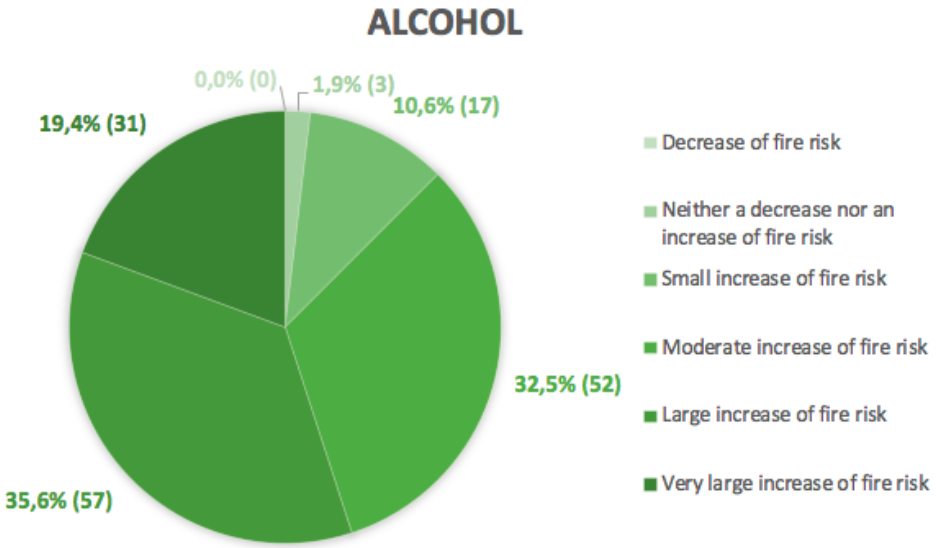

Figure 8: A pie chart illustrating, based on the results from the survey, how the general public believed alcohol affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of alcohol use?* 98.1% of the respondents answered that it was an increase in fire risk. 1.9% thought it was neither a decrease nor an increase and nobody believed alcohol use led to a decrease in fire risk. Most respondents thought the increase was either moderate (32.5%) or large (35.6%) and consists of 68.1% of the answers.

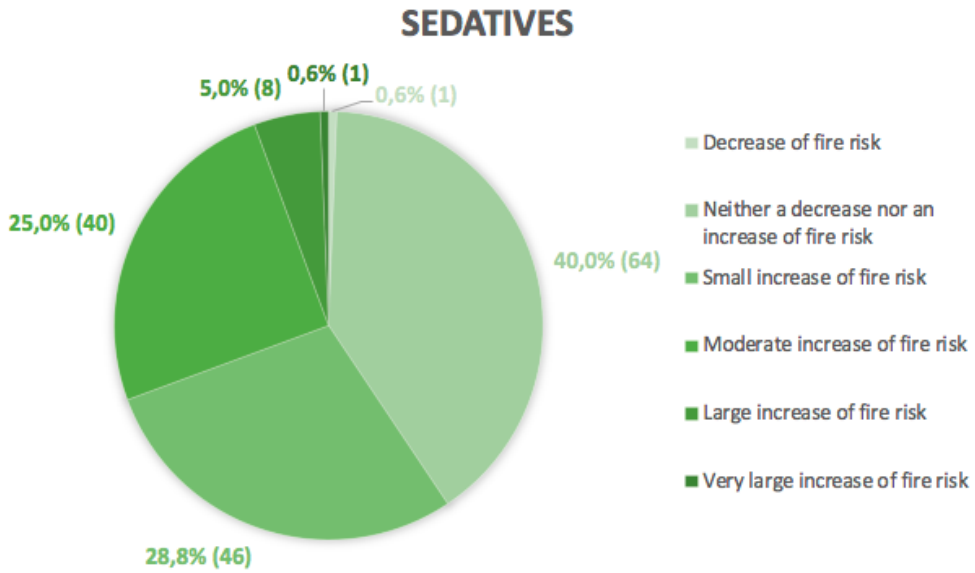

Figure 9: A pie chart illustrating, based on the results from the survey, how the general public believed sedatives affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of the use of sedatives among residents?* 40% of the respondents answered that sedative usage had neither a decrease nor an increase in fire risk fatality. A considerable amount of the respondents also thought it led to a small increase in fire risk fatality (28.8%) or a moderate increase in fire risk fatality (25%). 5.6% thought the increased risk of fire fatalities was large or very large and 0.6% thought that it had an increased risk of fire fatalities.

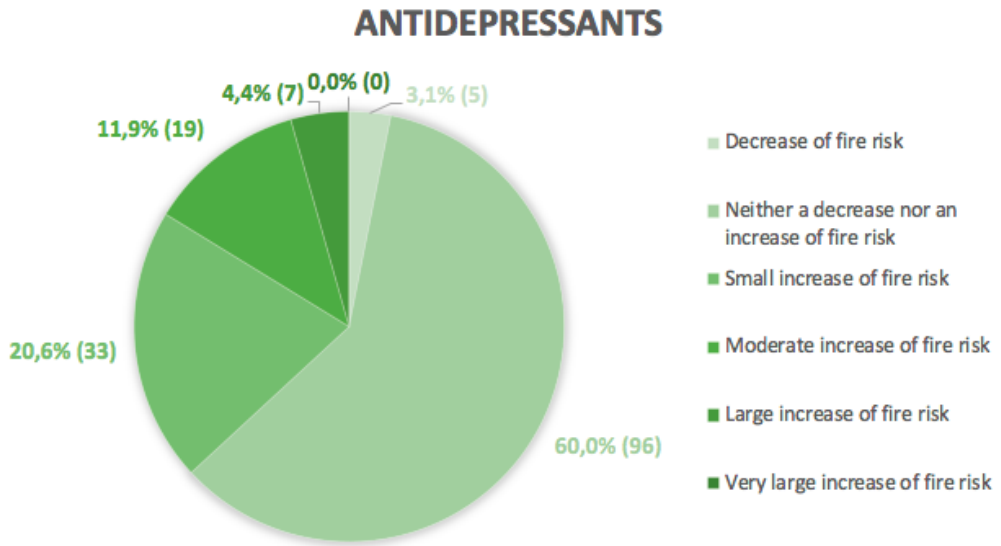

Figure 10: A pie chart illustrating, based on the results from the survey, how the general public believed antidepressants affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of the use of antidepressants among residents?* a majority of the respondents answered that antidepressant usage had neither a decrease nor an increase in fire risk fatality (60%). The second largest category was small increase in fire risk with 20.6%. Nobody believed antidepressants led to a very large increase in fire risk, and 16.3% thought it had a moderate or large increase in fire risk. 3.1% thought the use of antidepressants led to a decreased fire fatality risk.

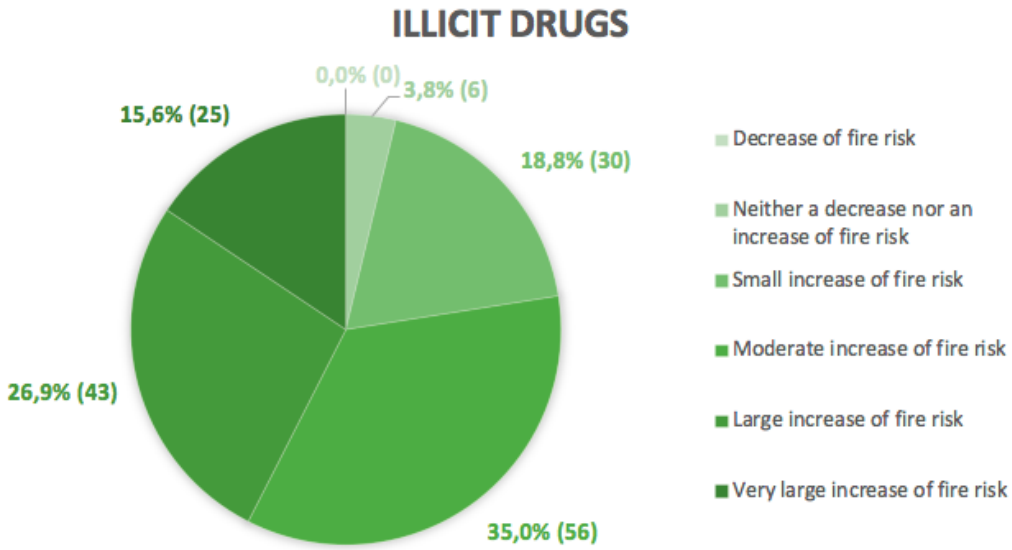

Figure 11: A pie chart illustrating, based on the results from the survey, how the general public believed illicit drugs affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of the use of illicit drugs among residents?* 96.2% of the respondents answered that illicit drug use led to an increased risk in fire fatalities. A majority believed that the increase of fire risk was either moderate or large (61.9%). Nobody perceived that illicit drugs led to a decrease in fire risk, and 3.8% thought illicit drugs were neither a decreased nor increased risk of fire.

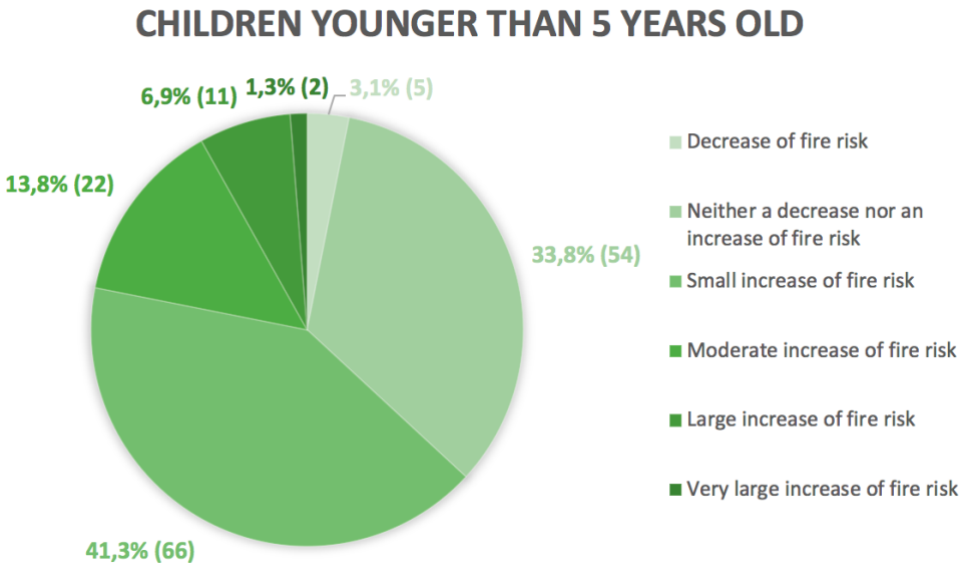

Figure 12: A pie chart illustrating, based on the results from the survey, how the general public believed children younger than 5 years affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact on children younger than five years old?* most respondents, 41.3%, answered that it led to a small increase. The option moderate increase of fire risk got a few less answers with 33.8% and 8.2% thinks small children have a large or very large risk of fire. 3.1% believe children younger than 5 years old have an increased risk of fire.

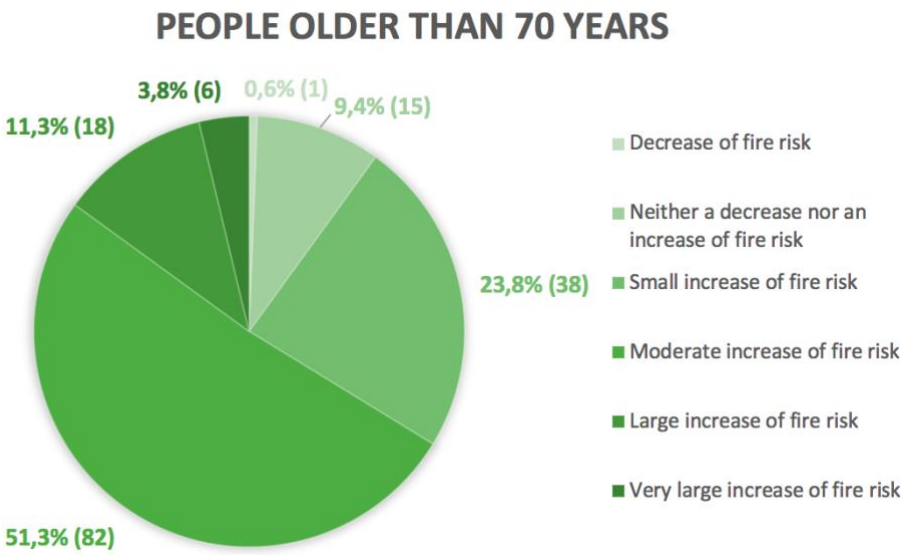

Figure 13: A pie chart illustrating, based on the results from the survey, how the general public believed people older than 70 years affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact on people over 70 years old?* a majority answered moderate increase in fire risk (51.3%). The second largest category was small increase in fire risk, with 23.8% of the answers. Large or very large increase in fire risk got 15.1% of the answers and one person (0,6%) thought being older than 70 years led to decreased risk of fire fatalities.

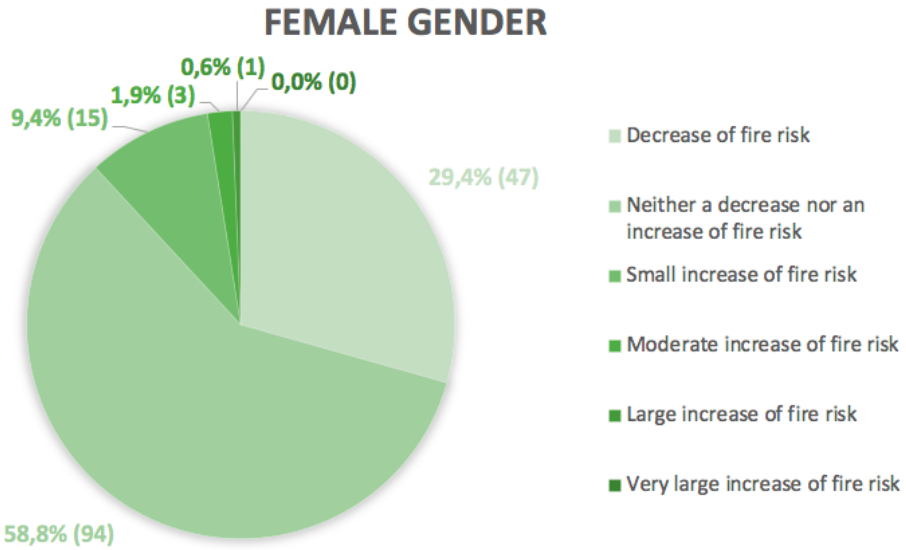

Figure 14: A pie chart illustrating, based on the results from the survey, how the general public believed being a female affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of being a female?* a majority believed it did not make a difference in the fire risk (58.8%). A considerable number of respondents also thought being female led to a decrease in fire fatality risk (29.4%). 11.9% believed being female led to an increased risk of fire.

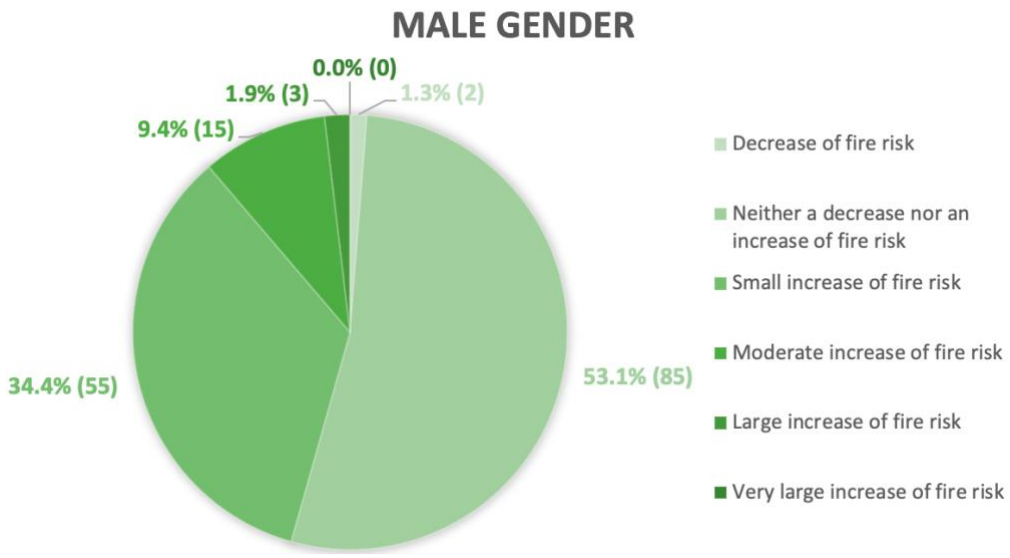

Figure 15: A pie chart illustrating, based on the results from the survey, how the general public believed being a male affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of being a male?* A majority believed it did not make a difference in the fire risk (53.1%). A considerable number of the respondents, 34.4%, thought being male led to a small increase in fire risk, and 11.3% of the respondents thought the risk was moderate and large. 1.3% believed being male led to a decreased risk of fire fatalities.

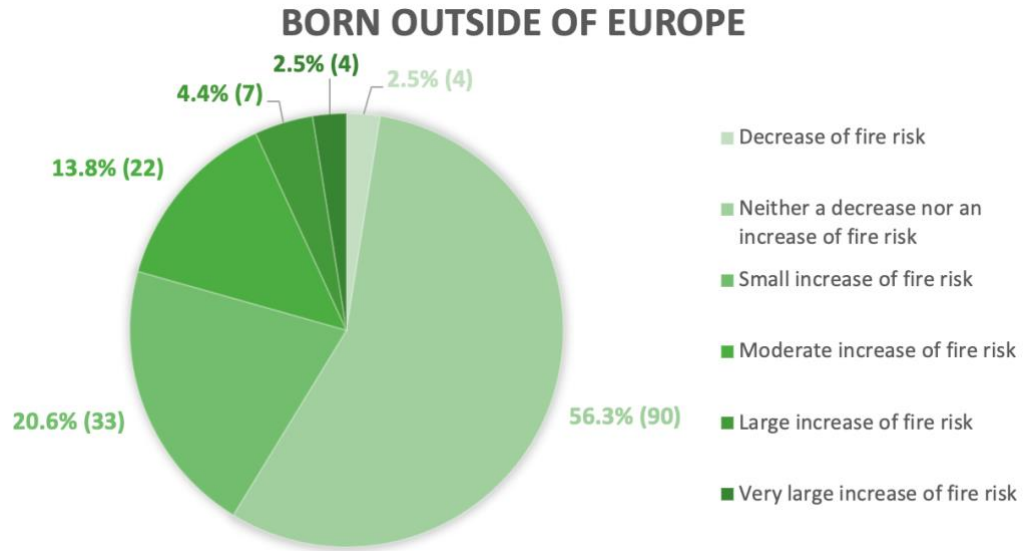

Figure 16: A pie chart illustrating, based on the results from the survey, how the general public believed people who live in Sweden, but were born in a country outside of Europe, affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact on someone who lives in Sweden but comes from a country outside of Europe?* a majority of the respondents, 56.6%, answered that it neither led to a decrease nor an increase in fire risk. The second largest category was moderate increase in fire risk, with 20.6 %. Some respondents, 13.8%, also thought it led to a moderate increase in fire risk. 6.9% thought the fire risk was largely or very largely increased, and 2.5% thought it led to a decrease in fire risk.

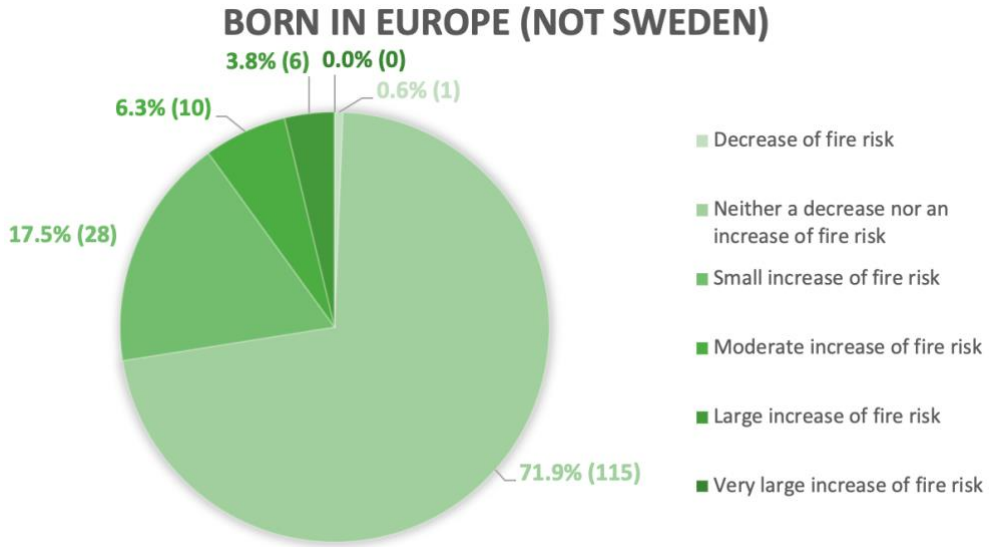

Figure 17: A pie chart illustrating, based on the results from the survey, how the general public believed people who live in Sweden, but were born in another country non-Nordic country in Europe, affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of someone who lives in Sweden, but comes from another country in Europe (not a Nordic country)?* a majority, 71.9%, answered that it was neither a decreased nor increased risk of fire and 17.5% of the respondents believed it led to a small increase in fire risk. Nobody believed being born outside of Europe led to a very large risk of fire, and 10.1% thought it was a moderate or large fire risk. One person (0.6%) thought it led to a decreased fatality risk.

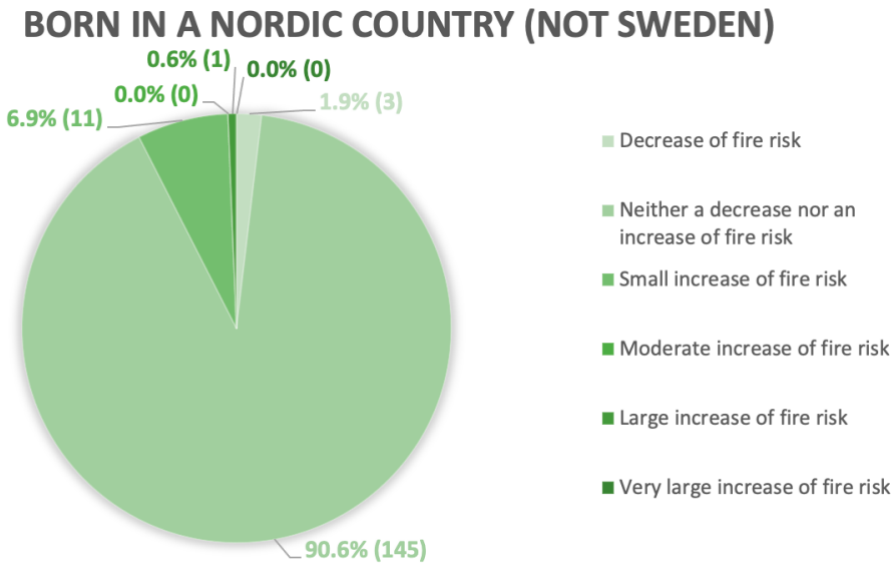

Figure 18: A pie chart illustrating, based on the results from the survey, how the general public believed the presence of people born in a Nordic country (not Sweden) affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact on someone who lives in Sweden, but comes from another Nordic country?* almost everyone, 90.6%, answered that being born in a Nordic country other than Sweden led to neither a decrease nor an increase in fire risk. 6.9% thought the increase in risk was small and one person, 0.6%, thought it led to a large risk of fire fatality. 1.9% thought being born in a Nordic country led to a decreased risk.

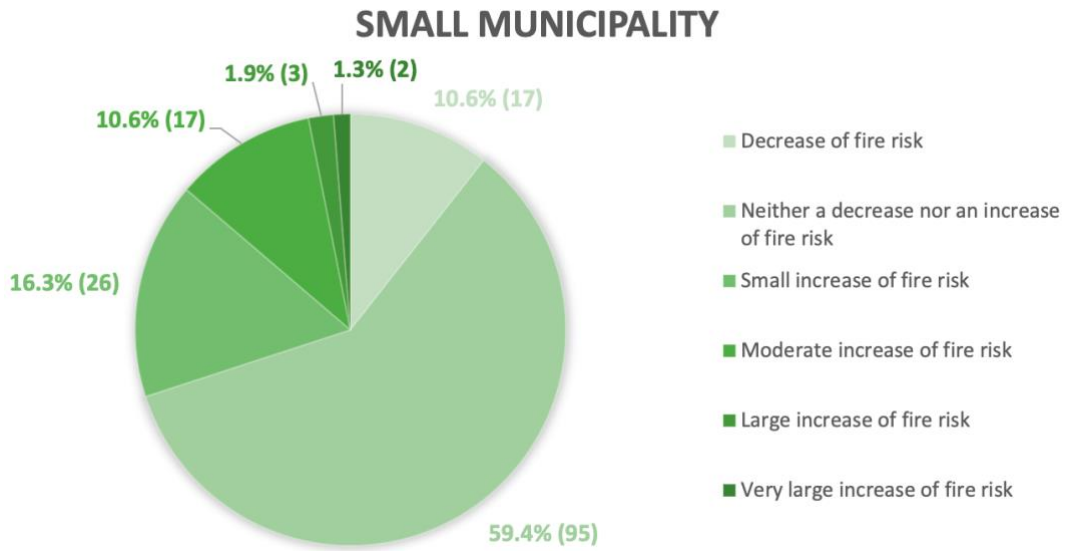

Figure 19: A pie chart illustrating, based on the results from the survey, how the general public believed living in a small municipality affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of living in a small municipality (municipality with less than 20 000 inhabitants)?* more than half of the respondents answered that living in a small municipality had neither a decrease nor an increase in fire risk fatality (59.4 %). 16.3 % thought it have a small increase in fire risk, 10.6 % thought the increase in risk was moderate, 1.9 % that it was large and 1.3 % that it was very large. 10.6 % perceived that living in a small municipality led to a decrease in fire risk.

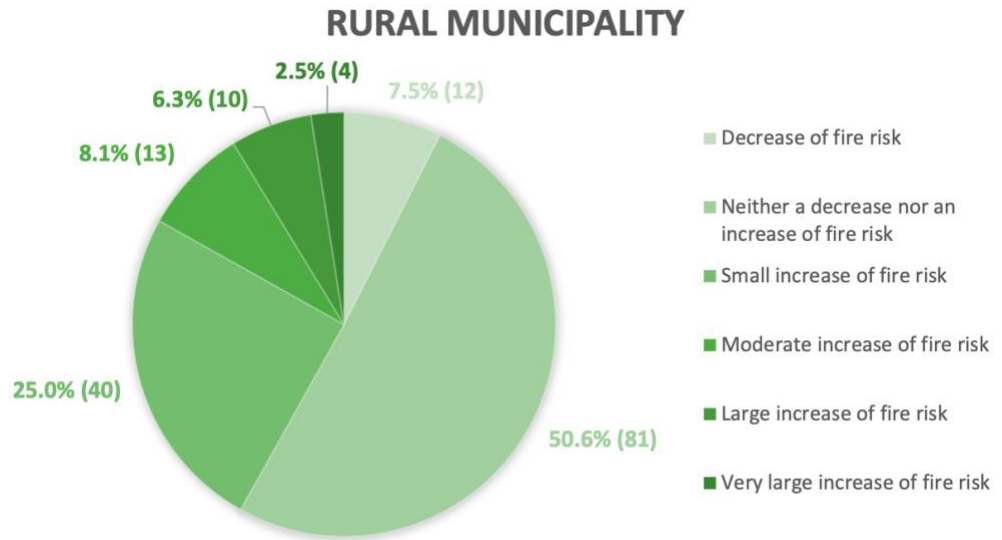

Figure 20: A pie chart illustrating, based on the results from the survey, how the general public believed living in a rural municipality affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of living in a rural municipality?* 50.6 % of the respondents thought that living in a rural municipality had neither a decrease nor an increase in fire risk fatality and 25.0 % believed it had a small increase in fire risk. 8.1 % of the respondents thought the increase in fire risk was moderate, 6.3 % thought it was large and 2.5 % thought it was very large. 7.5 % of the respondents perceived that living in a rural municipality led to a decrease in fire risk.

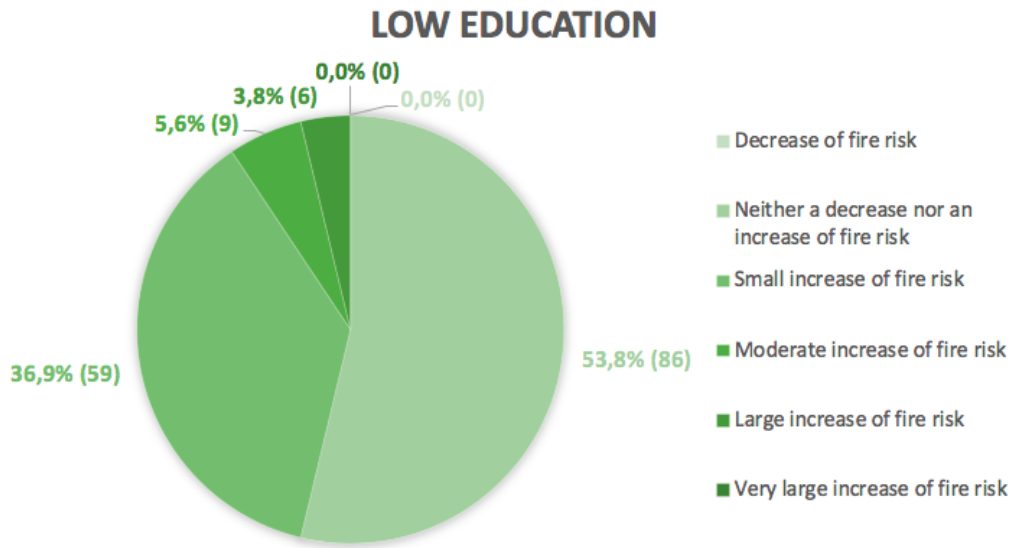

Figure 21: A pie chart illustrating, based on the results from the survey, how the general public believed people´s education level affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of having a low education level (9 years of basic education)?* more than half of the respondents answered that low education had neither a decrease nor an increase in fire risk fatality (53.8 %). 36.9 % of the respondents thought the increase in fire risk was small, 5.6 % thought it was moderate and 2.5 % thought it was large. Nobody perceived that low education led to either a very large increase in fire risk or a decrease in fire risk.

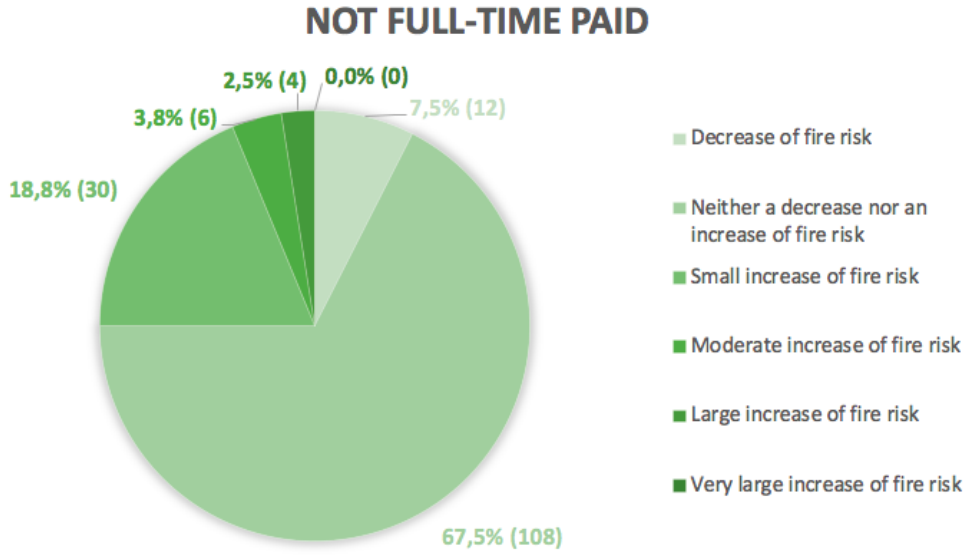

Figure 22: A pie chart illustrating, based on the results from the survey, how the general public believed not having a full-time job affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of someone who does not have a full-time occupation?* a majority, 67.5%, answered that those who do not have a full-time occupation had neither a decreased nor an increased risk of fire fatalities. Some respondents thought it led to a small increased risk of fire (18.8%) and some thought it led to a decreased risk of fire (7.5%). 6.3% thought not having a full-time job led to a moderate or large increase in fire.

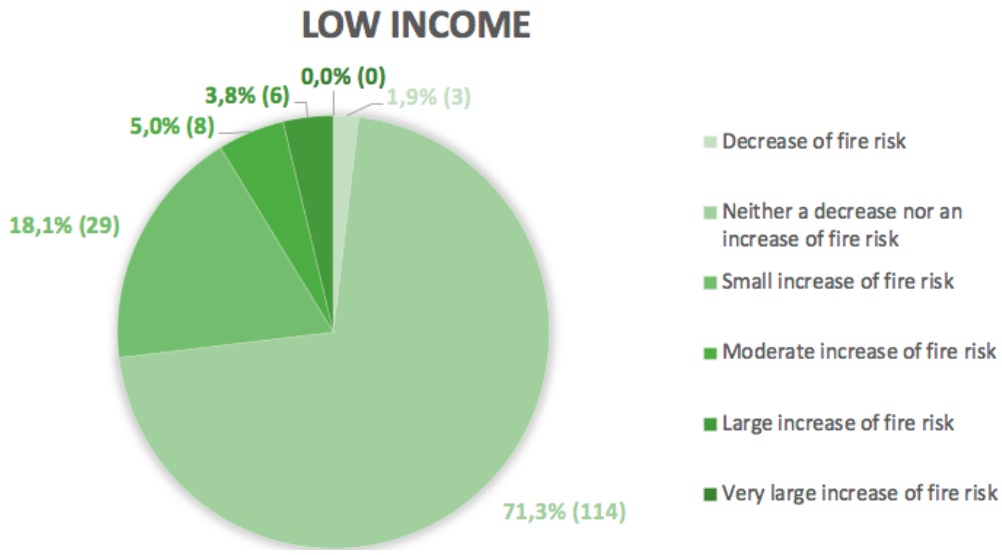

Figure 23: A pie chart illustrating, based on the results from the survey, how the general public believed having a low income affects the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of having a small income?* The majority of the respondents thought a low income had neither a decrease nor an increase in fire risk fatality (71.3 %). 18.1 % thought it had a small increase in fire risk, 5.0 % thought the increase was moderate and 3.8 % thought it was large. Nobody thought that low income led to a decrease in fire risk.

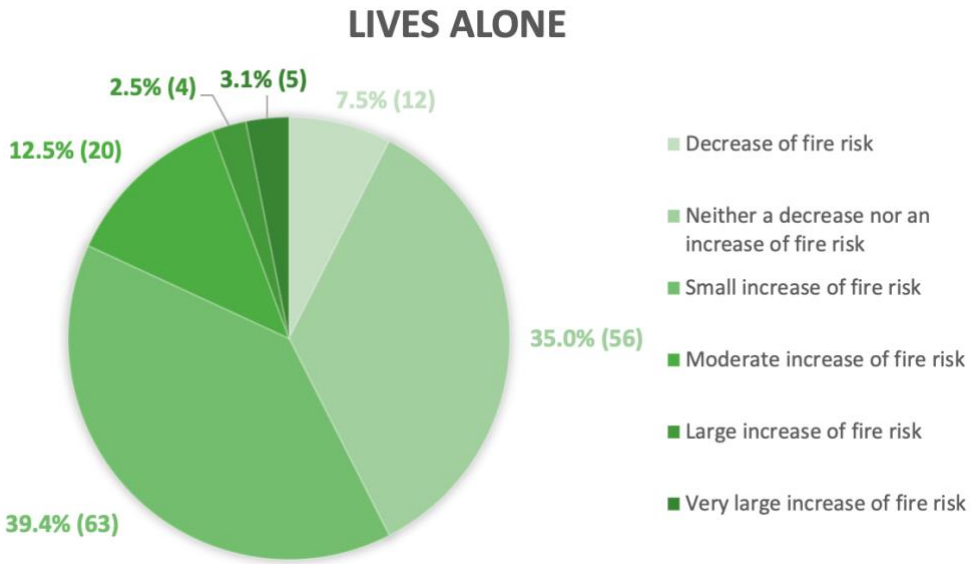

Figure 24: A pie chart illustrating, based on the results from the survey, how the general public believed people living alone affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of living alone?* 39.4 % of the respondents answered that living alone led to a small increase in fire risk, 12.5 % believed that the increase in fire risk was moderate, 2.5 % that it was large and 3.1 % that it was very large. 35.0 % of the respondents answered that living alone had neither a decrease nor an increase in fire risk fatality and 7.5 % perceived that living alone led to a decrease in fire risk.

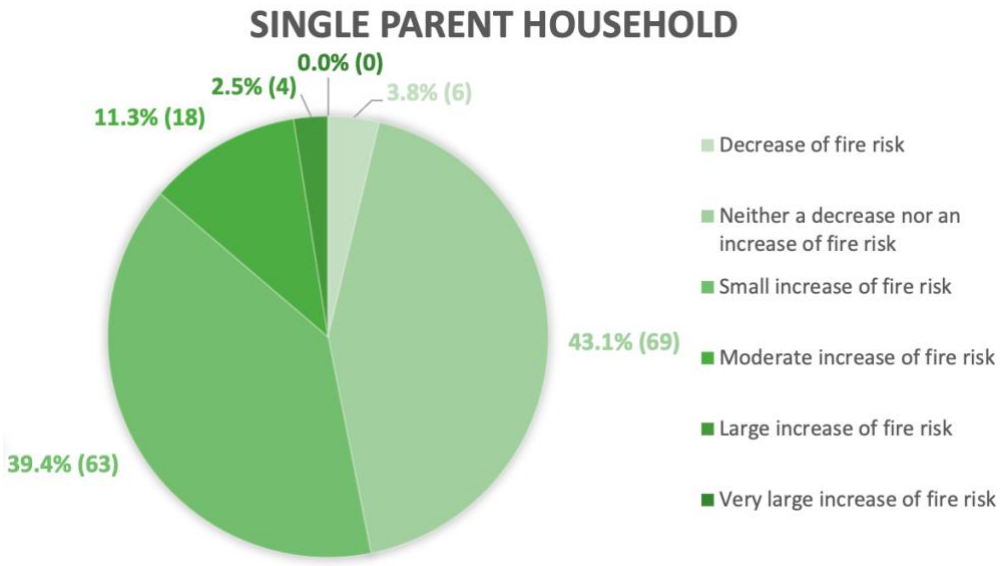

Figure 25: A pie chart illustrating, based on the results from the survey, how the general public believed single-parent households affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of single-parent households?* 43.1 % of the respondents answered that single parenting had neither a decrease nor an increase in fire risk fatality and 39.4 % of the respondents thought it had a small increase in fire risk. 11.3 % perceived that single parenting had a moderate increase and 2.5 % a large increase in fire risk. Nobody thought that single parenting led to a decrease in fire risk.

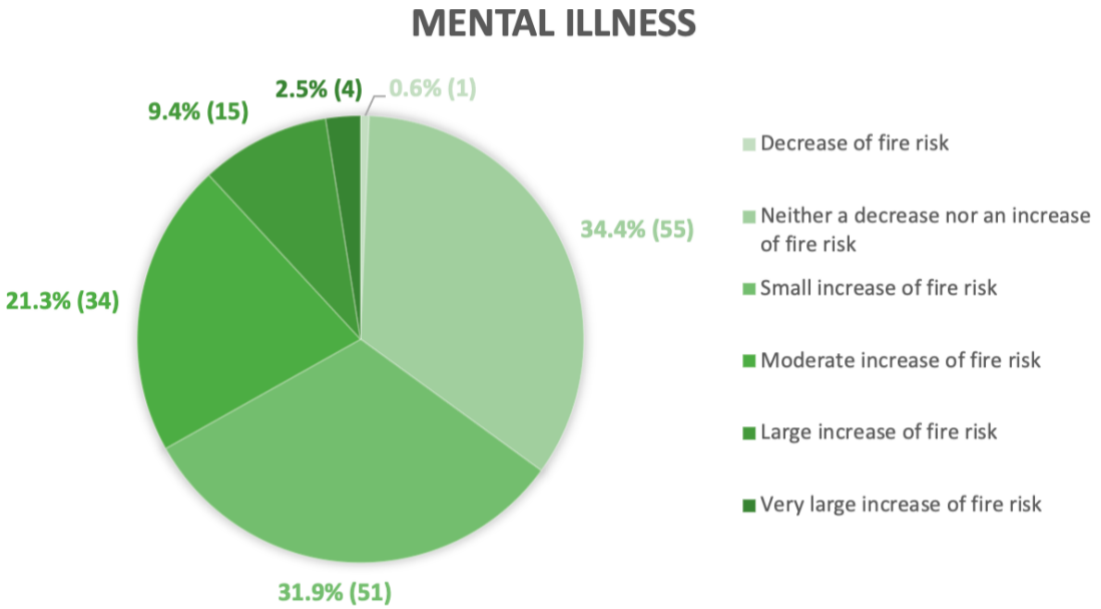

Figure 26: A pie chart illustrating, based on the results from the survey, how the general public believed people with a mental illness affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of having a mental illness?* 34.4 % of the respondents thought mental illness had neither a decrease nor an increase in fire risk fatality and 31.9 % thought it had a small increase in fire risk fatality. 21.3 % thought the increase was moderate, 9.4 % thought it was large and 2.5 % very large. 0.6% thought mental illness led to a decreased fire fatality risk.

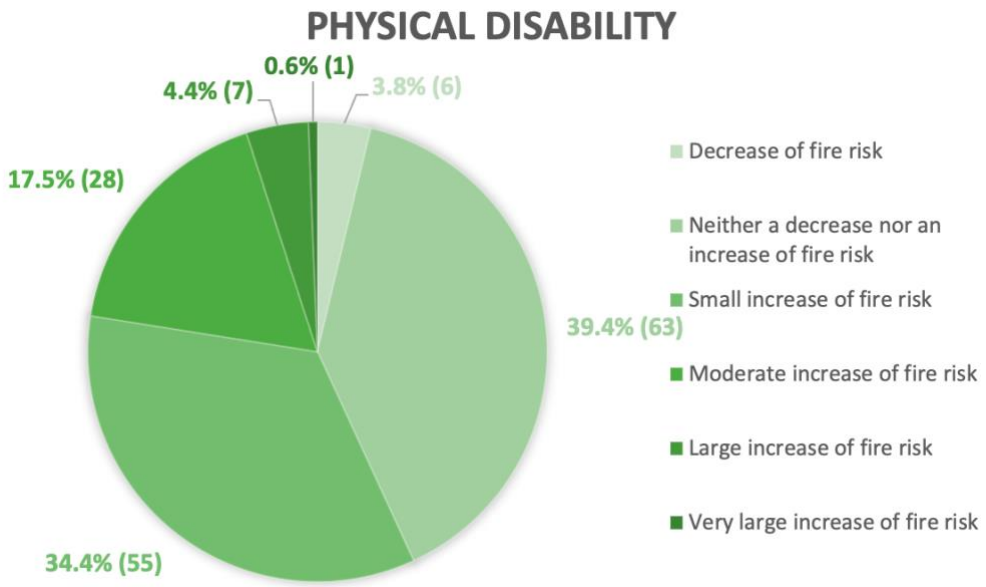

Figure 27: A pie chart illustrating, based on the results from the survey, how the general public believed people with a physical disability affect the risk of fire fatalities in residential buildings.

On the question *Considering fire fatalities in residential settings, what is the impact of having a physical limitation (mobility, visual, hearing)?* 39.4 % of the respondents answered that physical disability had neither a decrease nor an increase in fire risk fatality and 34.4 % of the respondents believed it correlates with a small increase in fire risk. 17.5 % thought the increase was moderate, 4.4 % thought it was large and 0.6 % very large. 3.8 % perceived physical disability led to a decreased fire fatality risk.

5 Interview results

A total of 25 interviews were held with fire consultants and people in the rescue service. A total of nine consultants and sixteen people from rescue services were interviewed. Most of the interviewees were fire safety engineers and some of the engineers had a master for instance in risk management and some had studied RUB – the Swedish Civil Contingencies Agency's education for fire safety engineers. A few were also firefighters who focus on preventative work, fire inspectors, and one occupational therapist. The interviewees had different work experiences, some of them were new graduates, while others had worked for many years in many different fields in the industry.

Since there were many interviews, the result presented here is not the full interviews, but rather themes that could be found in the fire safety experts' answers. The method for selecting the main points in the interviews was thematic analysis (Peel, 2020; Smedberg et al., 2022) and is presented further in the method chapter 2.3 Interview study. Some socio-demographic factors were often mentioned early on in the interviews, while others had to be asked about by the interviewers. Some themes could therefore be identified in the first part since the same factors often were mentioned by most of the fire safety experts. This can give a good indication of what factors the fire safety experts actually know about. For example, the factor *employment status* was seldom mentioned by the interviewees without being asked about it. While most of the fire safety experts did say this correlated with an increase, which is correct, they probably have little knowledge about this factor in comparison to smoking, which was a factor that most interviewees mentioned without being asked. The factors that were often mentioned in the first phase were smoking, substance abuse, old age, living alone, and functional limitation. Income, employment status, educational level, and municipality were instead mostly not mentioned by the fire safety experts, even though they answered correctly on these factors. These answers were probably more of a guess than built on actual knowledge, and many of the interviewees said it was difficult to know how they correlated, in contrast to for example smoking, living alone, and old age. A quantitative method was also used to see how many of the fire safety experts' perceptions matched with reality on the factors that were found in the literature study.

Many of the interviewees had read research about how socio-demographic factors correlate with fire risk and referred to the statistics on multiple occasions. A recurring theme in the interviews is the interrelation between the factors. Many mentioned that a factor is often not an issue by itself, but rather together with one of the other factors. Many also thought some of the factors such as unemployment, low income, and age are a symptom, rather than the root cause. That it is the underlying factors that are the real contributor to the risk of fire fatality, and that those underlying factors are more common in some of the main factors. An example of this is age, where old age may not be the actual issue, but rather the disabilities that can come with age. Age is therefore more of a symptom, while disabilities are the actual root cause of the increased risk. Consequently, the factors that are studied may look like the problem, when in fact it is not a problem in itself.

5.1 Smoking

All interviewees but one believed that smoking can increase the risk of dying in residential fires. Some believed it was one of the most common causes of fatal fires, while others believed that smoking as an isolated factor did not increase the risk significantly. Some believed it was in combination with other factors such as age, disability, or in combination with alcohol that smoking can increase the risk of a fatal fire. An interviewee discussed that if an elderly person lives alone without home care in combination with the person smoking, the risk of a fire can increase, and the person has more difficulty extinguishing the fire themselves and evacuating. Several fire experts discussed the risk of bed smoking and believed it was a significant reason for fatal fires.

5.2 Alcohol use

All interviewees believed that alcohol use can increase the risk of fatal fires. Several fire experts discussed that people become less aware when they drink alcohol and that taking care of themselves before and during a fire is more complicated. A consequence can be that people act in a dangerous way that they would not have done if they were sober. Many interviewees discussed that it is common for people to fall asleep or forget that there is food on the stove or that they have a candle that ignites a fire. Combined with a reduced ability to evacuate, this can increase the risk of fatal fires in housing.

A fire expert also mentioned that it is the society that provides people with alcohol because it is legal, which will always mean that a part of the population will abuse alcohol and thus the risk of a fatal fire. This interviewee and other fire experts agreed that factors such as socioeconomics, unemployment, and mental illness could be the root causes of alcohol use and that it is a combination of factors that can increase the risk of fatal residential fires.

5.3 Drugs

According to many fire experts, illegal drugs are a factor that correlates with the increase in the risk of fatal fires. However, one person thought it had neither a negative nor a positive effect. In the same way, as with smoking and alcohol, several interviewees believed that drugs, in combination with other risk factors, can increase the risk of fatal fires. Several people discussed how peoples' minds deteriorate as a consequence of drugs and that the response time then deteriorates. Consequently, it becomes more difficult for people who use drugs to handle the situation. "If you dampen your cognitive ability as a result of drugs, you have a worse perception and a reduction in awareness. Then it increases the risk of dying because the person does not notice a fire in time and cannot get to safety."

A majority of the fire experts also believed that prescription drugs such as antidepressants and sedatives can increase the risk of fatal fires. Many pointed out that prescription drugs are often taken in controlled forms, while people who use illegal drugs are more unaware of the situation. "I do not think it increases fire risk if you use medicines correctly. Those who use prescription drugs use them in a controlled way [...] Nevertheless, people do it under controlled conditions. So, if you use it as medicine, it should not increase the risk. However, if a fire occurs for another reason, and if you have a reduced ability to perceive a fire or if you

perceive a fire but have a reduced ability to move in a way that you cannot get out, I think it increases the risk of dying. Given that a fire occurs."

Several fire experts agreed with the above interviewee that the ability to handle the situation and to be able to evacuate is impaired by medication. "If there is more use of medicines, there is also a higher risk of more people dying in fires if you do not react to, for example, fire alarms or loud noises." Three interviewees considered that antidepressants and sedatives neither positively nor negatively correlate with the risk of fatal fires.

5.4 Age

All interviewees agreed that old age can increase the risk of fatal fires. "I would probably say that the things that significantly increase the risk of fatal fires are a high age. If a person has impaired ability, mobility or cognitive ability, i.e., the ability to perceive events, the risk increases". Several interviewees discussed that older people generally tend to have impaired mobility and sometimes cognitive ability, and many mentioned dementia as a contributing factor to an increased risk. Many interviewees also discussed that many elderlies live at home longer instead of living in retirement homes and that this can increase the risk because they have not adapted fire protection and cannot get help evacuating. Many saw a significant problem with the lack of retirement homes because, without them, older people cannot get help to the same extent, contributing to older people being an extra exposed risk group.

The interviewees had divided opinions about whether children under the age of 5 can lead to an increased risk of fatal fires. However, the majority believed it had neither a positive nor a negative correlation. Seven people thought it can increase the risk, and one person thought the risk can decrease for children under five years of age. Some people were still undetermined whether it increased and discussed that parents significantly impact how vulnerable children under 5 are. "The parent's social factors affect more than the child's young age. But that assumes that the child is not alone, because then the risk increases". Several people mentioned that such young children are very dependent on adults to evacuate. Thus, provided that children are not alone, the risk does not increase. "Nowadays, most children go to preschool. They are not at home or daycare as it was, perhaps if you go back 20 years. However, there is perhaps a slightly increased risk for more minor children in that they may need assistance to get out".

5.5 Gender

The majority of the interviewees believed that men have a higher risk than women of fatal fires in the home, often in combination with other risk factors such as alcohol or drug use. "Men are overrepresented in drinking alcohol or abusing substances, which increases the risk. But it is not your gender alone that decides". Several fire experts considered that men were only a risk group in combination with other factors, but not if only gender is taken into account, i.e., men, to a greater extent, have substance abuse problems. Two people considered that gender had neither a negative nor a positive correlation.

5.6 Country of origin

Many of the interviewees had some difficulty separating the three subcategories born outside of Europe, born in Europe, and born in a Nordic country outside of Sweden. It was especially

hard to distinguish between the first two since the groupings are so large. One interviewee expressed it like this: “There are so many non-European countries that also have good fire protection, and some in Europe might have really bad fire protection. So, I doubt that it is the Europe part that is.” Some also mentioned that there can be an increased risk when you come from a culture that is very different from Sweden’s, but since there are cultures that are both a lot like and unlike Sweden both in and outside of Europe, it is hard to answer definitely. This was also the reason why many of the fire safety experts thought being born in another Nordic country did not lead to an increased risk, since the cultures are so similar to Sweden’s. Many interviewees thought that there is no particular difference between being born in Europe or outside of Europe since the language differences are there anyway, and it is the language that makes being born outside of Sweden an increased risk.

One fire safety expert said that they did not think there were more fires in general, but that more of the fires resulted in fatalities. Another interviewee argued the opposite. “I also think there is another expectation on the fire protection, that you are more active in trying to help your neighbors and others to get out in a completely different way than a European born- and taught person might, who either know or expect to be safe in the building.”

When having to make a decision, many thought that being born outside of Europe can lead to the largest increase, that being born inside of Europe can lead to an increase but not as large and that being born in a Nordic country can lead to neither a decrease nor an increase in fire risk. Many referred to the knowledge of how to behave in a fire, like staying in the apartment in case of a fire in another apartment, instead of going out into the staircase to escape. One interviewee also said that if a person has moved to Sweden, they have so many other things to deal with, that fire safety may not be a priority. However, three of the interviewees had read the statistics on this topic and said that being born outside of a Nordic country in or outside of Europe correlates with a decreased risk, and being born in a Nordic country correlates with an increased risk. Some of the interviewees said they had been surprised when reading this statistic since before doing so, they believed the opposite.

5.7 Type of municipality

A majority of 18 interviewees, believed that living in a small municipality neither correlates with a decrease nor increase in the risk of fire fatalities. 14 interviewees believed living in a rural municipality correlates with an increased risk of fire. One person thought that living in a small or rural municipality can lead to a decreased risk since large and middle-sized municipalities have more problematic areas. Six fire safety experts believed living in a small municipality is a risk factor regarding fire fatalities and eight fire safety experts believed that living in a rural municipality neither correlates with a decrease nor increase in the risk of fire fatalities. Many of those who answered that living in a small or rural municipality can lead to an increased risk thought the increase was small relative to other socio-demographic factors.

One of the reasons stated by many of the fire safety experts as to why living in a rural municipality is a risk factor while living in a small municipality is not, is that rural municipalities have a longer distance to rescue services and this does not necessarily apply to small municipalities. Some of those who did not think small and rural municipalities are a risk factor, argued that it is specific areas rather than entire municipalities that have issues. One

interviewee also thought it is the status of the municipality rather than the size, that makes it riskier to live in.

One fire safety expert who believed living in a small municipality correlates with an increased risk, argued that there are more villas in small municipalities, and older people who live in villas are more reluctant to move out. Consequently, they stay longer and can have a decreased risk of managing a fire event. Another thought it had to do with taxes and answered the following: “I think that in a smaller municipality, the basis for tax revenue is not as large, which means the municipality does not have the same opportunities to have a sufficiently robust system to take care of, for example, the elderly. […] But I think the risk will be greater there and also in sparsely populated municipalities, there are more part-time and the distance to the rescue service will be longer. […] You simply do not have the resources for it, […] you cannot have any specific competence in the rescue service or the municipality.”

5.8 Education level

Everyone but three interviewees thought a lower education level correlates with an increased risk. The motive most of the fire safety experts mention as a reason for this is that higher education leads to a better understanding of risks. Someone also mentioned that education does not impact the number of fires in general, only the number of fires that lead to fatalities. Many also thought low education is a risk factor because of the underlying connections it may have with risk factors such as substance abuse and unemployment. This can be seen in the following reasoning by one of the interviewees who got the question how they thought low education impact the risk of fire fatalities in residents: “There, the reasoning is that the level of education is connected with the risk of ending up in some form of social vulnerability in society, which in itself increases the risk […] of not being able to handle a fire situation. So, there will be many steps along the way, but I think that the level of education increases the risk that you might not get a job […], and to be unemployed is a risk in itself. It can increase the risk of undetected psychological problems and can lead to substance abuse.”

5.9 Employment status

All fire safety experts, but two, thought unemployment correlates with an increased fire risk. One interviewee did not know how employment status correlates with the fire risk and one thought it neither decreased nor increased the fire risk. This was a factor that many of the fire safety experts thought was not an issue by itself but could lead to an increase in fire risk because it is connected to other risk factors such as depression, addiction, and loneliness. Two of the interviewees thought it was a risk factor since more time might potentially be spent in the home, which makes you more exposed to fires that occur specifically in a residential setting.

5.10 Income

Almost all interviewees thought low income can lead to an increased fire risk, although many said that while they believe low income can lead to an increase in fire risk, the increase is very small. Two fire safety experts said that income does correlate with fire fatality risk, but that it is more connected with what type of socioeconomic area a person lives in rather than the

individual income. Two fire safety experts thought low income does not correlate with an increase in fire safety.

Some stated that the reason why they believe low income is a risk factor is that those who have a lower income do not have the same capacity or priority to buy fire safety equipment such as smoke alarms and fire extinguishers. They are also more likely to live in cheaper buildings that do not have as good fire safety as more expensive residents. One fire safety expert reasoned: “I can imagine it is a question of priorities. If you do not have a steady income, you may prioritize other things than fire protection.” Another interviewee argued on the other hand that most fire safety equipment is cheap and something most people with a low income can afford, which makes low income a very small increase of fire risk. “I would not say it is such a big deal. It is not like you need to spend a lot of money on fire protection. If you have a fire alarm in your apartment for 89 crowns from Clas Ohlson, that’s often enough.”

Some interviewees mentioned that low income is connected to low education, which correlates with an enhanced fire fatality risk. A few also mentioned that lower income is not what leads to a higher fatality risk in itself; it is rather a symptom than the cause. The problem is instead what is causing someone to have a low income or the consequences of having a low income, which could be, for example, depression or a functional limitation.

5.11 Living arrangement

All fire safety experts but one thought living alone was a risk factor and many said that it is one of the largest contributors to fire fatalities in residents. One interviewee reasoned that when living alone fewer people can help detect a fire in the home, which can increase the fire fatality risk. On top of that, there is nobody in the residence that can help the person escape, which makes them reliant on others outside the household such as neighbors and the fire rescue service. This reason was mentioned multiple times and one interviewee phrased it like this: “If you live by yourself, you have a rather increased risk. Because for natural reasons […] there are fewer who can detect a fire. And when something does happen, you have nobody there to help.” Another interviewee reasoned that if many people are living in the residence, more people can help control that for example candles are not lit or the stove is off. A third interviewee believed that living alone is not in itself a danger, but rather the reason why the person is living alone. Several fire safety experts connected living alone to loneliness and thought that having a small or no social network can lead to an increased risk of fire fatalities in residents.

Most interviewees believed single-parent households had neither a decreased nor an increased risk of fire fatalities. One of the interviewees did not know whether single-parent households are a risk factor or not, and five people thought it can lead to an increased risk, although one of the four thought it was only marginal. One fire safety expert thought it correlates with a decrease in fire fatality risk, because, they argued, parents better manage fire safety such as smoke alarms at home since they are responsible for a child. One of those who thought single-parent households correlates with an increased risk reasoned like this: “I think that as long as the parent is at home, there is probably no difference. Well, now this may be far-fetched, but

if the parent has to work more and longer days because they are a single parent, the child is home alone more […] If you look at children in general, maybe there is a tendency like that."

5.12 Disabilities

All interviewees thought disabilities were a risk factor that correlates with an increased risk of dying in a residential fire. Everyone but one person thought physical disabilities were a risk factor, although this person believed cognitive disabilities correlate with an increased risk of fire fatalities. The other interviewees agreed that disabilities such as physical and mental entailed a higher risk. Both cognitive disability and mental health issues were brought up as risk factors regarding mental disability. Disability was a factor that many mentioned as one of the main factors that contribute to fire fatalities and was often mentioned without the interviewers having to specifically ask about it.

Dementia was mentioned by multiple interviewees as a risk and one of the fire safety experts reasoned that it is a risk factor since they thought it enhances the risk of forgetting for example food on the stove or checking the smoke alarm. Other cognitive disabilities were also discussed by other fire safety experts. One interviewee argued that people with a cognitive disability are both more likely to accidentally start a fire and to not be able to handle the consequences of it, which makes them even more likely to die of a fire. This was a difference to individuals with a physical disability since they are not more likely to start a fire, they only have the decreased ability to evacuate if a fire were to start, the interviewee argued. The decreased ability to evacuate from the residence for people with a physical disability was mentioned by several fire safety experts, since they may not, for example, be able to escape through windows and thus have fewer escape routes. The risk may also be enhanced since people with a disability may not have the same ability to keep up with the preventative fire safety work such as changing batteries in the smoke alarms.

6 Comparison

The goal of this chapter is to answer the second research question: Do the perceived factors of the general public and fire safety experts match the socio-demographic factors in reality? This will be done by comparing the result from the literature review, survey, and interviews. The survey result is also presented in a box chart, to illustrate how it differs from reality. The actual score is therefore also illustrated in the graph. To be able to use box plots as a device, and also calculate the mean and standard deviation, the qualitative values were converted into quantitative values, see Table 6.

Table 6: Qualitative values converted into quantitative values.

Qualitative value	Quantitative value
Decrease of fire risk	-1
Neither decrease nor increase of fire risk	0
Small increase of fire risk	1
Moderate increase of fire risk	2
Large increase of fire risk	3
Very large increase of fire risk	4

6.1 Smoking

Smoking correlates with a large increased risk of fire. All interviewees but one believed that smoking correlates with an increased risk of fire fatalities. 95% of the survey respondents agreed that smoking correlates with an increased risk, and the other 5% believed it had no impact. Most of the respondents believed the increase was moderate and a close second option was large increase. This result indicates that both fire safety experts and the general public knows smoking is an important risk factor.

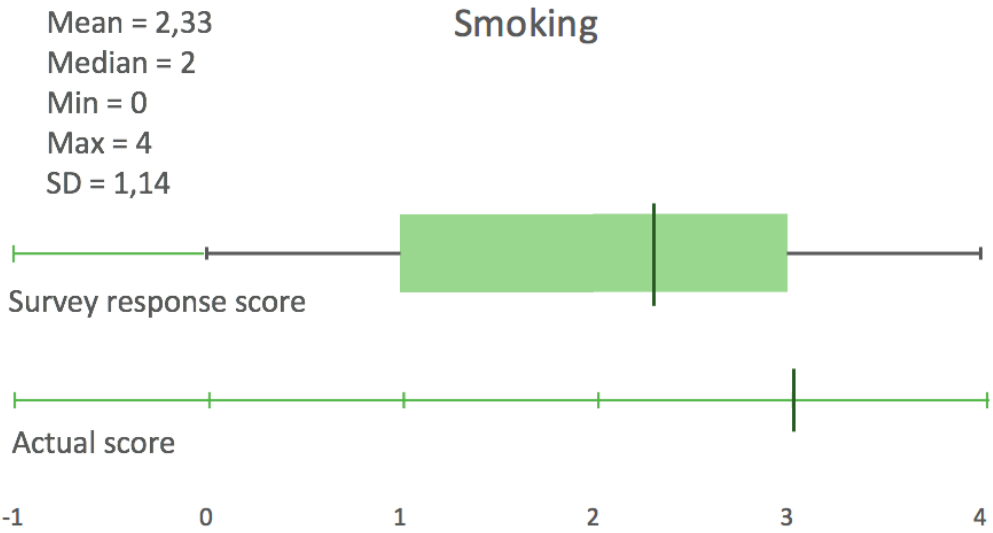

Figure 28: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for smoking.

6.2 Alcohol

Alcohol correlates with a large increased risk of fire. This was a factor that all interviewees believed correlates with an increased risk. This factor was also further discussed by many of the interviewees and mentioned as one of the largest risk factors. Most of the survey respondents, 98.1%, also believed that this socio-demographic factor correlates with an increased risk, and the option that was selected by most of the survey respondents was large increase, followed by moderate increase. Summing up, this seems to be a factor that both fire safety experts and the general public have sufficient knowledge of.

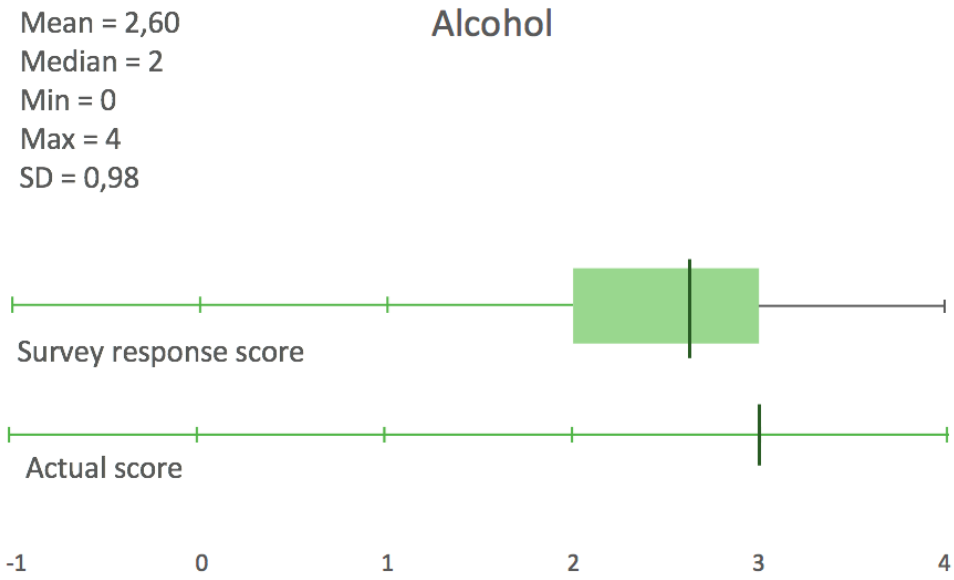

Figure 29: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for alcohol use.

6.3 Drugs

The use of antidepressants correlates with a moderate increase in the risk of fatal fires and sedatives have a very large risk of fatal fires. This corresponds with the fire safety experts' answers, as most of them thought the use of sedatives and antidepressants correlates with an increased risk of fire fatalities. However, few of the interviewees said they thought the risk of fire fatalities was larger with sedatives than with antidepressants. Nevertheless, since they were not asked to scale the increase of fire risk, it is possible more of the fire safety experts understood sedatives can lead to a much larger risk than the few who said it explicitly. A majority of the survey respondents believed antidepressants have no correlation with fire risk and 36.9% believed it can lead to some sort of increase. Although the majority of the respondents believed sedatives correlate with an increase in fire risk, only 0,6% believed that the increase was in fact very large. 40% believed the use of sedatives did not with the fire risk. This implies that the fire safety experts have a better understanding of the use of prescriptive medicines than the general public, although none of them understood quite how large the correlation actually is, especially for sedatives.

Illicit drugs correspond with a decrease in fire risk. However, this might not completely correspond with reality as some other research say it increases. Almost all fire safety experts believed that illicit drugs can lead to an increase. None of the survey respondents or fire safety

experts believed it correlates with a decrease. 96.2% of the survey respondents thought that the use of illicit drugs correlates with an increase. This indicates that both the general public and fire safety experts have insufficient knowledge of this factor and that they overestimate the risk.

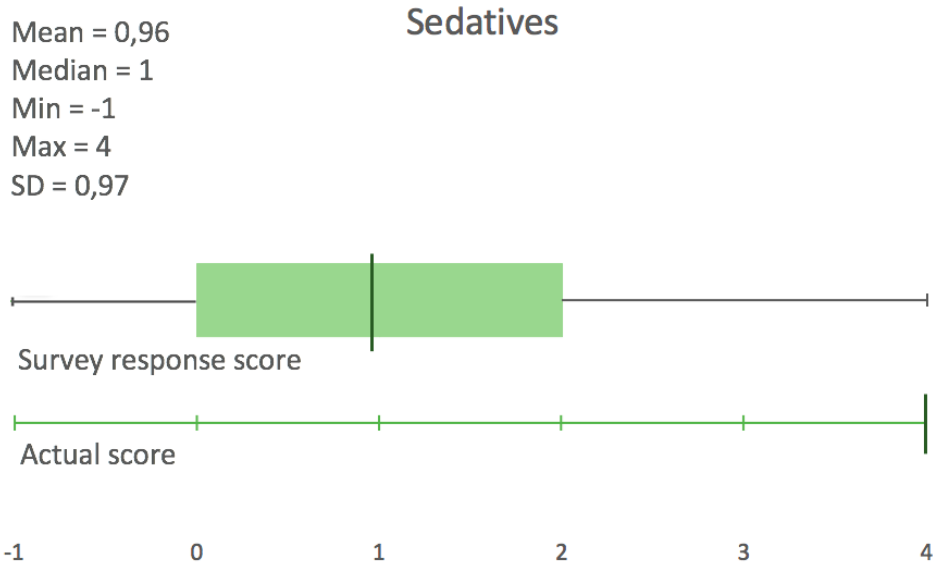

Figure 30: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for use of sedatives.

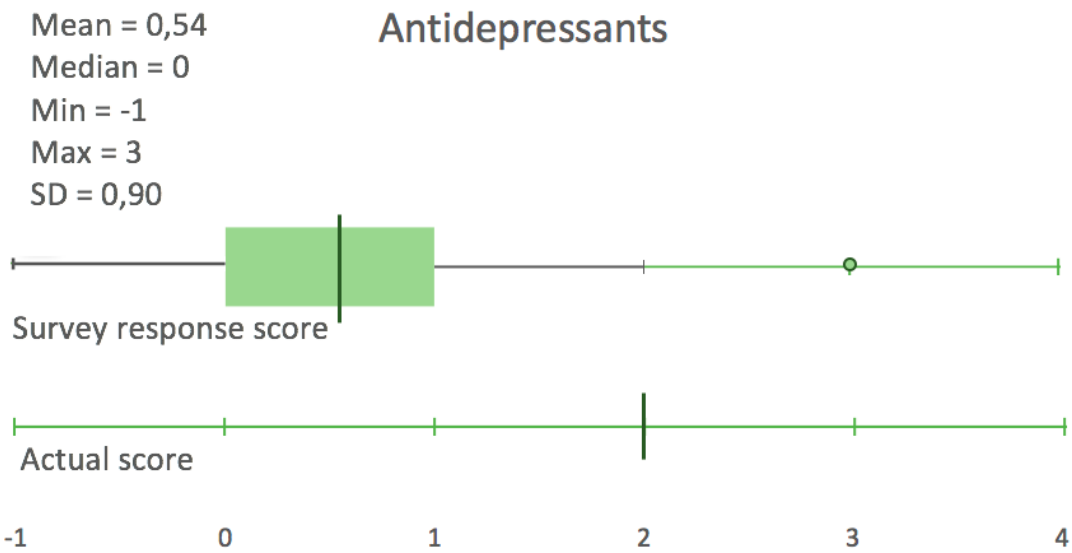

Figure 31: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for use of antidepressants.

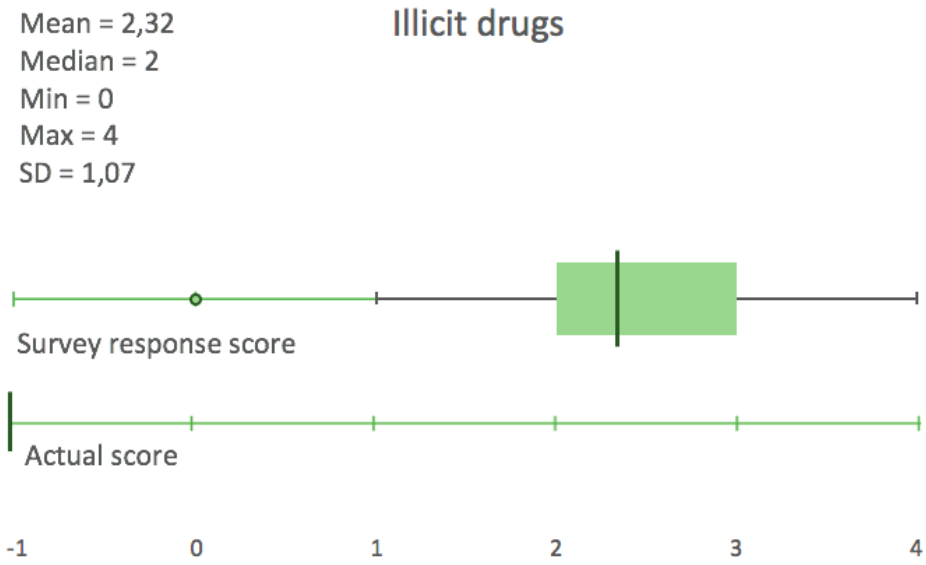

Figure 32: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for use of illicit drugs.

6.4 Age

The socio-demographic factor of being older than 70 years, correlates with a very large increase in fire risk. This is represented in the fire safety experts' answers as all of them believed old age correlates with an increased risk. This was a factor that many of the interviewees discussed further and put in a societal context, which indicates that they know this is a factor that has a very large impact. Six survey respondents (3.8%) believed being older than 70 years led to a very large increase in fire risk. Instead, moderate increase in fire risk got the majority of the answers. 10% of the survey respondents believed being older than 70 years old did not lead to an increase in fire risk. This indicates that both the general public and fire safety experts know this is a factor that correlates with an increase in fire risk.

Being younger than five years correlates with a decrease in fire risk. Most fire safety answered that being younger than five years old correlates with neither a decreased nor an increased risk of fire. Although this is incorrect, most of the interviewees realized that at least it is not a risk factor. The majority of the survey respondents believed that being younger than five years old led to an increased risk of fire and five people (3.1%) believed the correct answer of a decrease. This result implies that fire safety experts understand this socio-demographic factor is not a risk factor, while the general public thinks it is a factor that contributes to increased risk. Hence, the general public has an insufficient understanding of the factor's implications.

Figure 33: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for children younger than five years old.

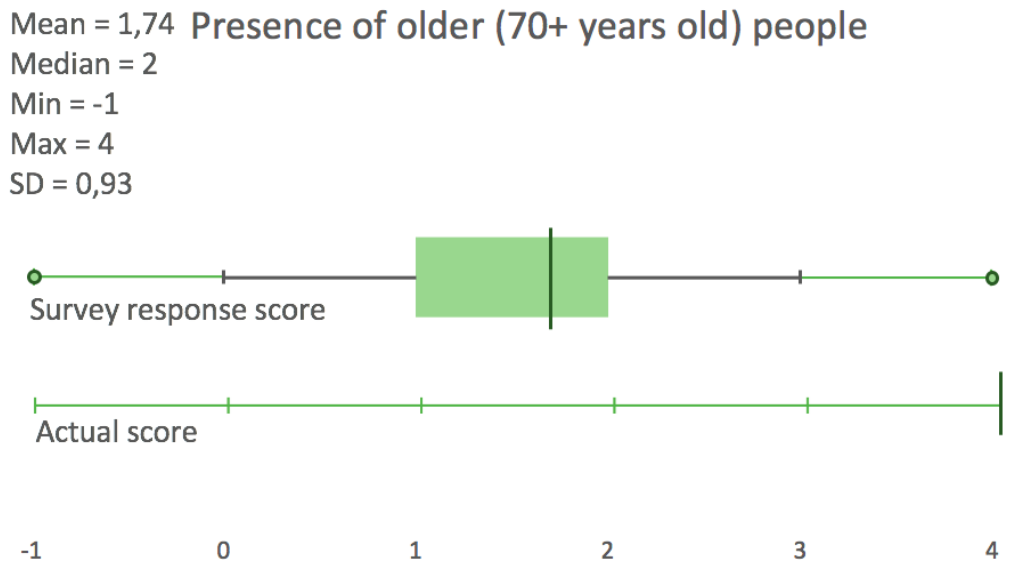

Figure 34: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people older than 70 years old.

6.5 Gender

Males correlate with a small increased risk of fire fatalities in residential settings, and women with a decreased risk. This matches the fire safety experts' perception, as most of the interviewees thought men correlate with a higher risk of fire. Most survey respondents believed being a female has no impact on the fire risk, and 29.4% also believed that being female led to a decreased risk. 11.9% of the respondents believed females led to an increased fire risk. A majority of the respondents also believed males did not affect the risk of fire, and 34.4% believed being male led to a small increase in fire risk. This result shows that fire safety experts had a sufficient understanding of the fire risk and that the general public is somewhat knowledgeable.

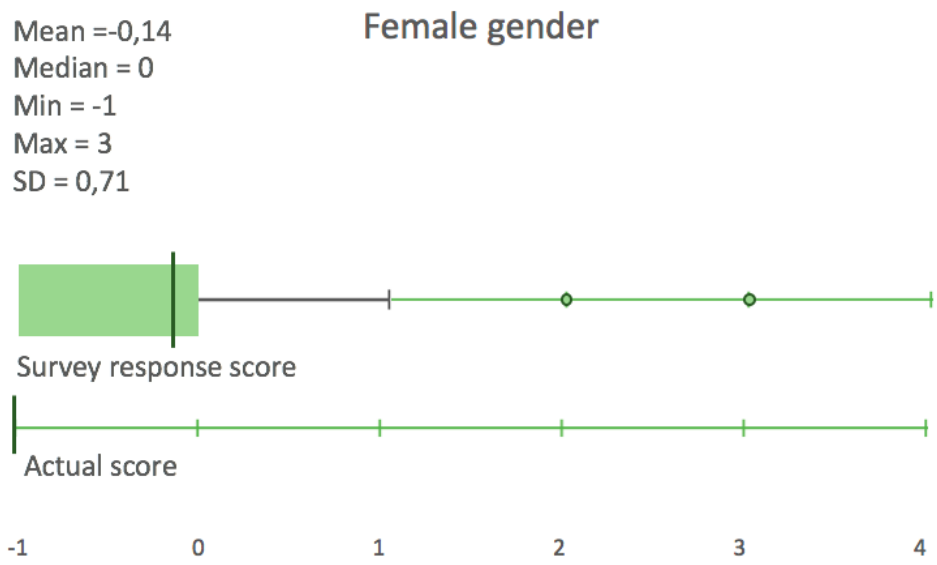

Figure 35: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for female gender.

Figure 36: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for male gender.

6.6 Country of origin

Being born outside a Nordic country correlates with a decrease in fire fatality risk and being born in a Nordic country other than Sweden can lead to a small increased risk of fire fatality. Few of the interviewees answered this and most of the interviewees thought the opposite. The only ones being correct were those three who had read this particular research on this topic. Most survey respondents thought country of origin had no connection to fire risk. 7.5% believed being born in a Nordic country outside of Sweden led to an increased risk of fire, 27.6% believed being born in a European country led to an increased risk and 41,3% believed being born outside of Europe led to an increased risk. This is the opposite of how the factors correlate with reality since being born in a Nordic country is the only one that leads to an

increased risk. Some respondents, 2.5% and 0.6% respectively, thought being born outside of Europe or in Europe led to a decreased risk. In summary, both fire safety experts and the general public need to be educated about this socio-demographic factor, as most answered incorrectly.

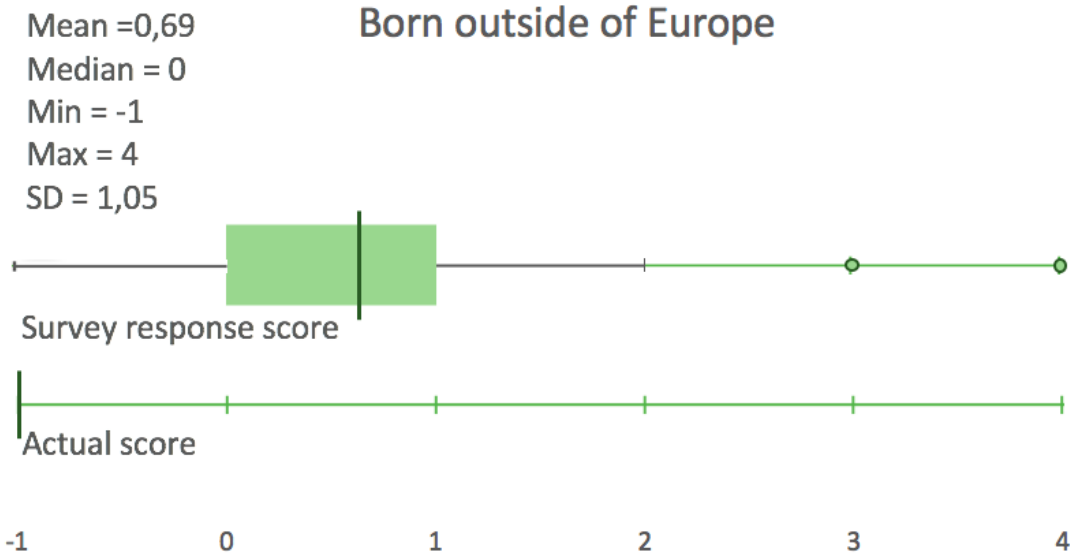

Figure 37: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people who were born outside of Europe.

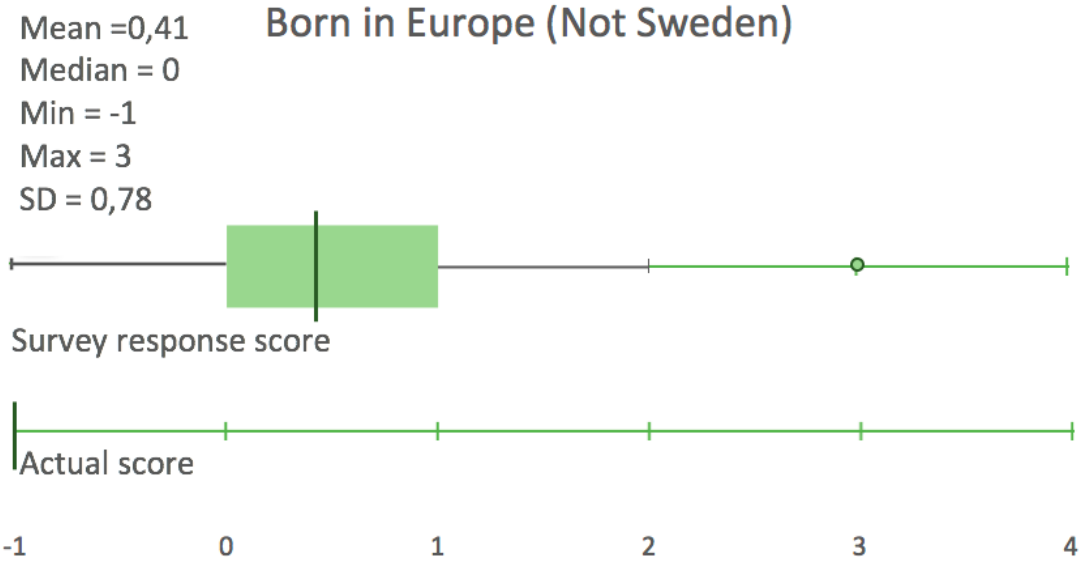

Figure 38: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people who were born in Europe.

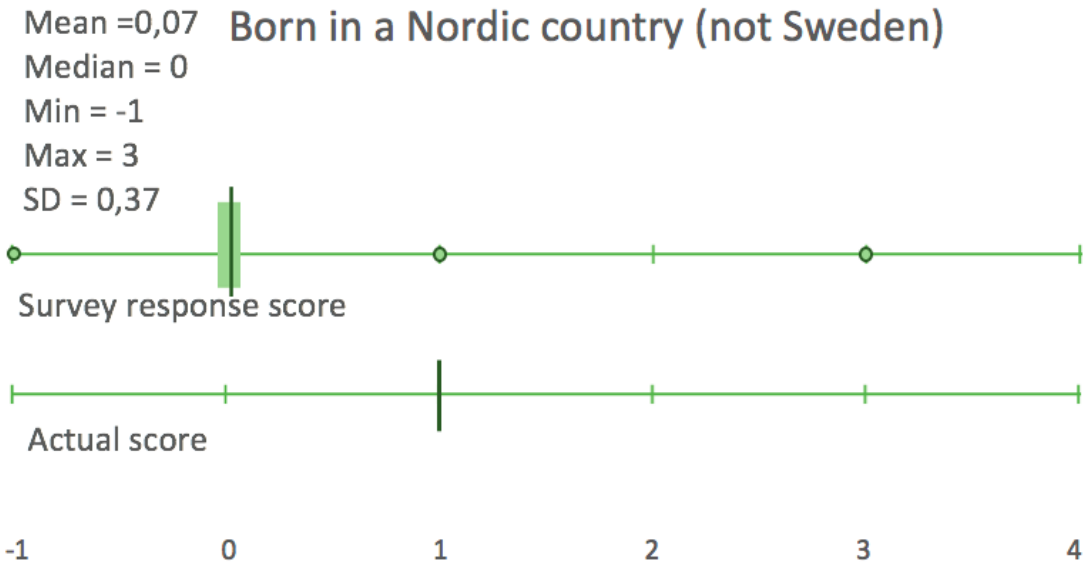

Figure 39: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people who were born in another Nordic country.

6.7 Type of municipality

Living in a small or rural municipality correlates with a small increase in fire risk. Most fire safety experts believed that living in a small municipality does not correlate with the fire risk, and many of those who believed it can lead to an increase, said they thought the increase was marginal. Most fire safety experts believed living in a rural municipality can lead to an increase, though many of them said they thought the increase was small compared to other factors. This matches the research somewhat, as both small and rural municipality correlates with an increase, but the increase is small. The interviewees' answers also match the research since living in a rural municipality is slightly riskier than living in a small municipality. The general public is less correct with this factor since a majority believes living in a rural or small municipality does not correlate with fire risk and some think it even can decrease the risk. A quarter of the respondents believed living in a rural municipality led to a small increase and 16.3% believed living in a small municipality led to a small increase. In essence, the general public lacks some knowledge of this socio-demographic factor, and the fire safety experts are more correct, but could still be more educated.

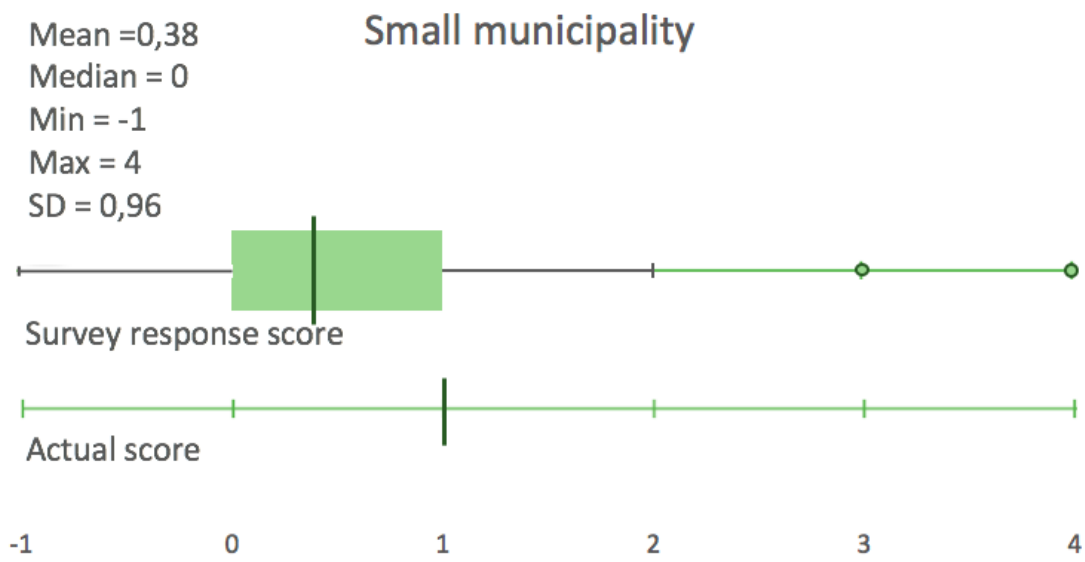

Figure 40: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people who live in a small municipality.

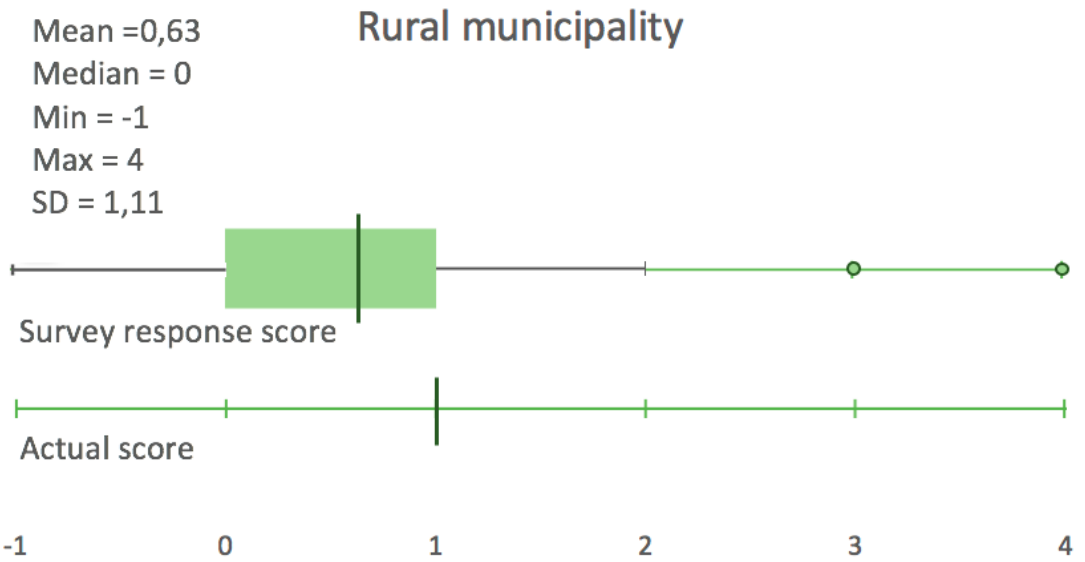

Figure 41: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people who live in a rural municipality.

6.8 Education level

People who have gone to school for nine years or less correlate with a moderate increase in risk of dying in a residential fire. This is represented in the fire safety experts' answers, as 23 out of 25 interviewees thought having a low education level correlates with an increased risk of fire fatalities. The majority of the survey respondents, 53.8%, believed that education level had no correlation to fire risk and 46.3% believed the risk leads to an increase. Consequently, about half of the general population understands the implications of education level, and most of the fire safety experts have a good understanding of the factor.

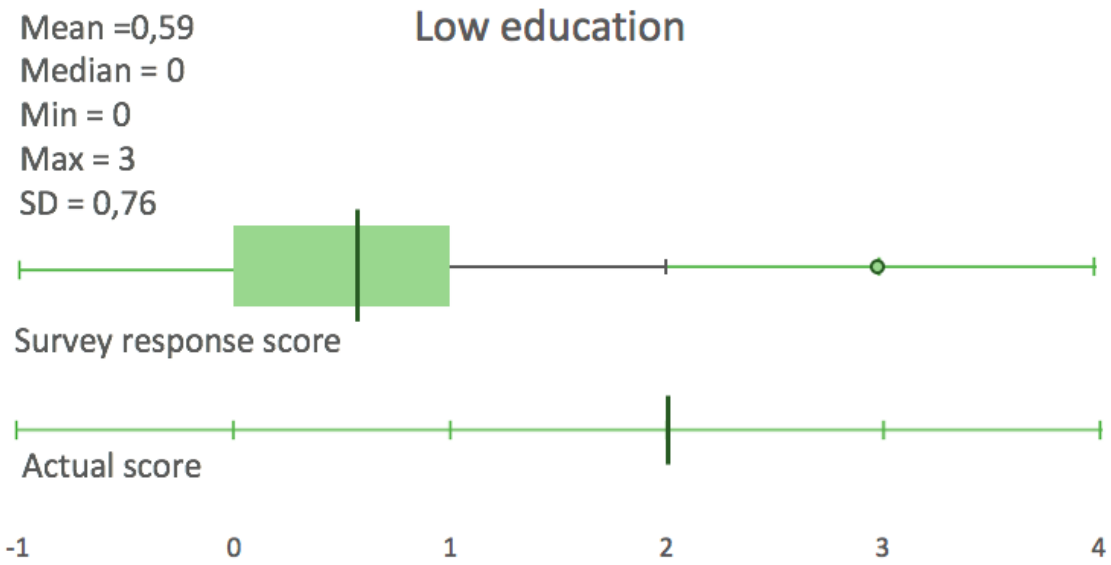

Figure 42: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people with a low education level.

6.9 Employment status

Not having a full-time job correlates with a moderate risk of fire fatalities. This matches with what the fire safety experts believed, as all but two of them thought not having a full-time job correlates with an increased fire fatality risk. The majority, 67.5% of the general public, on the other hand, believed that not having a full-time job led to neither a decrease nor an increase in fire risk. 25.1% of the respondents thought it led to an increase and 3.8% of the survey respondents believed that the increase in fire risk was in fact moderate. To conclude, the fire safety experts have a good comprehension of this socio-demographic factor, and the general public does not.

Figure 43: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people who do not work full-time.

6.10 Income

The research shows that having social allowance correlates with a risk of fire fatalities. This correlates with what the fire safety experts thought since all but two of them thought low or no income can have an increased risk of fire. The increase is moderate which also correlates with what many of the fire safety experts said, as many of them did not think the increase was as large as some other factors. However, 71.3% of the survey respondents thought low income had no impact on fire safety risk, with 5% answering the correct option of moderate fire risk. In summary, fire safety experts seem to have an understanding of this factor's implications on fire risk, while the general public does not.

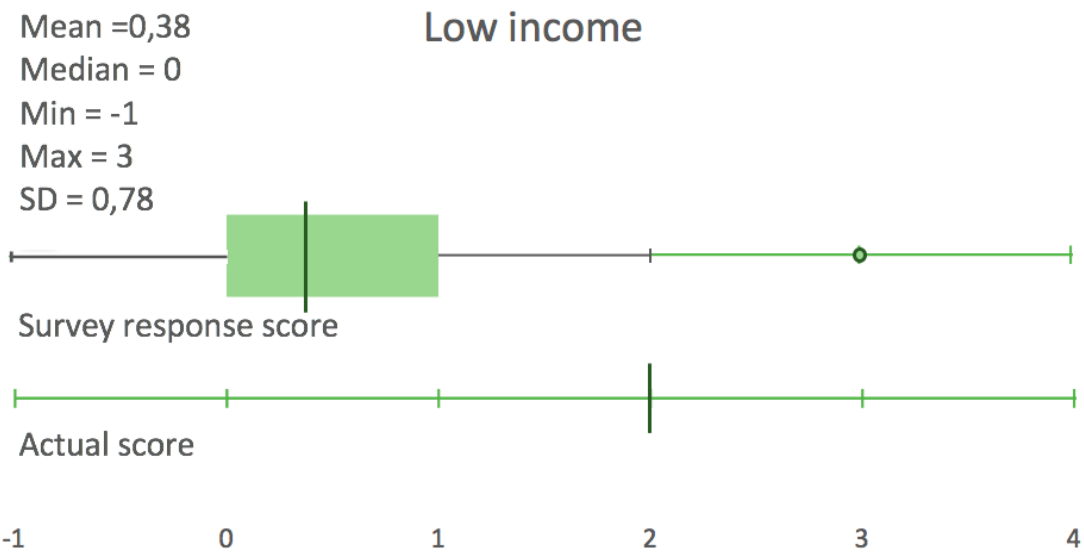

Figure 44: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people with a low income.

6.11 Living arrangement

Single-parent households correlate with neither a decreased nor an increased risk of fire. This corresponds with what most of the fire safety experts answered. It is also what most of the survey respondents answered. However, many of the survey respondents also thought that it led to a small increase in fire risk, and a majority of the answers thought that it led to some type of increase. Consequently, fire safety experts seem to have a good understanding of how single parent-households correlate with fire risk, and the general public is somewhat knowledgeable, but not as well-informed as the fire safety experts.

Living alone has a very large correlation with fire risk. The fire safety experts all answered that living alone is a risk and many also mentioned this factor early in the interview, which indicates that this is a well-known factor for fire safety experts. The general public's perception of this factor was, however, far from how living alone actually correlates with the fire risk. Out of the 202 respondents, 5 people (3.1%) thought that the risk is in fact very large. Instead, almost everyone thought the risk was small or had no impact at all. This shows that the general population's perception is lacking, but that the fire safety experts have a good comprehension of this factor.

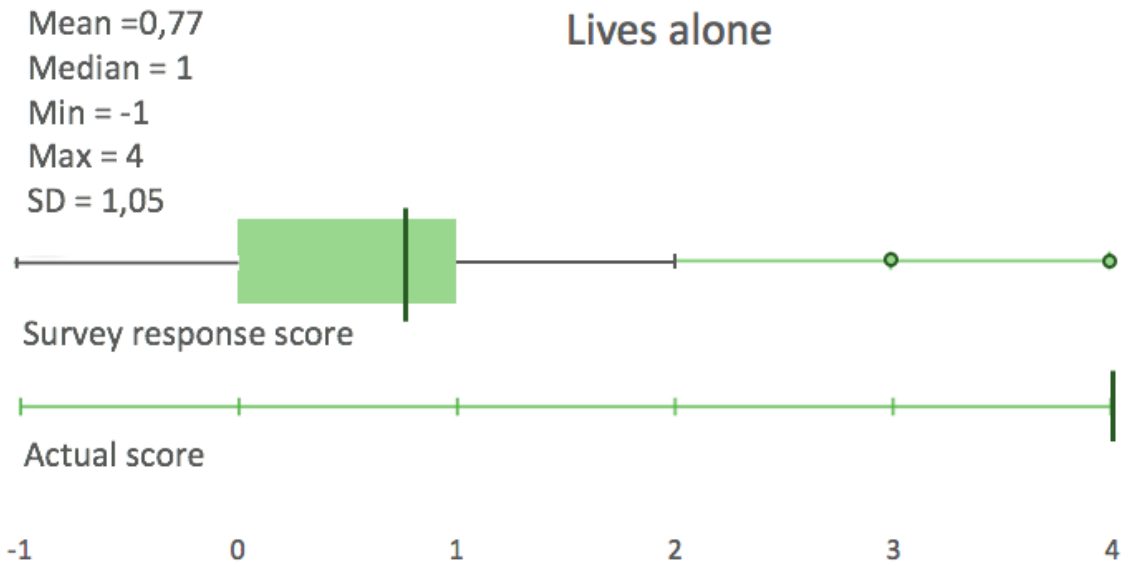

Figure 45: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people who live alone.

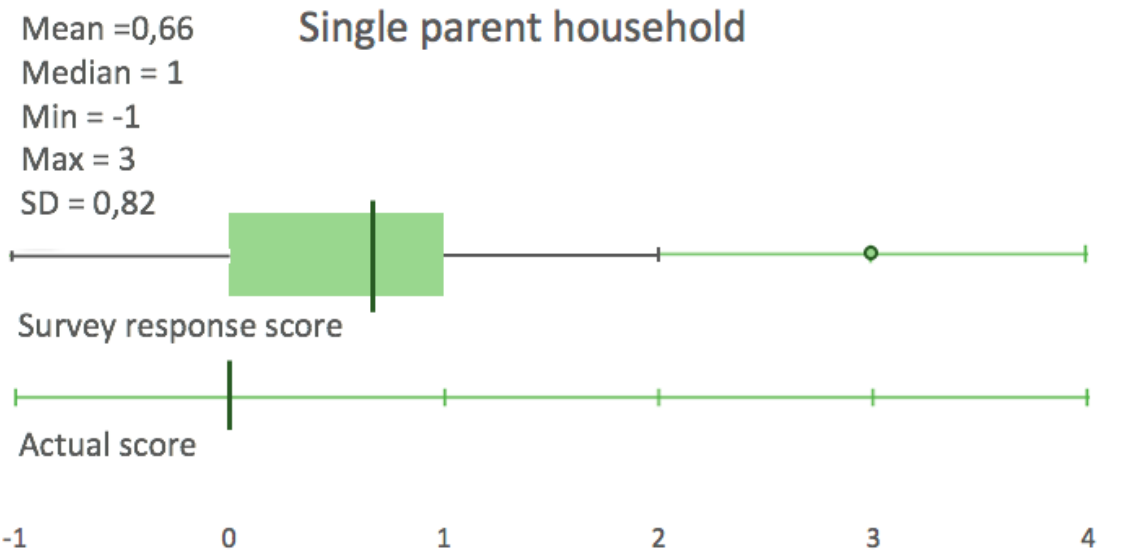

Figure 46: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for single-parent families.

6.12 Disabilities

The statistics from the literature show that having a disability correlates with an increased risk of fire fatalities. Having a physical disability correlates with a large increase in fire risk, and people with mental health issues or a cognitive disability correlate with a moderate risk of fire fatalities. The fire safety experts' answers match this, as everyone but one thought disability is a risk factor. The fact that many also mentioned disability as a factor before being specifically asked, indicates that it is a relatively well-known factor for fire safety experts. This corresponds to the moderate and large increase in fire risk that can be seen in the literature review. This knowledge that the fire safety experts have is not quite as distinct for the general public. Most of the respondents thought disability led to neither a decrease nor an increase in

fire risk. Although, if all the increased alternatives are merged, a majority thought it led to an increase, where 56.8% of the survey respondents thought it led to an increase for people with a physical disability and 65.1% for people with a mental disability. This means that 43.2% and 34.9% of the respondents' answers were far from the reality of the situation. In summary, fire safety experts have a good understanding of these two factors, and the general public is lacking a sufficient understanding of how disability may correlate with fire risk.

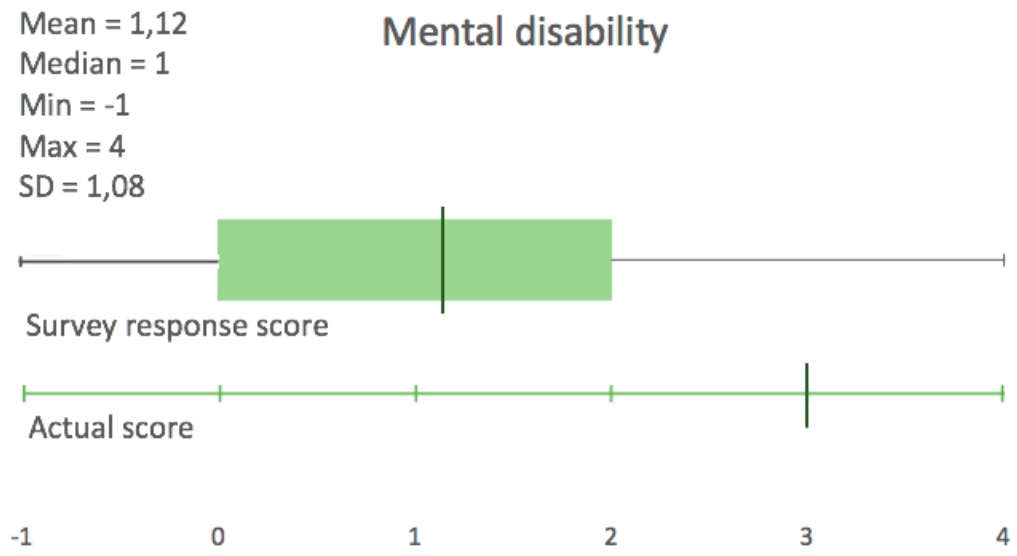

Figure 47: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people with a mental disability.

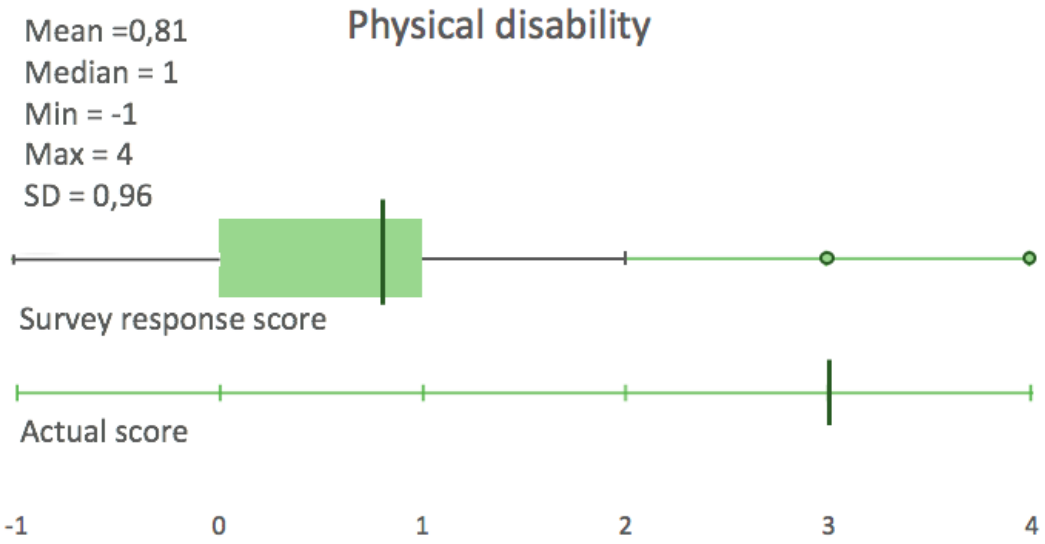

Figure 48: A graph illustrating the survey responses in a box plot where the mean is marked with a line. The mean, median, minimum value, maximum value and standard deviation (SD) of the responses are described above. Below the box plot the actual score for the socio-demographic factor is indicated with a line. The scores illustrated in this graph are for people with a physical disability.

6.13 Compilation of comparison

Here is a compilation of the conclusions from this chapter presented, see Table 7. The grade of understanding of the factors has been divided into three: sufficient knowledge, somewhat knowledgeable, and lack of sufficient knowledge. Since different methods have been used to

collect the data from the general public and the fire safety experts, the results for the two different groups may not be directly comparable and translatable. Hence, the comparison should mainly be between one of the groups and reality, and not between the two different groups. The result was impacted by the different approaches since, for example, the interviewees had the opportunity to reason about and discuss the socio-demographic factors, while the general public could not. Another issue that the differences in approach led to was that the general public could grade the increase in a way that the fire safety experts were not asked to do. However, an attempt to grade the answers from the interviews was made, for example by using thematic analysis where it was analyzed which factors most of the fire safety experts brought up themselves without being asked in the beginning. Some of the interviewees also mentioned differences in importance and increase of risk between the factors. This has hopefully provided a result that made the interviews and the survey comparable with each other, but these limitations are important to keep in mind when reviewing the result.

Table 7: Compilation of the perception of the general public and fire safety experts compared to reality.

Factor	Fire safety experts	General public
Smoking	Have sufficient knowledge	Have sufficient knowledge
Alcohol use	Have sufficient knowledge	Have sufficient knowledge
Use of sedatives	Are somewhat knowledgeable	Lack sufficient knowledge
Use of antidepressants	Are somewhat knowledgeable	Lack sufficient knowledge
Use of illicit drugs	Are somewhat knowledgeable	Are somewhat knowledgeable
Old age	Have sufficient knowledge	Have sufficient knowledge
Young age	Are somewhat knowledgeable	Lack sufficient knowledge
Female	Have sufficient knowledge	Are somewhat knowledgeable
Male	Have sufficient knowledge	Are somewhat knowledgeable
Born outside of Europe	Lack sufficient knowledge	Lack sufficient knowledge
Born in Europe	Lack sufficient knowledge	Lack sufficient knowledge
Born in a Nordic country	Lack sufficient knowledge	Lack sufficient knowledge
Small municipality	Are somewhat knowledgeable	Lack sufficient knowledge
Rural municipality	Are somewhat knowledgeable	Lack sufficient knowledge
Low education level	Have sufficient knowledge	Lack sufficient knowledge
Employment status	Have sufficient knowledge	Lack sufficient knowledge
Low income	Have sufficient knowledge	Lack sufficient knowledge
Lives alone	Have sufficient knowledge	Lack sufficient knowledge
Single-parent households	Have sufficient knowledge	Are somewhat knowledgeable
Physical disability	Have sufficient knowledge	Lack sufficient knowledge
Mental disability	Have sufficient knowledge	Lack sufficient knowledge

7 Discussion

This chapter contains discussions on the result. It also contains a discussion on how different limitations and sources of error may have affected the result. Furthermore, this chapter contains some thoughts on how the choice of the survey and interview approach may have affected the result.

7.1 The results

The results indicate that the fire safety experts are knowledgeable on how most of the socio-demographic factors correlate with the risk of fire fatalities in residential buildings and that the general public may be slightly less knowledgeable. Many of the fire safety experts had read research about socio-demographic factors, and also have a lot of work experience in seeing who is at risk in real life. They also know more about how fires work and can therefore relate to how this might affect different types of people in different situations. The general public did not have as much background knowledge to lean back on when answering and might therefore have been more guided by misconceptions and prejudice. It is therefore logical that the perception of fire safety experts matches better with reality. The general public sometimes gives counter-intuitive answers, for example, some thought the correlated risk of fatality was very large for people with a disability, while others thought the risk decreased. The reason for this could be that everyone has different preconceptions about socio-demographic factors, and these are probably larger for people who are not educated in the area like a fire safety expert. For example, those who answered that disability correlates to a decreased risk might have reasoned that people with a disability are more risk aware. Those who answered that it correlated with a very large risk, might have thought that the chance of detecting a fire or evacuating decreases and therefore correlates with a larger risk.

Another reason why the general public showed signs of being less knowledgeable than the fire safety experts, may have something to do with the fact that they never got to discuss the questions. Sometimes for example an interviewee would start by saying a socio-demographic factor did not correlate, but when they began talking and reasoning about why they thought the way they did, they changed their answer. It is possible the general public did not put as much thought into the questions before they chose an alternative on the survey, since they did not have the same chance to reason about the questions. Had the general public had the same opportunity to discuss the questions, they may have been closer in their answers. This could also be a limitation of the survey method since there could have been options as well as space for comments in the survey. This would have provided the general public an opportunity to also share their thoughts and reasoning.

When evaluating the socio-demographic factors, it is important to consider interfering factors. Some of the socio-demographic factors may not be an issue by themselves but rather other risk factors they are associated with. For example, age may not actually be a risk factor, but rather the illnesses that can come with age (Erik Eggert & Fredrik Huss, 2017). Other possible factors that may correspond with each other may be for example income, educational level, employment status, and substance abuse. This can have affected the answers of the respondents. For example, the reason why so many in the general public answered *neither decrease nor increase of risk* on old age, can have been because they reasoned that age

increases the risk, but only because older people sometimes have more disabilities and age is not actually a risk factor itself. It could not be detected if this was the case since they answered through a survey and could not tell the authors their reasoning the same way the fire safety experts could. It is therefore possible that the general public had more knowledge about the different socio-demographic factors' impacts than what has been reported in this thesis. In Figure 49 possible correspondences between different socio-demographic factors are illustrated.

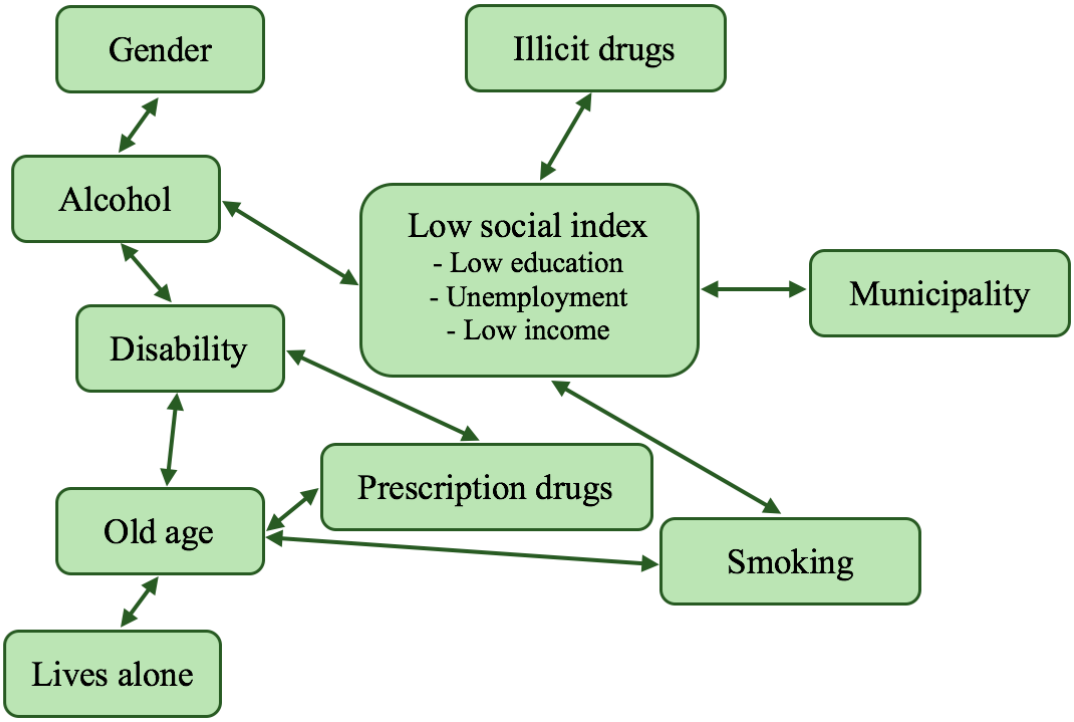

Figure 49: Possible correlations between different socio-demographic factors.

There can also be a correlation between different risk factors, that enhance the risk. According to Runefors (2020) smoking and people older than 85 years, for example, have a strong synergy and when combined, they can increase the fire fatality risk by about 45 times compared to the risk of the general population. For an older person who does not smoke, however, the relative risk of dying in a residential fire is less than three times that of the general public. It would therefore have been relevant to look more into these groups of risk factors instead of investigating every risk factor in isolation. Old age is therefore more of a risk indicator and it does not necessarily lead to an increased risk. This should have been made clearer in the survey and interview questions. The questions were phrased in a way that indicated that the factors definitely led to an increase instead of the factor correlating with fatal residential fires. After all, it is not certain that a risk factor will lead to an increased risk, or that it will lead to a fatality in a residential fire. What can be seen is only a correlation and the connection between socio-demographic factors and the risk is not one of causality. For example, using illicit drugs does not directly lead to a decrease in risk, it is only a correlation that has been found. Hence, taking illicit drugs to have a reduced risk of dying in a fire, is probably not going to work.

7.2 Limitations and sources of error

The idea was to focus on the perception of risk factors in Sweden. This was done by having the survey in Swedish and sending it out to forums where mostly people who live in Sweden were reached. Only Swedish fire rescue services and consultant agencies in Sweden were contacted. To be able to compare the perception with reality, previous data on the factors had to be found. There were not enough studies in Sweden to find data on how all the factors contributed to fire fatalities, and some data, therefore, had to be found from other countries. Since the socio-demographic factors probably differ between different countries, the result of the socio-demographic factors that were not based on Swedish research may not correlate completely with how it actually looks in Sweden. Thus, the comparison between reality and perception may not be completely at point. There was an attempt, however, to only use research from countries similar to Sweden, with for example similar culture and fire safety systems. The research that was used outside of Sweden was from Australia (Lykiardopoulos, 2014; Xiong et al., 2015), Canada (Chen et al., 2011; Clare & Kelly, 2017), the United States (Fahy & Maheshwari, 2021; Runyan et al., 1993), the United Kingdom (Dean et al., 2016; Elder et al., 1996), Ireland (Harpur et al., 2013) and Denmark (Leth et al., 1998). Hopefully, this provided a result that was close to the reality in Sweden.

Another limitation was the number of socio-demographic factors that could be found in the literature. Since the perception of the general public and fire safety experts were to be compared to reality, we had to use socio-demographic factors that had existing data on how they correlate with the risk of fire fatality in reality. Hence, there was no point in investigating the perception of socio-demographic factors that were not existing in the literature, as the perception of those socio-demographic factors could not have been compared with reality. For example, only the prescription drugs sedatives and antidepressants were included in the thesis, since there was not enough data about other prescription drugs. This led to a restriction on the factors that were used in the thesis. There were however many socio-demographic factors in the existing literature, and the main socio-demographic factors have been described in this thesis.

In the study, odds ratios have been used to simplify the comparison process. The odds ratio probably differs between different studies and years. Thus, the odds ratios used in this thesis may not completely correspond with how it looks in society today. However, the only odds ratio that did not correspond to other sources where the value was measured qualitatively, was illicit drugs. Illicit drugs got assigned value *decrease* only based on the odds ratio. When comparing the difference between perception and reality regarding illicit drugs, this was considered since the odds ratio may not have been completely correct in this particular circumstance. This was done to decrease the influence of a single source, so if one source was incorrect, it would not influence the accuracy of the thesis as much. Many of the interviewees and survey respondents believed drugs correlated with an increase in fire fatalities, and this was therefore not directly deemed as a lack of knowledge for fire safety experts and the general public. Ultimately the odds ratios were helpful when comparing, but due to the possible difference in data, they were critically assessed first and not used exclusively.

7.3 Data collection approach

Because the survey was disseminated through social media, it was difficult to control who answered, and to get respondents that represented the general population. In the chapter about the respondents' background information, it is illustrated that 66.9% identified as females. Almost 75% of the respondents had a university education and a majority of the respondents were between 18 and 30 years old. An ideal sample would have been respondents who have similar characteristics and socio-demographics as the general population as it would have made the responses more applicable to the general population. Since the respondents are not particularly representative of how the population is in Sweden, it makes it difficult to draw any certain conclusions about how the result relates to the general population and thus actually say the result is the perception of the general public. When examining the result and conclusions of the thesis, this should therefore be considered.

An issue that made it more difficult to compare the perception of the general public and the perception of fire safety experts was the use of different data collection methods. In the survey the general public was asked to grade the risk, while the fire safety experts only had to answer whether or not they believed the socio-demographic factor was a risk factor; there was no certain way of really knowing whether the fire safety experts believed the increase was very large or small, except for the cases when they voluntarily offered this information. Another limitation of the interviews is that only 25 fire safety experts were interviewed. The frequency of how often an answer is given is therefore purely indicative, due to the low amount of answers. However, it was very informative to hear the reasoning the fire safety experts had, and these discussions could sometimes be used to understand how large they believed the increase was. The interviews are therefore mainly meant to highlight overall themes and aspects that cannot be captured as easily with other methods such as surveys. There was not enough time to have interviews with the general public as well, and therefore the best alternative was to use a survey to gather information on their perception. After seeing the result, the realization came that it would have been better to also ask the interviewees to more precisely say if they thought the increase was small or large, to have some more qualitative values to consider. This can therefore be seen as a potential for improvement in the report. A further limitation of the method is that the interviewees had room to discuss, while the survey respondents did not have that opportunity. A space for open comments in the survey would have been another potential improvement in the report.

A limitation of interviews is that bias can occur, as the participant can be affected by the interviewer and thus say what they think the interviewer wants to hear. That can lead to a distorted result (Dahmström, 2005). A limitation of survey studies is that survey fatigue can occur with the result that people do not complete the survey or that the last questions are answered carelessly. The last questions in a lengthy survey often have more measurement errors or misclassification (Egleston et al., 2011). An improvement could have been to randomize the questions to avoid the same questions getting a less reliable answer.

8 Conclusion

The result shows that fire safety experts have a lot of knowledge on the subject, and many of the interviewees had read research on this particular topic. The factors the fire safety experts had sufficient knowledge of were smoking, alcohol, age, gender, education level, employment status, low income, living arrangement, and disabilities. There were some factors, however, that the fire safety experts lacked sufficient knowledge of and where their perception differed from how the socio-demographics correlate in reality. These socio-demographic factors were:

- Country of origin
- Use of sedatives and antidepressants
- Small and rural municipalities

The general public was also knowledgeable in some areas, but not nearly as many as the fire safety experts. The factors the general public had sufficient knowledge of were smoking, alcohol, and old age. There were multiple factors where the general public's perception did not match reality. Those factors are:

- Use of sedatives and antidepressants
- Children younger than 5 years old
- Country of origin
- Small and rural municipalities
- Education level
- Employment status
- Low income
- Lives alone
- Disabilities

This result shows that the focus should mainly be on educating the general public as it is mostly them that lack knowledge on socio-demographic factors' correlation with fatal fires in residential settings. There are, however, some areas where fire safety experts have to be more educated as well. The result shows that while the fire safety experts lack knowledge on some factors, they are mostly knowledgeable. This is a good start when it comes to teaching the general public and the work that has to be done to eliminate the inequalities that currently exist in fire safety. When reviewing the result, it is, however, important to keep in mind that different approaches were used to collect data from the fire safety experts and the general public. It is therefore difficult to, with certainty, say that one of the two groups is more knowledgeable than the other. Had both groups had the same approach and opportunity to express their knowledge and perception in the study, the result may have been different and the distinction between fire safety experts and the general public may have not been the same.

Future research could focus on how to reach the people to whom these socio-demographic factors apply and teach them about the risks. This is also something that was requested by fire safety experts in the study. Many rescue services already do proactive work with people with risk factors, but they want to know what the best approach is. This could therefore be a next step in the process of eliminating inequalities in fatal residential fires.

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Appendix A – Survey questions

Section 1

1. Considering fire fatalities in residential settings, what is the impact of the presence of people smoking?
    - Decrease in fire risk
    - Neither a decrease nor an increase in fire risk
    - Small increase in fire risk
    - Moderate increase in fire risk
    - Large increase in fire risk
    - Very large increase in fire risk

2. Considering fire fatalities in residential settings, what is the impact of alcohol use?
    - Decrease in fire risk
    - Neither a decrease nor an increase in fire risk
    - Small increase in fire risk
    - Moderate increase in fire risk
    - Large increase in fire risk
    - Very large increase in fire risk

3. Considering fire fatalities in residential settings, what is the impact of the presence of people over 70 years old?
    - Decrease in fire risk
    - Neither a decrease nor an increase in fire risk
    - Small increase in fire risk
    - Moderate increase in fire risk
    - Large increase in fire risk
    - Very large increase in fire risk

4. Considering fire fatalities in residential settings, what is the impact of the presence of children younger than five years old?
    - Decrease in fire risk
    - Neither a decrease nor an increase in fire risk
    - Small increase in fire risk
    - Moderate increase in fire risk
    - Large increase in fire risk
    - Very large increase in fire risk

5. Considering fire fatalities in residential settings, what is the impact of the use of sedatives among residents?
    - Decrease in fire risk
    - Neither a decrease nor an increase in fire risk
    - Small increase in fire risk
    - Moderate increase in fire risk
    - Large increase in fire risk

- Very large increase in fire risk

6. Considering fire fatalities in residential settings, what is the impact of the use of anti-depressants among residents?
   - Decrease in fire risk
   - Neither a decrease nor an increase in fire risk
   - Small increase in fire risk
   - Moderate increase in fire risk
   - Large increase in fire risk
   - Very large increase in fire risk

7. Considering fire fatalities in residential settings, what is the impact of the use of illicit drugs among residents?
   - Decrease in fire risk
   - Neither a decrease nor an increase in fire risk
   - Small increase in fire risk
   - Moderate increase in fire risk
   - Large increase in fire risk
   - Very large increase in fire risk

8. Considering fire fatalities in residential settings, what is the impact of being a female?
   - Decrease in fire risk
   - Neither a decrease nor an increase in fire risk
   - Small increase in fire risk
   - Moderate increase in fire risk
   - Large increase in fire risk
   - Very large increase in fire risk

9. Considering fire fatalities in residential settings, what is the impact of being a male?
   - Decrease in fire risk
   - Neither a decrease nor an increase in fire risk
   - Small increase in fire risk
   - Moderate increase in fire risk
   - Large increase in fire risk
   - Very large increase in fire risk

10. Considering fire fatalities in residential settings, what is the impact of having a physical limitation (mobility, visual, hearing)?
   - Decrease in fire risk
   - Neither a decrease nor an increase in fire risk
   - Small increase in fire risk
   - Moderate increase in fire risk
   - Large increase in fire risk
   - Very large increase in fire risk

11. Considering fire fatalities in residential settings, what is the impact of having a mental illness?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

12. Considering fire fatalities in residential settings, what is the impact of living in a small municipality (municipality with less than 20 000 inhabitants)?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

13. Considering fire fatalities in residential settings, what is the impact of living in a rural municipality?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

14. Considering fire fatalities in residential settings, what is the impact of someone who lives in Sweden, but comes from a country outside of Europe?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

15. Considering fire fatalities in residential settings, what is the impact of someone who lives in Sweden, but comes from another country in Europe (not a Nordic country)?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

16. Considering fire fatalities in residential settings, what is the impact of someone who lives in Sweden, but comes from another Nordic country?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

17. Considering fire fatalities in residential settings, what is the impact of having a low education level (only 9 years of basic education)?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

18. Considering fire fatalities in residential settings, what is the impact of someone who does not have a full-time occupation among residents?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

19. Considering fire fatalities in residential settings, what is the impact of having a small income?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

20. Considering fire fatalities in residential settings, what is the impact of living alone?

- Decrease in fire risk
- Neither a decrease nor an increase in fire risk
- Small increase in fire risk
- Moderate increase in fire risk
- Large increase in fire risk
- Very large increase in fire risk

21. Considering fire fatalities in residential settings, what is the impact of single-parent households?
    - Decrease in fire risk
    - Neither a decrease nor an increase in fire risk
    - Small increase in fire risk
    - Moderate increase in fire risk
    - Large increase in fire risk
    - Very large increase in fire risk

Section 2: Background questions

1. What is your age?

2. What is your gender?
    - Male
    - Female
    - Non-binary
    - Prefer not to say

3. In which country have you lived in the longest in your life?

4. What is (are) your nationality(ies)?

5. How many people live in your household?
    - I live alone
    - Myself with child/children
    - Two or more adults with child/children
    - Two or more adults

6. What is the highest level of education you have completed?
    - Compulsory school
    - Upper secondary school
    - University
    - Other post-secondary education

7. Is your occupation or education related to fire safety, building design or building management?
    - Related to fire safety
    - Related to building design or building management
    - Both of the above
    - None of the above

8. If your occupation or education is related to fire safety, building design or building management, what is your occupation or education?

9. Do you smoke?
    - Yes
    - No

10. How often do you drink alcohol?
    - Rarely
    - 1-3 days/week
    - 4-7 days/week

11. Do you have any functional limitation regarding mobility? Temporary impairment is not included in this.

    1 2 3 4 5 6

    No limitation □ □ □ □ □ □ Extensive limitation

12. Do you have any functional limitation regarding vision? Temporary impairment is not included in this.

    1 2 3 4 5 6

    No limitation □ □ □ □ □ □ Extensive limitation

13. Do you have any functional limitation regarding hearing? Temporary impairment is not included in this.

    1 2 3 4 5 6

    No limitation □ □ □ □ □ □ Extensive limitation

14. What type of building you have lived in during your life?
    - Multi story house
    - Single-story house
    - Apartment
    - Other types [FREE TEXT]

15. Have you experienced a fire event?
    - Yes, a real fire event
    - Yes, a fire drill
    - Both of the above
    - I have never experienced a fire

16. If you answered that you have experienced a real fire event or a fire drill in the previous question, what was the event?

Appendix B – Interview sequence

The order of the interviews is presented here. Since the interviews were semi-structured, the questions differed between different interviews and did not always follow the same structure. Therefore, what is presented here is only the foundation the interviews were based on. For example, if the subject in part 3 had already mentioned their perception of one of the factors written in part 4, they were not asked to repeat it.

Part 1

Small introduction and background about the interviewers and the thesis. The structure of the interview was also presented to the interviewee.

Part 2

The interviewee was asked to describe their background regarding education, previous work experience and current field of work.

Part 3

The interviewee was asked to list what social factors they believed were important when it comes to fatal fires in residential settings. More specifically, the question was:

What social factors do you think increase or decrease the risk of fatalities in residential fires?

Part 4

In part four every social factor from the literature review was listed one by one and the interviewee was asked to say if they thought the factor decreased, increased or had no impact on the risk of fatalities in residential fires. The factors were the following:

- Smoking
- Alcohol
- Drugs
    - Sedatives
    - Antidepressants
    - Illicit drugs
- Age
    - Young age, children younger than 5 years old
    - Old age, people older than 70 years old
- Gender
    - Female
    - Male
- Country of origin
    - Born outside of Europe
    - Born in Europe (not a Nordic country)
    - In a Nordic country other than Sweden
- Type of municipality

    - Small municipality
    - Rural municipality
- Low educational level (9 years of education or less)
- Not having a full-time job
- Low income
- Living arrangement
    - Living alone
    - Single parent household
- Functional limitation
    - Mental
    - Physical

Appendix C – Excluded responses on survey

The answers of the 42 respondents who were not considered the general public when it comes to fire safety are presented here. The majority of the respondents in this section are students in fire safety engineering, but there were a few fire safety engineers and firefighters.

Background information

In the second part of the survey, the respondents answered questions about their socio-demographics. Here, some background information about the removed answers is illustrated. The average age of the respondents was 29.8 years. All of the respondents had lived the majority of their life in Sweden and their nationality was Swedish.

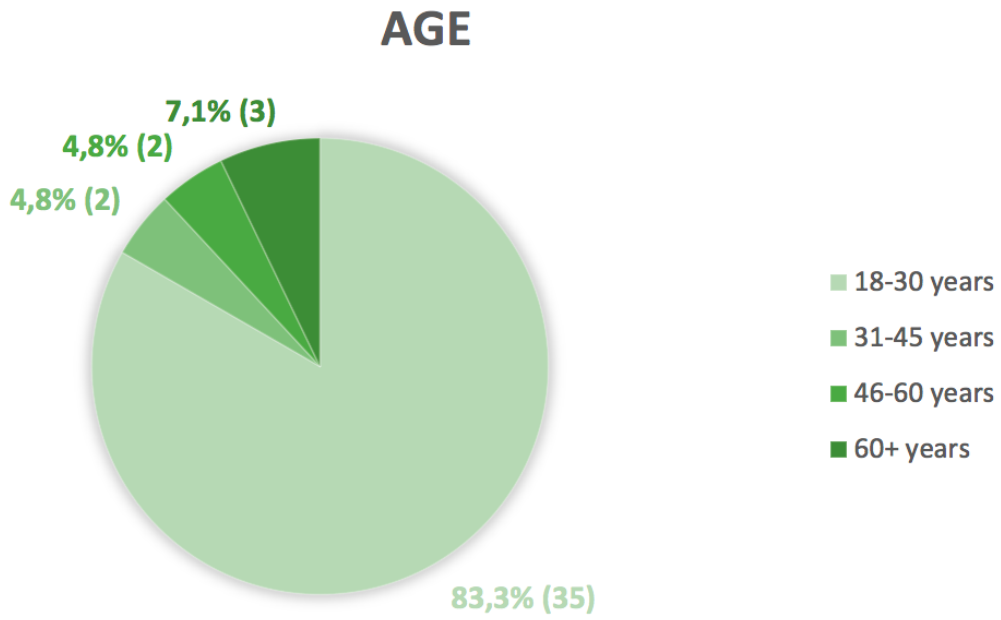

Figure50: The age distribution of the 42 respondents.

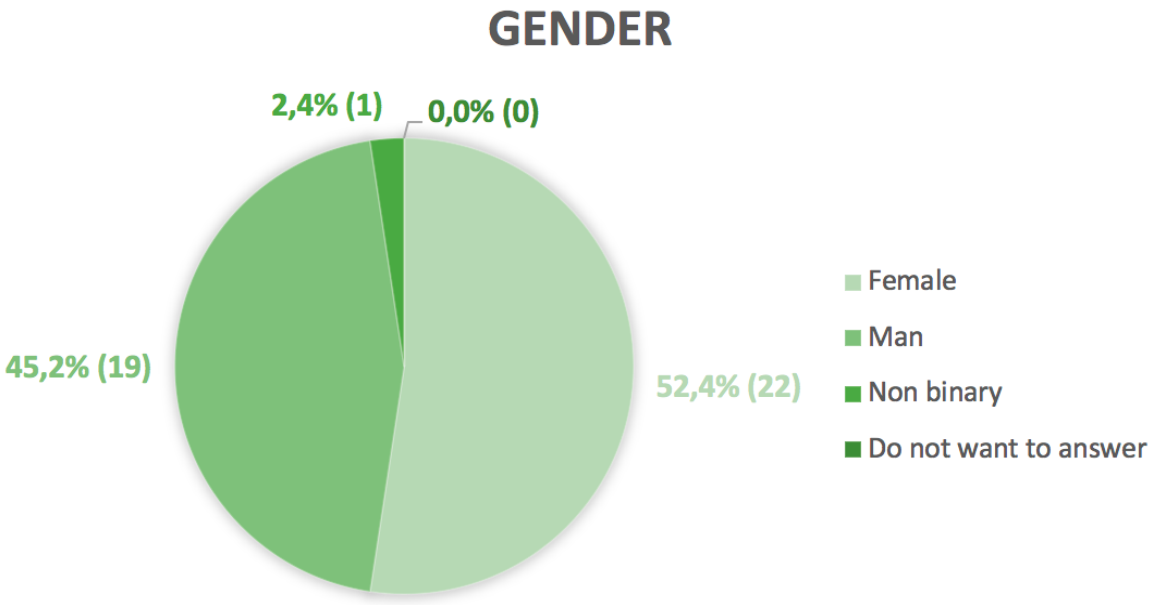

Figure51: The genders of the 42 respondents.

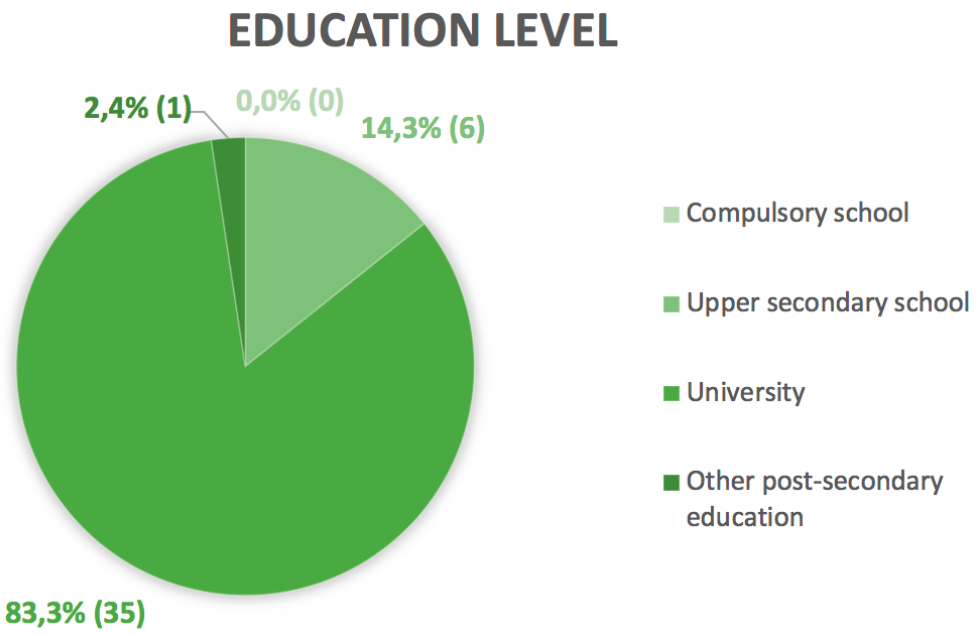

Figure 52: The education level of the 42 respondents.

Result

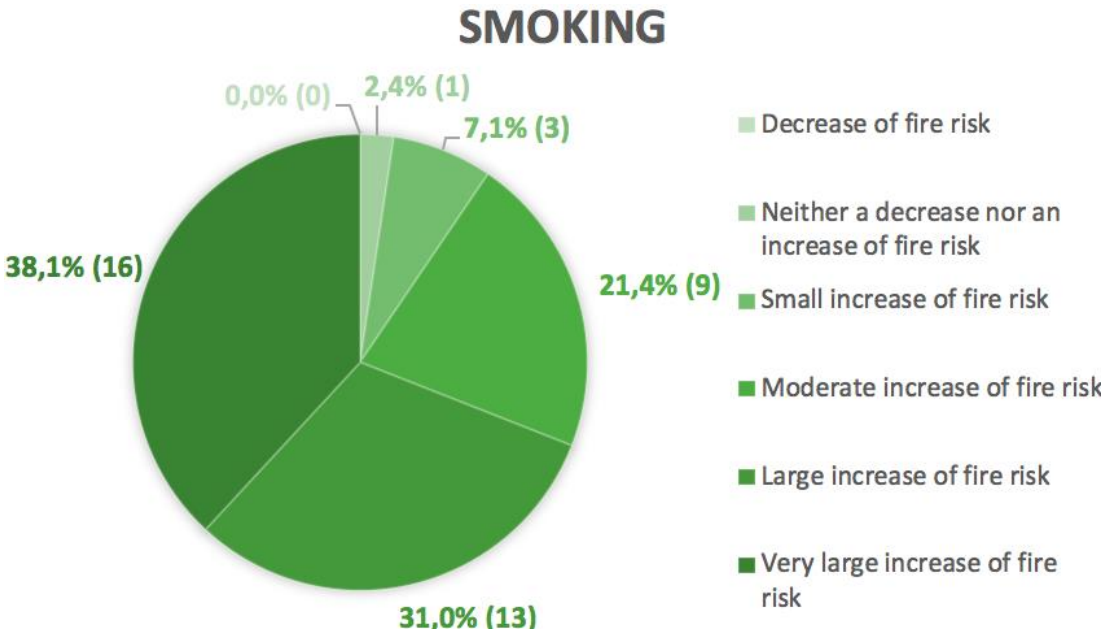

Figure 53: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed smoking affects the risk of fire fatalities in residential buildings.

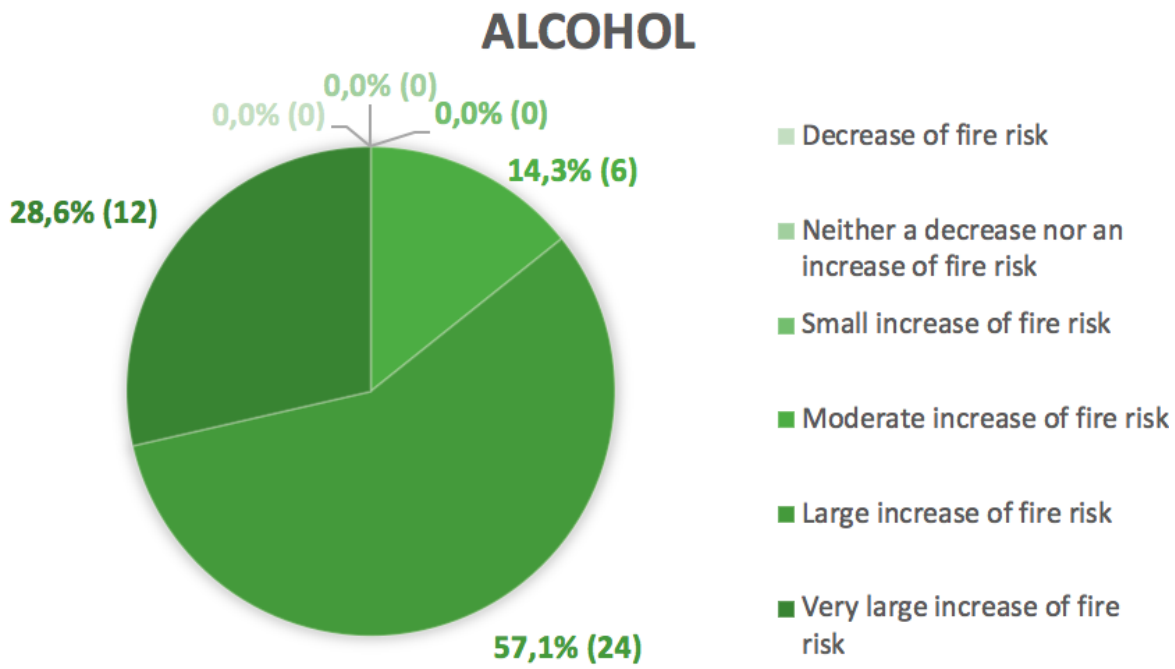

Figure 54: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed alcohol use affects the risk of fire fatalities in residential buildings.

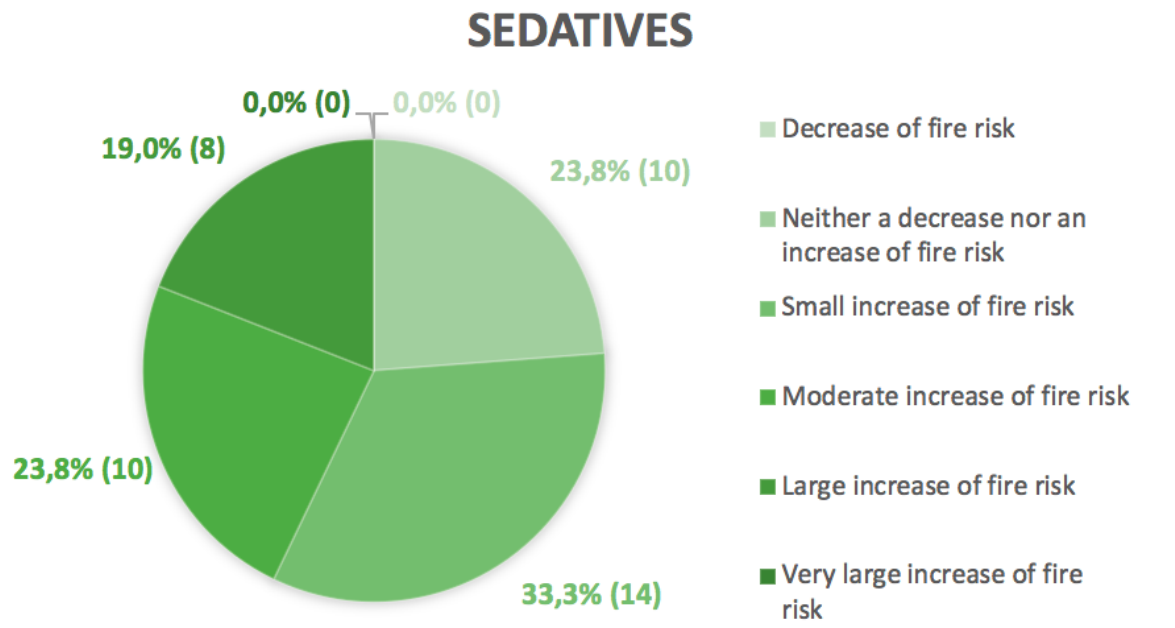

Figure 55: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed use of sedatives affects the risk of fire fatalities in residential buildings.

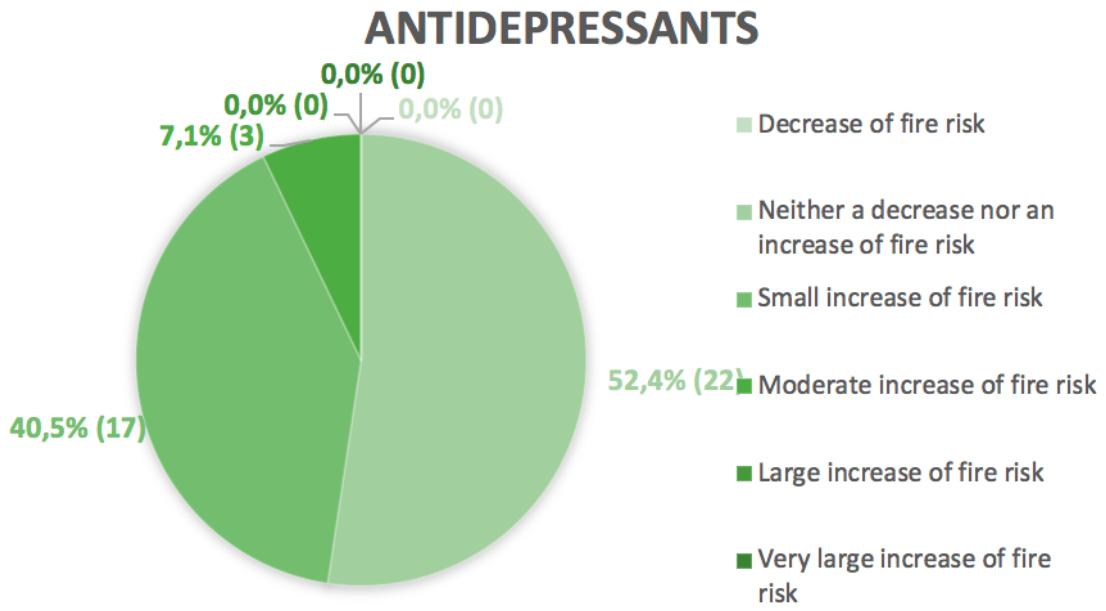

Figure 56: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed use of antidepressants affects the risk of fire fatalities in residential buildings.

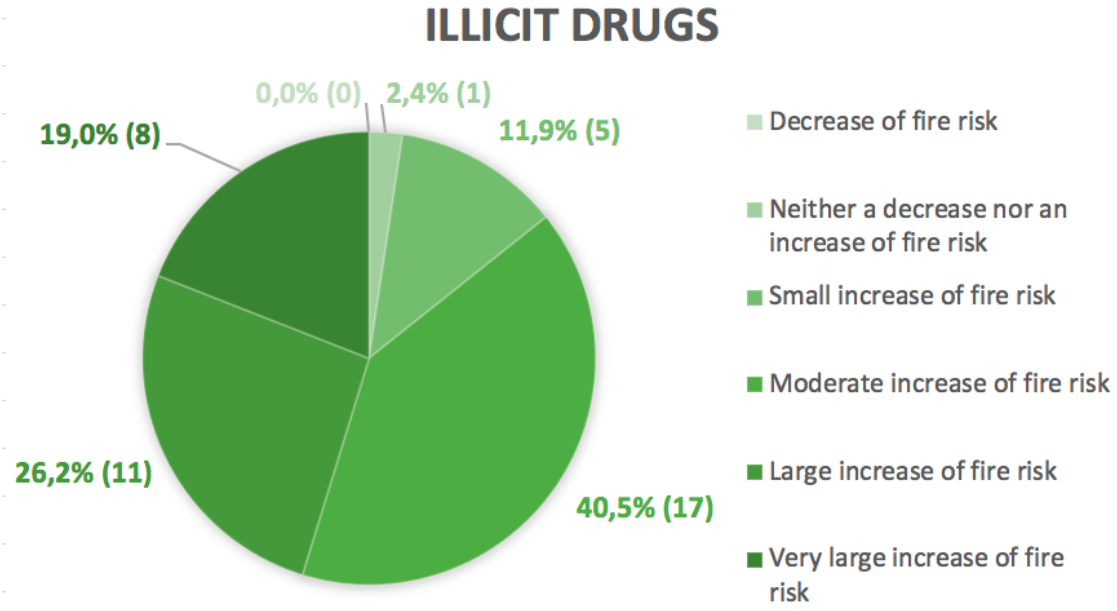

Figure 57: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed use of illicit drugs affects the risk of fire fatalities in residential buildings.

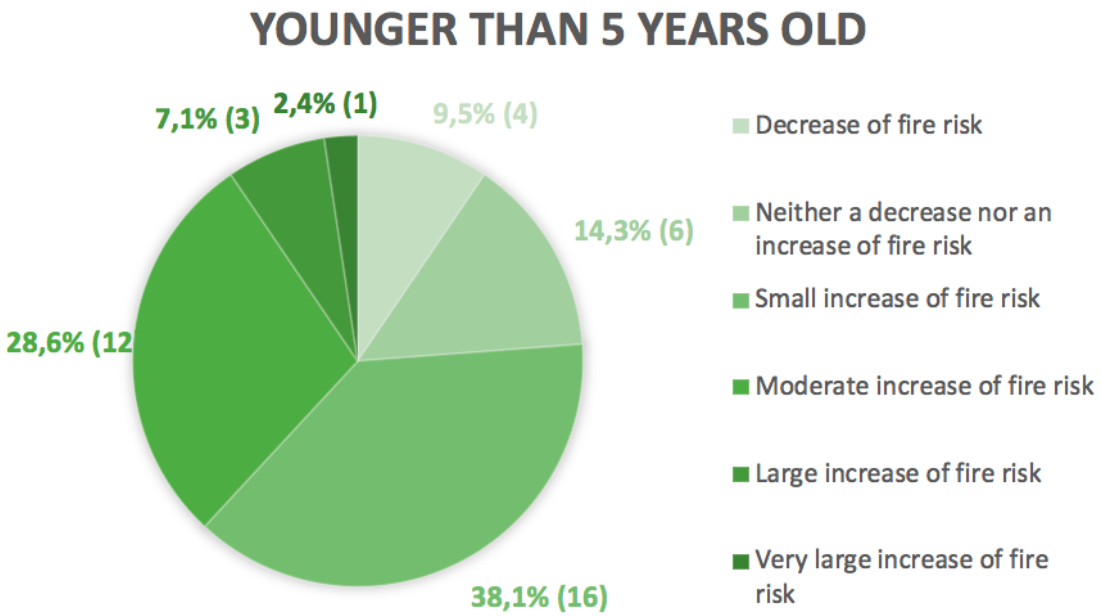

Figure 58: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed the presence of children younger than 5 years affects the risk of fire fatalities in residential buildings.

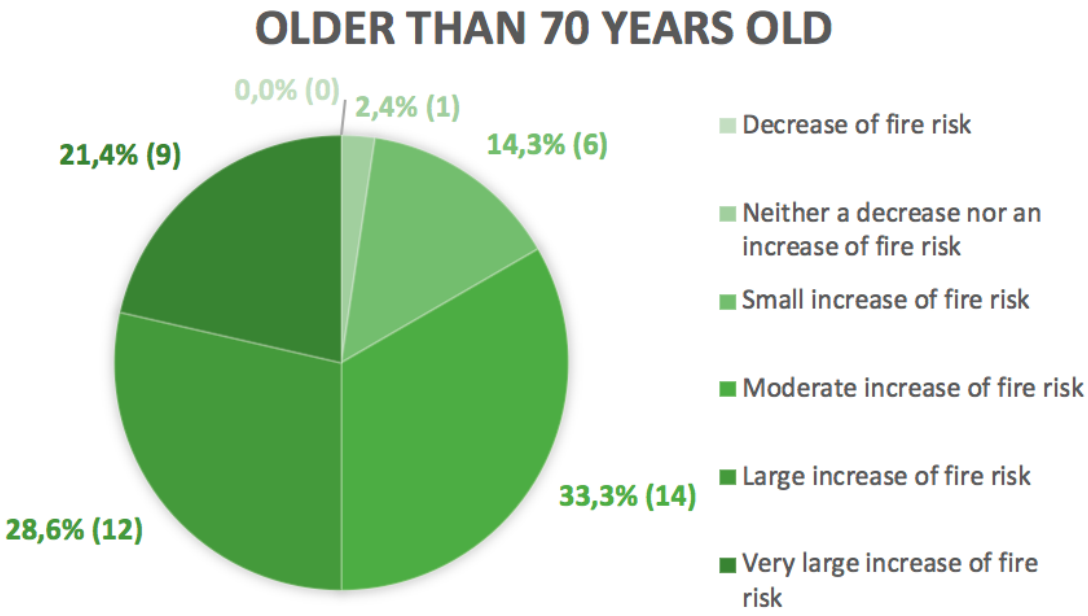

Figure 59: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed the presence of people older than 70 years affects the risk of fire fatalities in residential buildings.

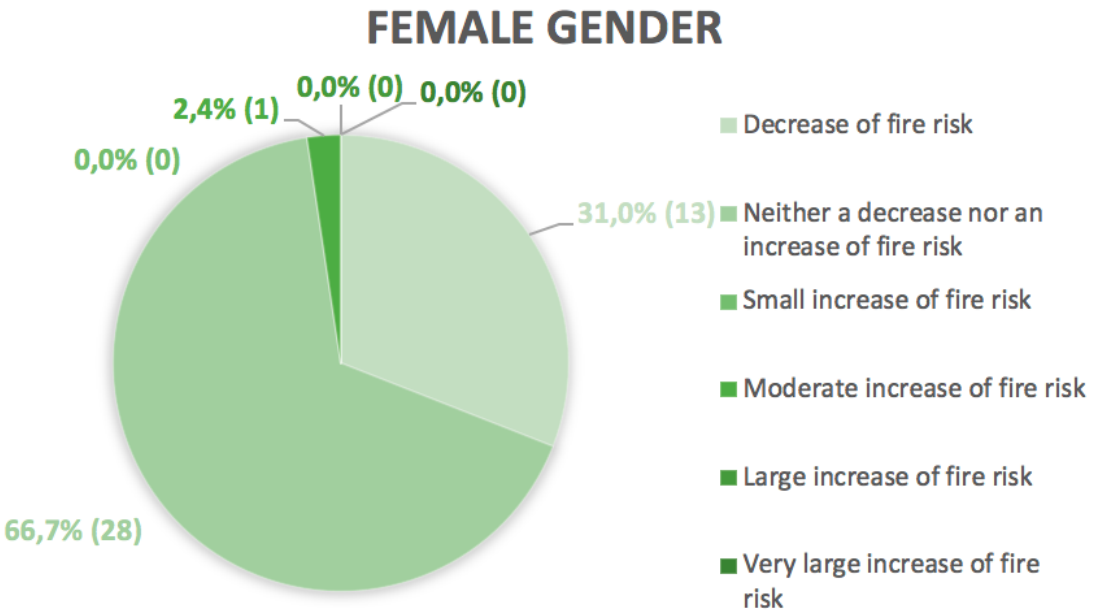

Figure 60: A pie chart illustrating, based on the results from the survey how the respondents that were not considered the general public believed being a female affects the risk of fire fatalities in residential buildings.

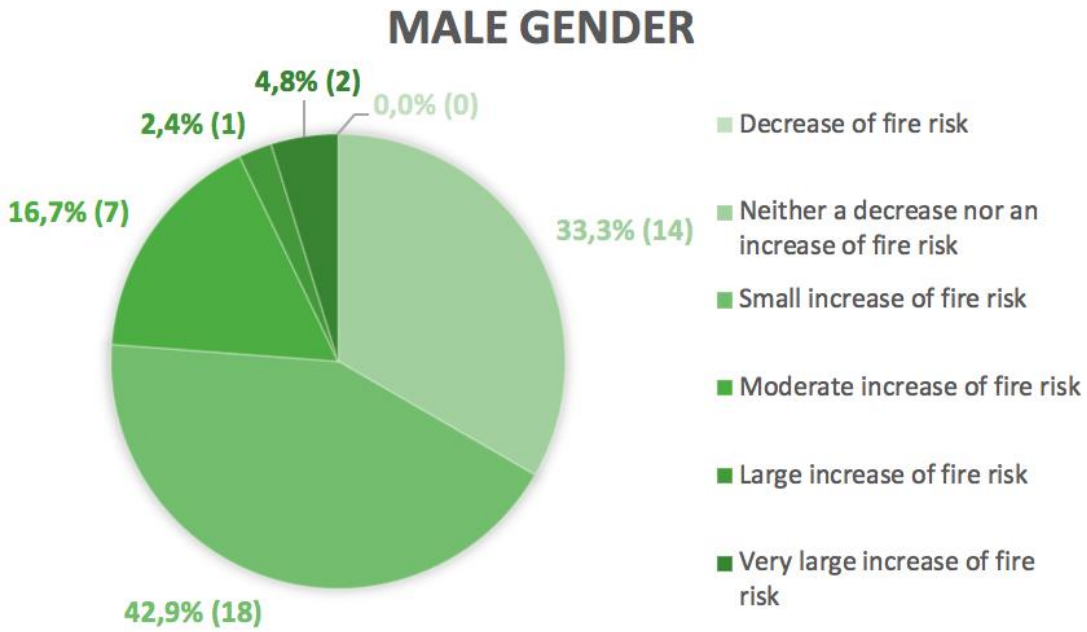

Figure 61: A pie chart illustrating, based on the results from the survey how the respondents that were not considered the general public believed being a male affect the risk of fire fatalities in residential buildings.

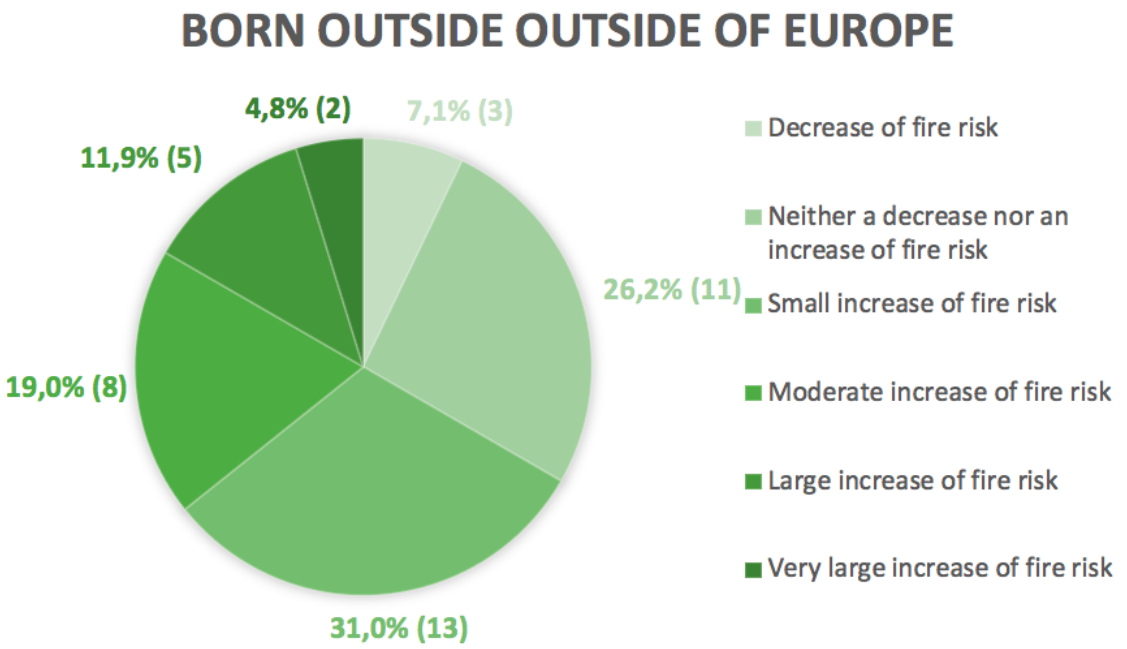

Figure 62: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed people who live in Sweden, but were born in a country outside of Europe, affect the risk of fire fatalities in residential buildings.

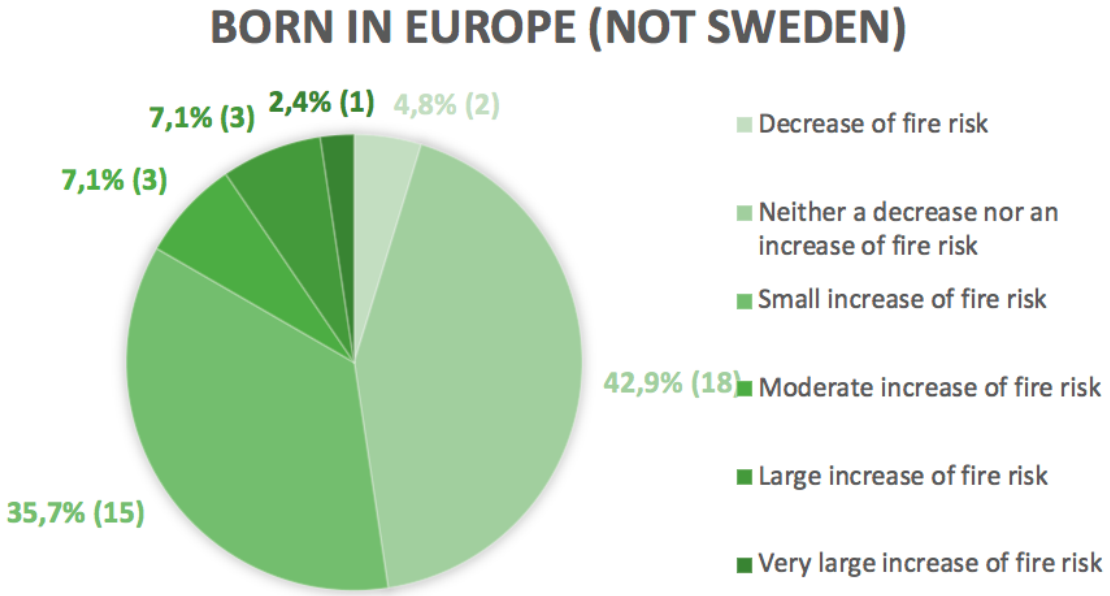

Figure 63: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed people who live in Sweden, but were born in another country non-Nordic country in Europe, affect the risk of fire fatalities in residential buildings.

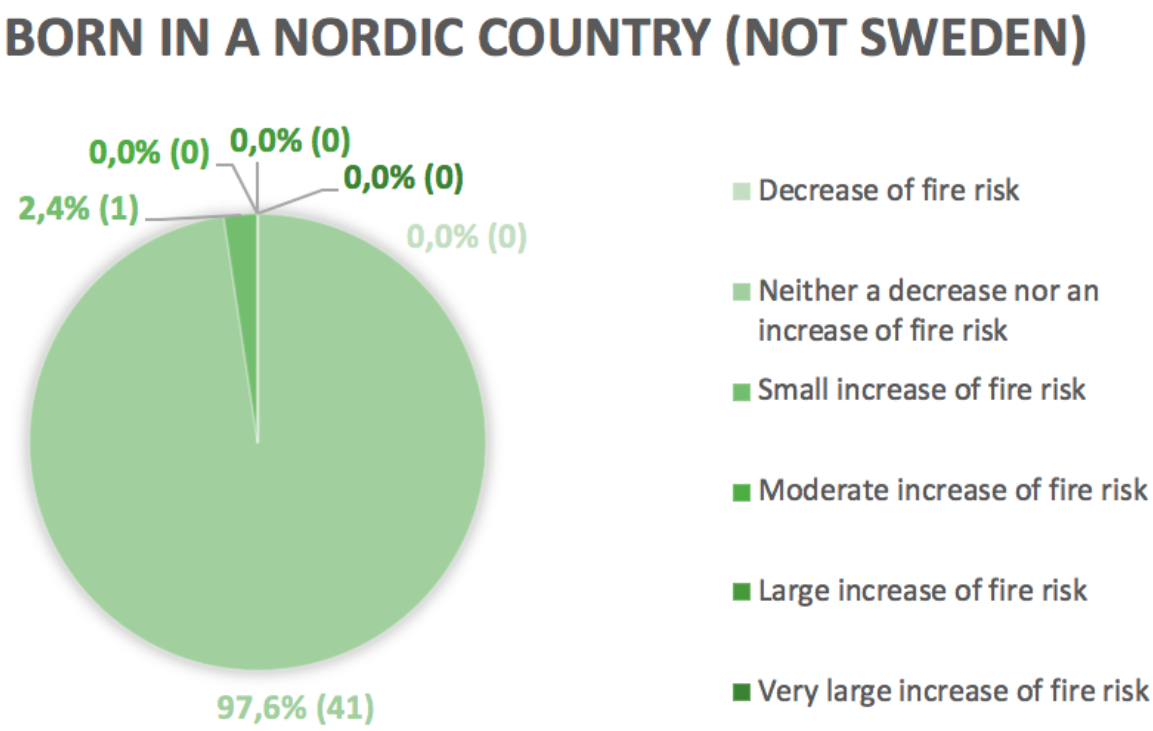

Figure 64: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed the presence of people born in a Nordic country (not Sweden) affects the risk of fire fatalities in residential buildings.

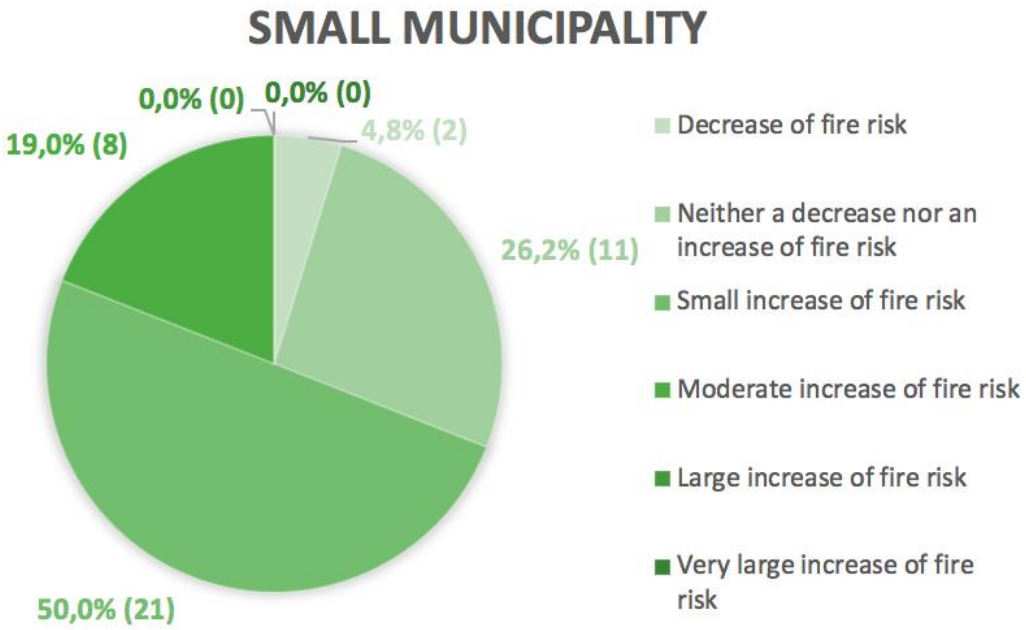

Figure 65: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed living in a small municipality affects the risk of fire fatalities in residential buildings.

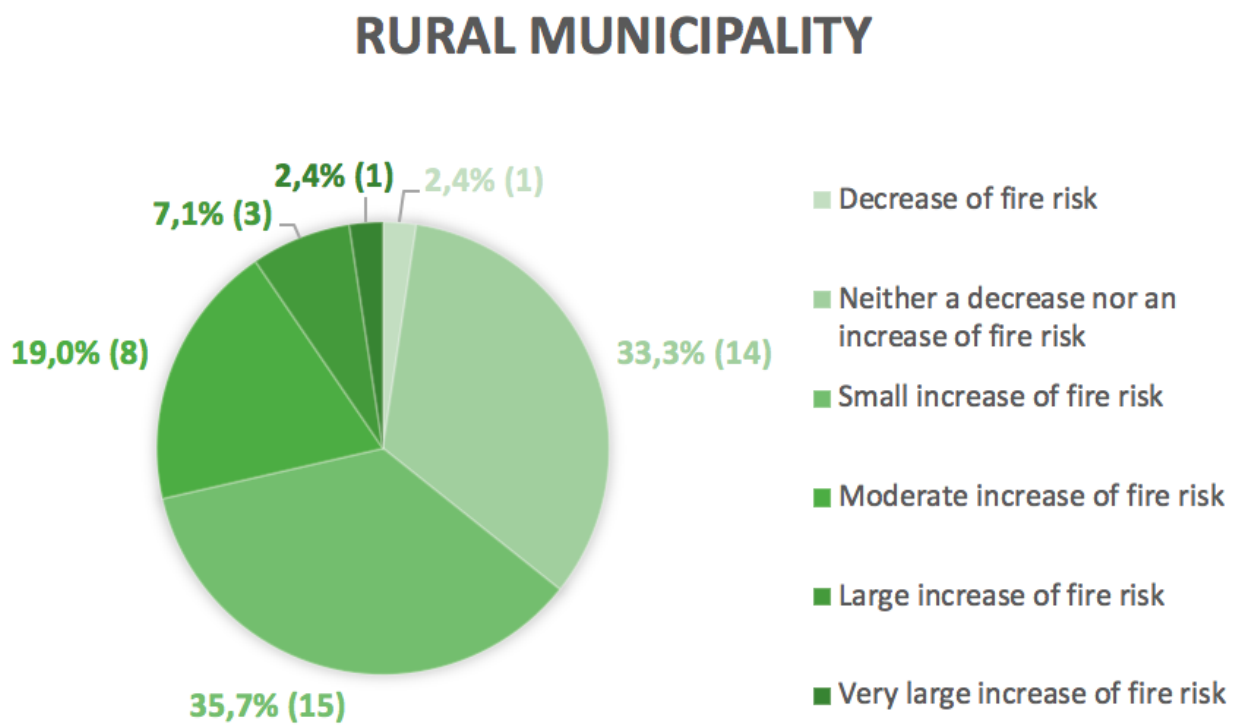

Figure 66: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed living in a rural municipality affects the risk of fire fatalities in residential buildings.

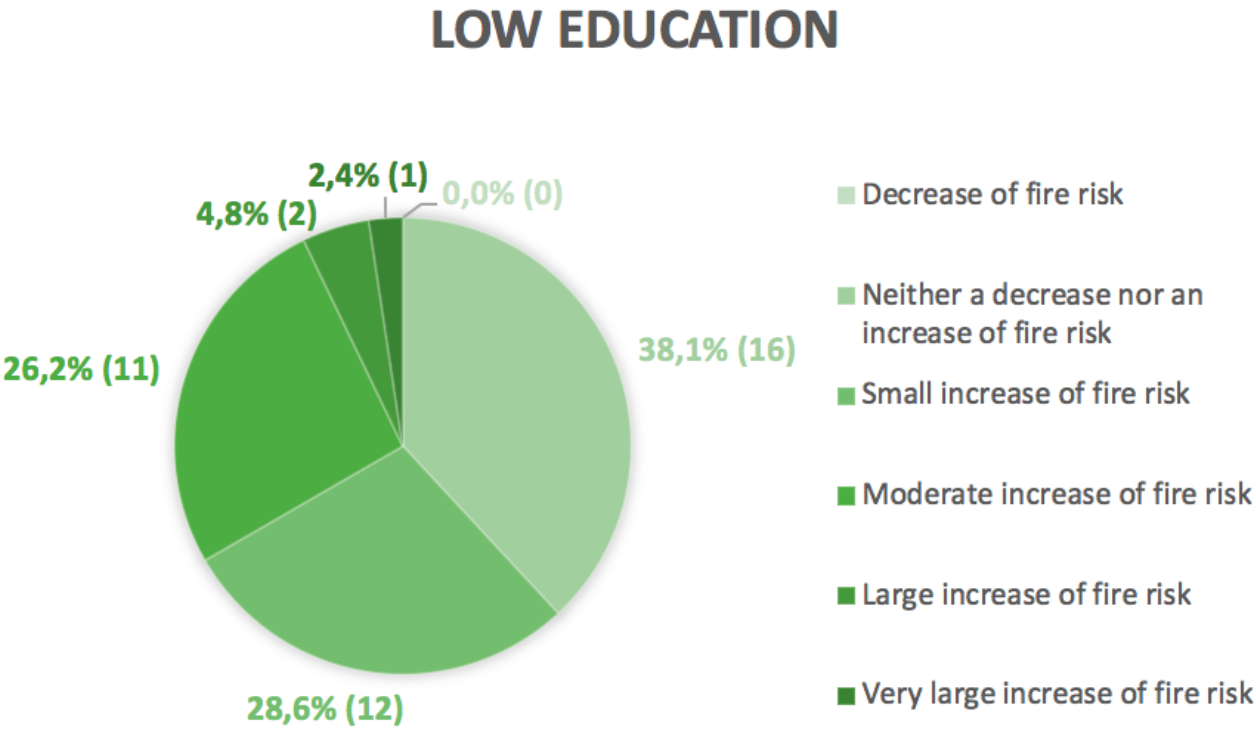

Figure 67: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed the presence of people´s education level affects the risk of fire fatalities in residential buildings.

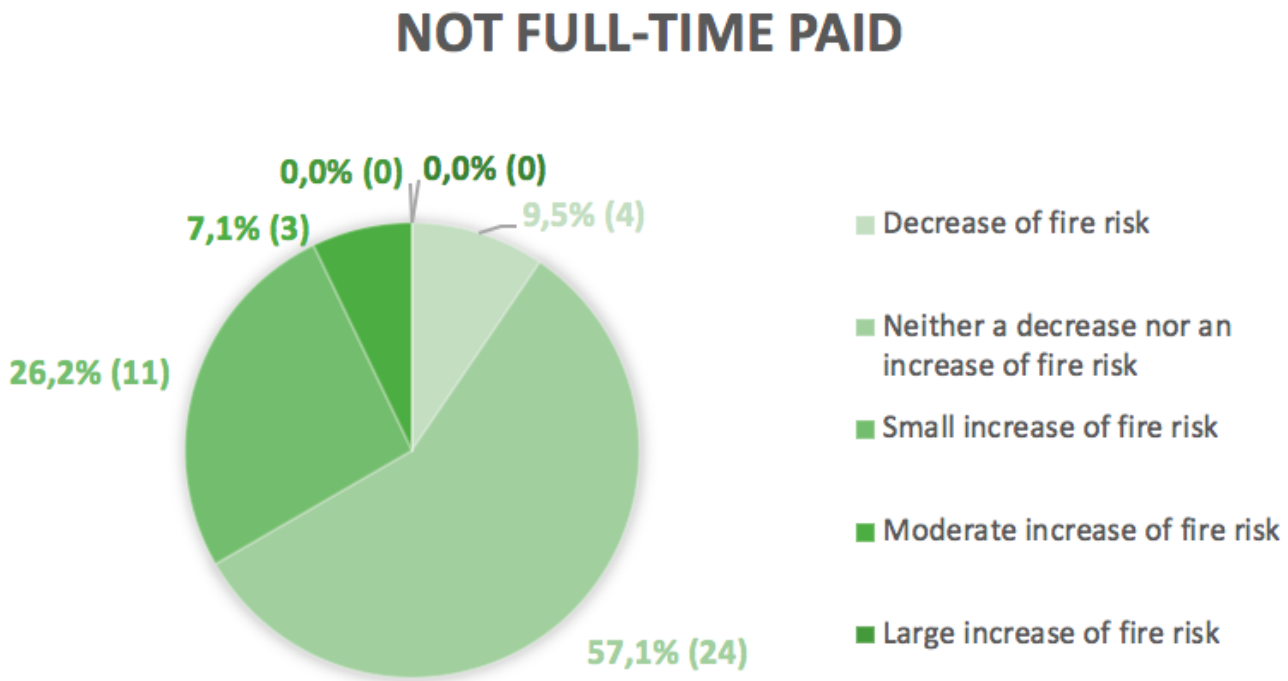

Figure 68: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed not having a full-time job affects the risk of fire fatalities in residential buildings.

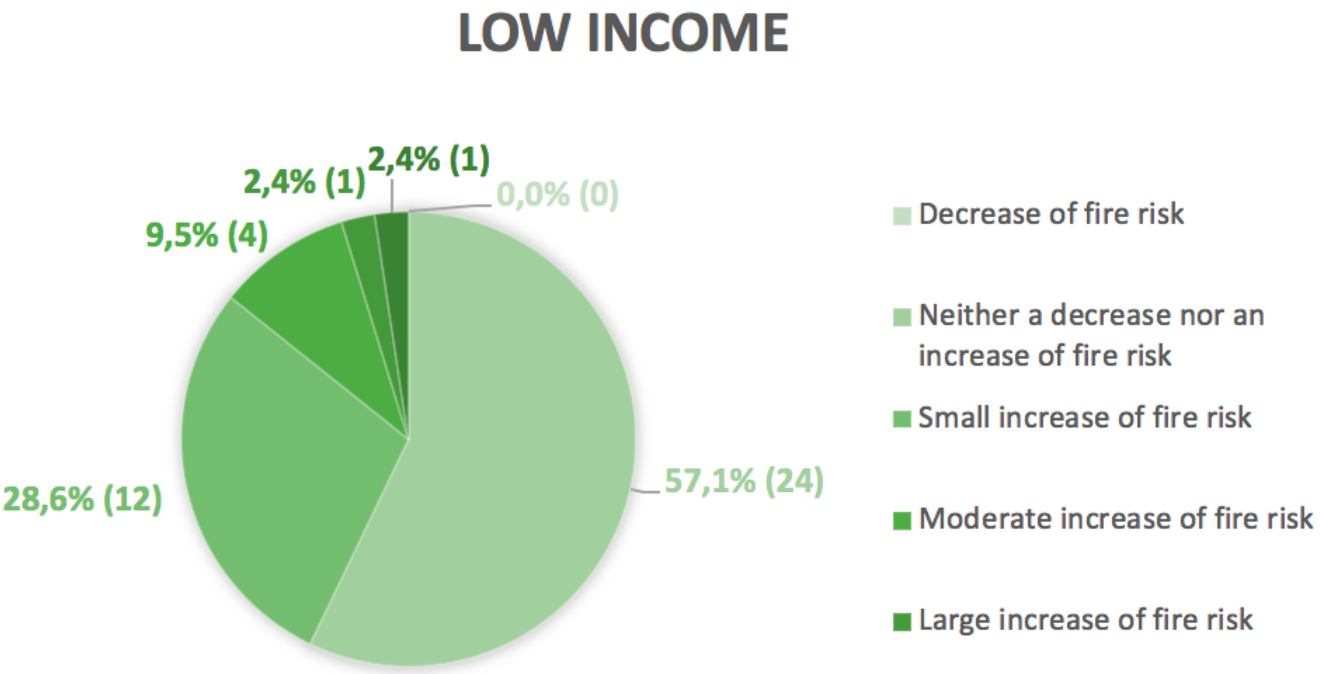

Figure 69: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed having a low income affects the risk of fire fatalities in residential buildings.

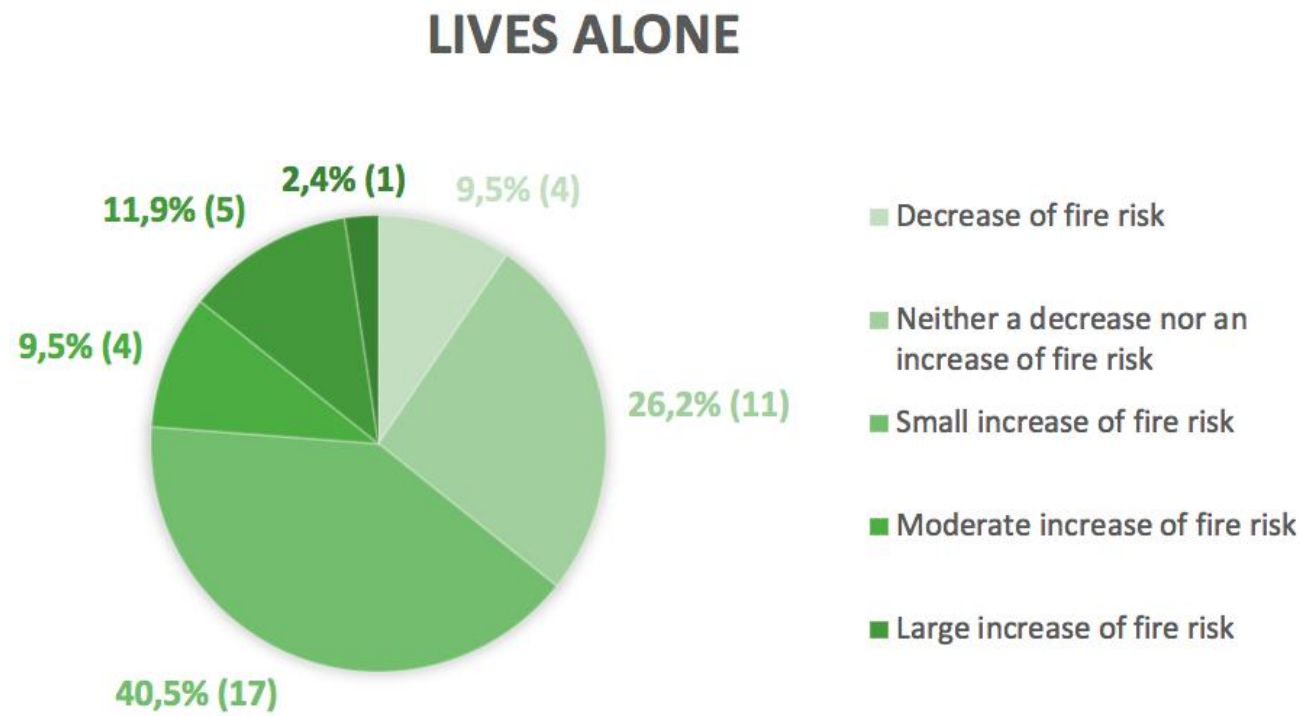

Figure 70: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed the presence of people living alone affects the risk of fire fatalities in residential buildings.

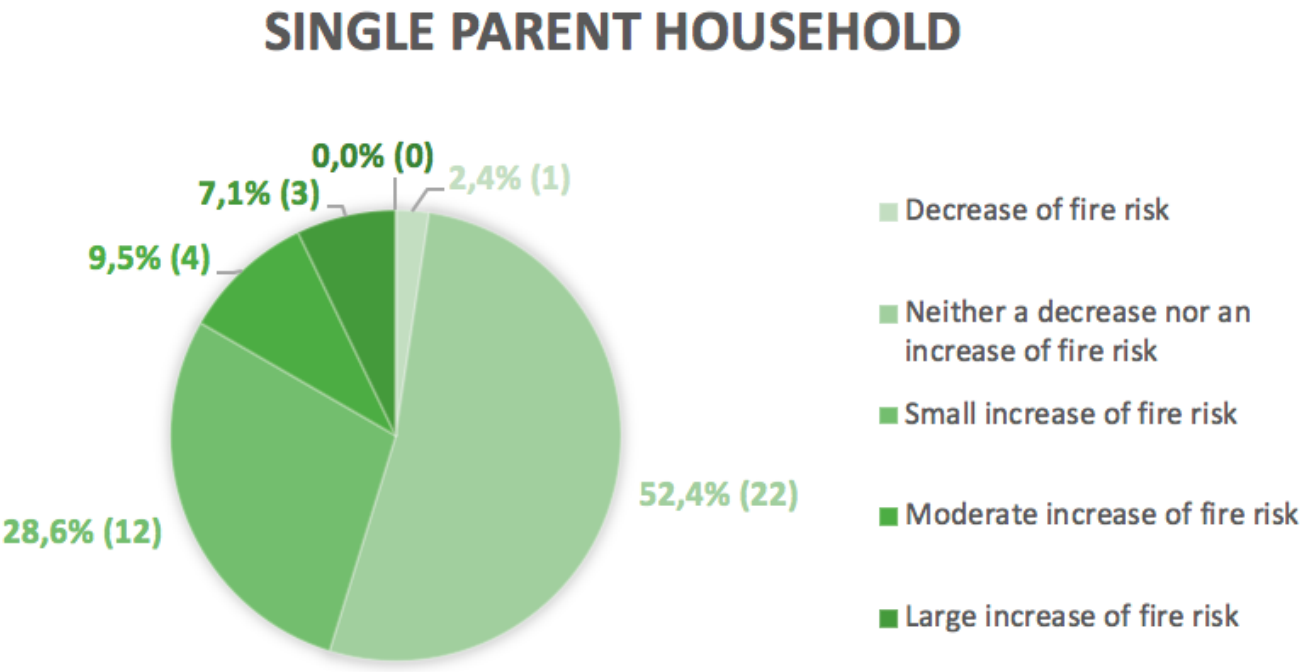

Figure 71: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed the presence of single-parent households affects the risk of fire fatalities in residential buildings.

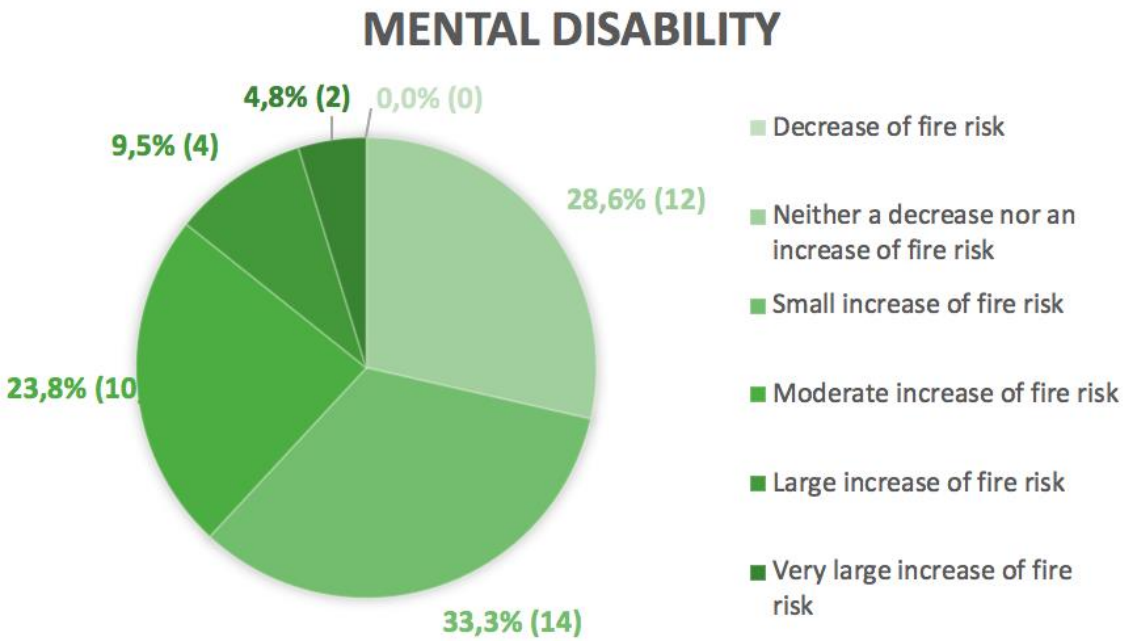

Figure 72: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed the presence of people with a mental illness affects the risk of fire fatalities in residential buildings.

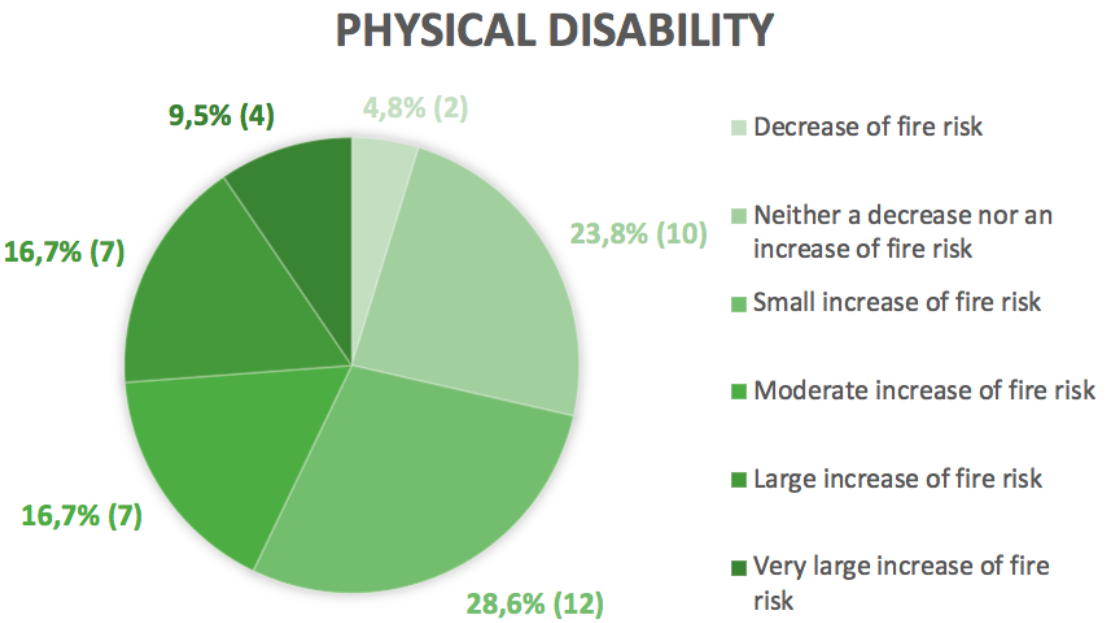

Figure 73: A pie chart illustrating, based on the results from the survey, how the respondents that were not considered the general public believed the presence of people with a physical disability affects the risk of fire fatalities in residential buildings.