A scoping review and bibliometric analysis on juvenile fire setting behaviour

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Abstract
The purpose of this review was to examine and analyse existing scientific literature on juvenile fire setting behaviour and to provide suggestions for future research. The PRISMA (Transparent Reporting of Systematic Reviews and Meta-Analysis) framework was used to search and collect relevant literature. Scopus, Web of Science and PubMed were used for the literature searches, and 71 studies met the inclusion and exclusion criteria. Determining the prevalence of fire setting behaviour among juveniles proved challenging primarily due to variations in research methods. However, relatively high prevalence rates, ranging from 27% to 37.5%, were found in specific samples. Juvenile fire setters appear to have a wide range of motives and risk factors, highlighting the importance of avoiding generalizations. Motives include, for instance, curiosity, revenge, boredom, and psychiatric problems. Commonly described risk factors in the reviewed studies involve family dysfunction, abuse and/or neglect and depression. The review identified gender and age differences in the behaviour and peer fire setting appeared common among juvenile fire setters. In conclusion, juvenile fire setting behaviour is a complex subject, and the group is highly diverse. Future research could focus on standardizing prevalence measurements, conducting more longitudinal studies, analysing geographic variances, examining co-occurring risk factors and motives, analysing influences of external factors and further exploring gender and age differences.

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Johanna Åkerström

Summary

A review of the current knowledge on juvenile fire setting behaviour was conducted. The aim of the review was to investigate the prevalence of fire setting among young populations, explore motives that drive juvenile fire setting acts and examining risk factors linked to fire setting behaviour among people 0 to 21 years old. To search for relevant papers the PRISMA (Transparent Reporting of Systematic Reviews and Meta-Analysis) framework was used. Data was collected from three databases Scopus, Web of Science and PubMed. Exclusion and inclusion criteria were set, and articles that met the criteria were included in the review. Furthermore, a snowball approach was conducted where reference lists of all included studies were examined and studies that met the inclusion criteria were retained. This resulted in a total of 71 reports included in the analysis. The publications of the reports ranged from 1961 to 2023 and the majority (55%) of the studies were from the US. A template was created to extract information and the content in the template was then analysed.

The reviewed studies explored prevalence of fire setting behaviour among juveniles. Prevalence refers, in this context, to the frequency of juvenile fire setters within a given sample. When examining six studies with community samples prevalence rates ranged from 4.6% to 37.6%. The differences could partially be described by different classifications of fire setting behaviour among the studies. Furthermore, some articles had time constraints for when the fire incidents must have occurred.

A wide range of motives for juvenile fire setting was identified. They include curiosity, revenge, peer influence, boredom, destroying evidence, fun, anger, and psychiatric problems. Risk factors associated with juvenile fire setting are also diverse. However, four risk factors stand out, i.e. they are mentioned in 20 or more articles. These were an unstable family situation, experience of abuse and/or neglect, challenging school situation and suicidal, self-harm, anxiety and/or depression. Furthermore, most researchers agree that it is more common for boys compared to girls to engage in fire setting behaviour. However, there are indications of gender differences making it crucial to examine girls fire setting behaviour rather than assuming they have the same risk factors and motivations as boys. There are indications that older children and adolescents engage more in fire setting behaviour compared to younger children. Noteworthy, a few studies have found children as young as ages 1 to 3 engaging in such behaviour.

Peer fire setting appears to be common among juvenile fire setters and many of the reviewed studies indicate that over half of juvenile fire setters have engaged in peer fire setting. In conclusion, there is a need for additional research on the subject to address gaps in previous studies. Research questions that could be investigated are standardizing prevalence measurements, conducting more longitudinal studies, exploring geographic variances, examining co-occurring risk factors and motives, analysing influences of external factors and further exploring gender and age differences.

Terminology

Arson

Arson is a legal term commonly used to describe a criminal act of deliberately setting fire to property. However, what is considered as arson can vary among different countries. Therefore, the broader term fire setting behaviour will be used most frequently in this review.

Fire setting behaviour

Fire setting behaviour, in this context, includes both intentional and unintentional acts of fire setting and involve both minor and more severe incidents.

Pyromania

Pyromania is, according to International Classification of Disorders (ICD-11), a psychiatric disorder characterized by a strong impulse to set fires (World Health Organization, 2024). This often leads to the ignition of multiple fires due to a failure to control the impulse. Individuals with this diagnosis are fascinated by fires and do not have another motive for the behaviour, such as revenge or attracting attention. The individuals feel some sort of tension or arousal prior a fire setting act, followed by relief or pleasure during or directly after the act (World Health Organization, 2024).

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1 Introduction

Two men, aged 18 and 21 living in a residential care facility, were convicted in the district court for starting a fire in Ängelholm, Sweden in 2022 (SVT Nyheter, 2022). The reason behind the fire setting was an expression of dissatisfaction and anger towards the staff at the residential care facility. As a result, they ignited a fire with the intention that the fire brigade would be able to extinguish it. Unfortunately, the flames spread to a nursing home, preschool and office spaces. The fire caused estimated damages to buildings worth 100 million Swedish Kronor (SVT Nyheter, 2022). The 18-year-old was later cleared of charges in the court of appeal.

Two 12-year-old boys admitted they had ignited a fire which led to a sport facility burning down in Gothenburg in 2019. According to their lawyer, they claimed that the fire spreading was an accident (Cliffordson, 2019). The municipality's insurance company filed a damage claim for 30 million Swedish Kronor to the boy's insurance company after the incident. In 2023, three children under 15 years old were suspected in five cases of arson in Visby (Kalm, 2023). For instance, the children were suspected to have thrown flammable material into mailboxes and to have set fire to a playhouse.

These incidents are just a few examples of the many situations where young individuals are suspected or charged for starting fires. Children under 15 years old are not criminally responsible in Sweden, but they could still be held economically responsible for damages if property is harmed by a fire they have started (Åklagarmyndigheten, 2021; SVT Nyheter, 2018). This could result in significant debts for the child. However, in many cases the majority of the damages will be covered by the juvenile's insurance company. Damage claims may take some time to reach an agreement between insurance companies. This can result in the final decision not being reported in newspapers, as the incident is no longer considered newsworthy. In Sweden the police and newspapers are usually quite reserved when it comes to crimes involving suspects who are children or teenagers, especially those under 15 years old. This is likely beneficial for the child but can make it challenging to access information about these events.

Approximately half (with an average of 53% from 2013 to 2022) of the suspects of fire related vandalism, including severe vandalism, in Sweden fall within the age range of 15 to 20 years old (Brottsförebyggande rådet, 2024). When reviewing individuals suspected of arson, including severe arson, from the years 2013 to 2022, an average of approximately 30% of the suspects are between the ages of 15 to 20 (Brottsförebyggande rådet, 2024). These statistics indicate that adolescents are suspected in a significant percentage of crimes related to fire setting behaviour. However, fire related crimes only make up about 1% (with an average of 1.1% from 2013 to 2022) of all the crimes that this age group are suspected of (Brottsförebyggande rådet, 2024).

Understanding juvenile fire setting behaviour can be challenging if only available crime statistics is examined. This difficulty arises because incidents involving younger children, who are not considered legally responsible, are normally not included in these statistics.

Additionally, there are likely individuals engaging in fire setting behaviour without it coming to the attention of law enforcement. Understanding the topic better and identifying methods to prevent fires could therefore require scientific efforts.

Several scientific studies suggest that an interest in fire can be considered a normal behaviour and that many individuals have experimented with fire during their childhood (Terjestam & Rydén, 1996). This fascination tends to develop early, and even very young children (ages 1 to 3 years old) have been observed playing with fire (Ellithy et al., 2022). However, not all who have played with fire in their childhood continues with more repetitive or serious forms of fire setting. Moreover, there are indications that young populations are not very good at predicting the severity of a fire (Fridolf & Nilsson, 2011; Henderson & MacKay, 2009). This can lead to situations where deliberately started fires can escalate beyond what was intended.

Children and young populations engaging in fire setting behaviour appear to have different motives, ranging from curiosity and boredom to seeking fun, expressing anger, seeking revenge, or signalling a cry for help (Ekbrand & Uhnoo, 2015; Perks et al., 2023). When comparing juvenile fire setting to that of adult fire setters, it is observed that juveniles tend to engage in fire setting more often in the company of others (Santtila et al., 2003). Group pressure can also function as a motive for the act (Uhnoo, 2016). Noteworthy, research rarely categorize pyromania as a motive of fire setting behaviour among juveniles. Instead, factors like family instability, abuse, and psychological issues are more commonly associated to this behaviour (Lambie et al., 2023). There are signs that juvenile fire setting may predict later delinquency, highlighting the importance of addressing this behaviour in an early stage (Becker et al., 2004). Understanding the underlying risk factors and motivations associated with underage fire setting can be crucial when developing treatment strategies. Additionally, it may also contribute to preventing future fire setting acts.

1.1 Aim and objectives

The main goal of this paper is to examine existing international academic literature on fire setting behaviour among juveniles ages 0 to 21. This is achieved through a review of relevant studies, aiming to identify key findings, theories, and methods used in previous research. The review aims to explore all types of fire setting incidents started by juveniles, ranging from igniting small objects to targeting larger structures such as houses or outdoor vegetation. In this paper, fire setting behaviour will refer to both intentional and accidental acts of igniting fires. Individuals engaging in such behaviour will be referred to as fire setters. Additionally, the study aims to explore gaps in previous studies to provide guidance for future research.

1.2 Research questions

The review aims to analyse and explore the current scientific knowledge on juvenile fire setting behaviour. To achieve this the following research questions have been formulated:

- What is the frequency of fire setting behaviour among young populations?
- What motives drive juvenile fire setters in their fire setting acts?
- What risk factors are linked to fire setting behaviour in young populations?

1.3 Limitations and delimitations

Several limitations and delimitations were implemented to limit the focus of the study. The primary aim of the review was to examine juvenile fire setting behaviour. Therefore, reports primarily focusing on adults were excluded, including studies where adults talked about engaging in fire setting in their childhood. This decision was made even acknowledging that investigating the fire setting behaviour of adults in their youth could have provided valuable insights into the effects of fire setting. However, time constraints prevented the examination of this aspect in the review. Additionally, studies primarily focused on treatment or prevention strategies were not included in the review. This reason was made because the behaviour itself was the study's primarily focus and not treatment or prevention strategies. Studies that only examined a single individual or a specific case were also excluded from the review. This decision was influenced by the recognition that the results of such studies might not be as easily generalizable as those involving larger sample sizes. Moreover, due to time constraints, it was necessary to narrow down the number of reviewed articles.

The report is subject to several limitations. First, the review is based on a set of 71 articles, limiting the depth of the analysis. Including more articles in the review could have provided more detailed results. Another limitation is the use of only three databases during the article search potentially leading to excluding relevant reports. However, a snowball approach was conducted where references of all the reviewed articles were screened. This was done to identify any potentially missed relevant articles from the database searches. Furthermore, only studies available in English was included in the review. The decision was made due to time constraints. However, this may have resulted in missing important studies that were not available in full English text.

Additionally, other review articles were excluded during the search for studies to include in this review. The decision was primarily made to focus on identifying primary studies and obtaining firsthand information. Nevertheless, examining reference lists of other reviews could have been beneficial to identify articles that might have been missed in initial searches. Unfortunately, this was not done due to time constraints, potentially leading to the oversight of relevant articles.

2 Methods

The PRISMA (Transparent Reporting of Systematic Reviews and Meta-Analysis) framework, as defined by Tricco et al. (2018), was used to systematically search for relevant papers. Data was collected from three databases: Scopus, Web of Science, and PubMed. Web of Science and Scopus were chosen because they are two major databases for scientific literature. PubMed was selected to ensure the inclusion of literature from psychology and behavioural science.

Initially, a basic string search was conducted in the three databases using different terms related to fire setting and juveniles. Keywords from the retrieved studies were then reviewed to identify any potentially overlooked terms. Additionally, five articles that was considered particularly relevant were examined to find additional keywords. The string search was then refined to include more synonyms, such as pyromania* and teenage*, resulting in an expanded set of results. Appendix 1 provides a record of the search strings used in each database in the final searches. For Scopus and Web of Science, a title-abstract-keywords search was performed, while for PubMed, a title-abstract search was conducted. The searches were conducted on October 9, 2023. After eliminating duplicates, this strategy resulted in 991 identified articles.

The titles and abstracts of these articles were thereafter examined, and the following exclusion criteria was set: duplicate records, review articles, articles only partially addressing underage fire setting behaviour (e.g., those focused on juvenile crimes in general), studies primarily involving adults, studies irrelevant to the subject, poor quality articles (e.g., lacking references), absence of full English text, and studies only focusing on an individual or a particular case. The exclusion criteria were established to limit the number of articles and generate a set of studies focused on juvenile fire setting behaviour. Initially, an age limit of 18 years or younger was set. However, to include more relevant articles, the limit was changed to 21 years or younger. One article included a 33-year-old person. However, this article was chosen for inclusion because it primarily focused on a younger age group and addressed juvenile fire setting behaviour.

After excluding articles according to the established criteria, a full-text screening was conducted on the remaining articles. To identify potentially missed articles, a snowball approach was adopted where the reference list from all articles that underwent full-text screening was screened. All articles in the reference lists were checked for relevance and if they passed the exclusion criteria they were included in the review. Figure 1 provides a visual presentation of the workflow through a flowchart. To extract information from the retrieved articles that met the exclusion criteria, a template was developed, as illustrated in Appendix 2. The template's content was then analysed. Additionally, a bibliometric analysis and visualization of information was conducted using VOSViewer.

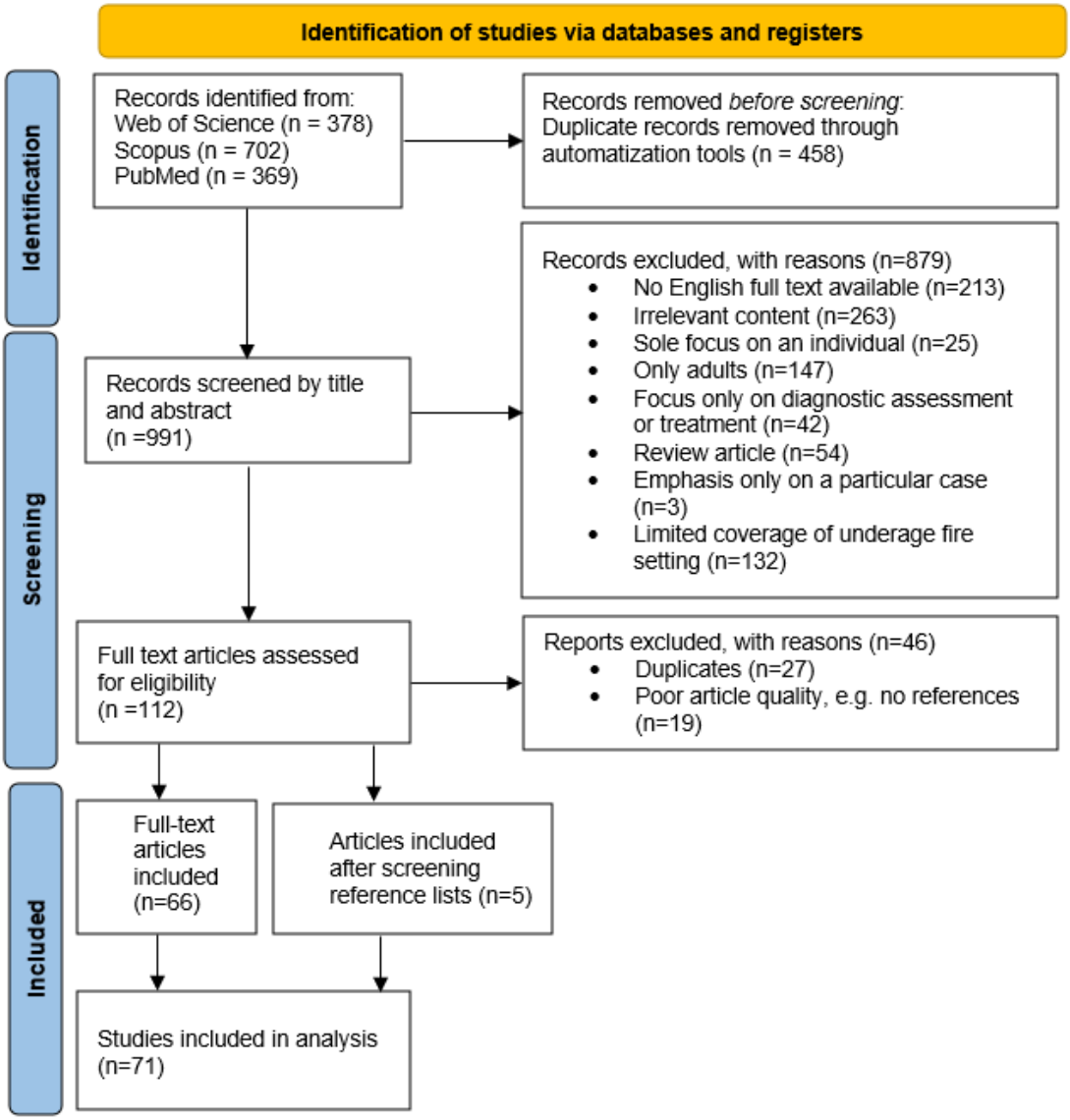

Figure 1 Flowchart illustrating the process of identifying relevant studies for the review.

3 Findings regarding juvenile fire setting

In this section, the focus is on analysing the 71 retrieved articles. Initially, a bibliometric analysis is conducted. Following this, the main findings of the retrieved articles are presented. The extracted information from the reviewed articles is available in Appendix 3.

3.1 Bibliometric analysis

The publication years of the reviewed studies are illustrated in Figure 2. No exclusion criteria were based on publication year, only the content and the requirement for articles to be in English and open source were considered. 42% of the studies were published before the year 2000 and 58% of the articles were published after the year 2000.

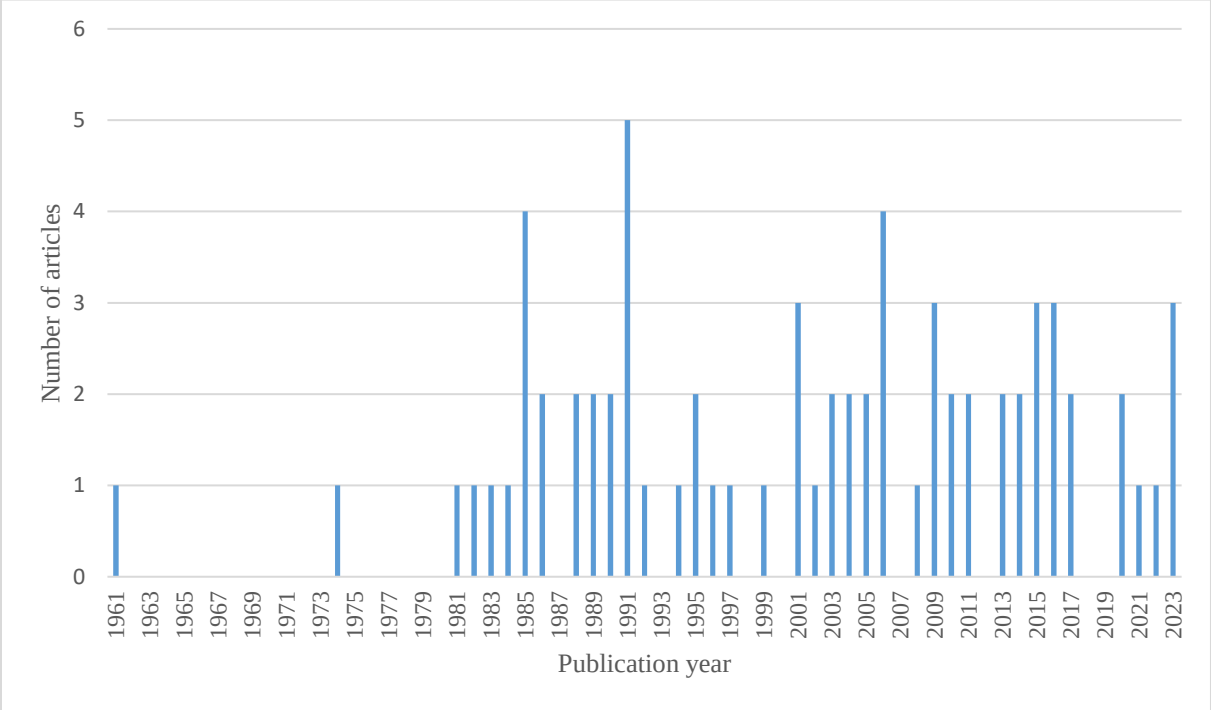

Figure 2 The number of articles published each year across the 71 reviewed studies.

An analysis of co-authorship was performed using VOSviewer. This analysis includes authors that have written two or more articles that is included in the review. The results, presented in Figure 3, identifies 14 authors involved in two or more articles. The size of the circles corresponds to the frequency of the author's occurrence. It is apparent that some authors have contributed more to the studies included in the review than others. For instance, Kolko and Kazdin participated in writing 11 out of the 71 articles. Some authors have collaborated with others, while others have written most articles by themselves. Notably, it seems that most authors who collaborate with others tend to do so with the same set of co-authors.

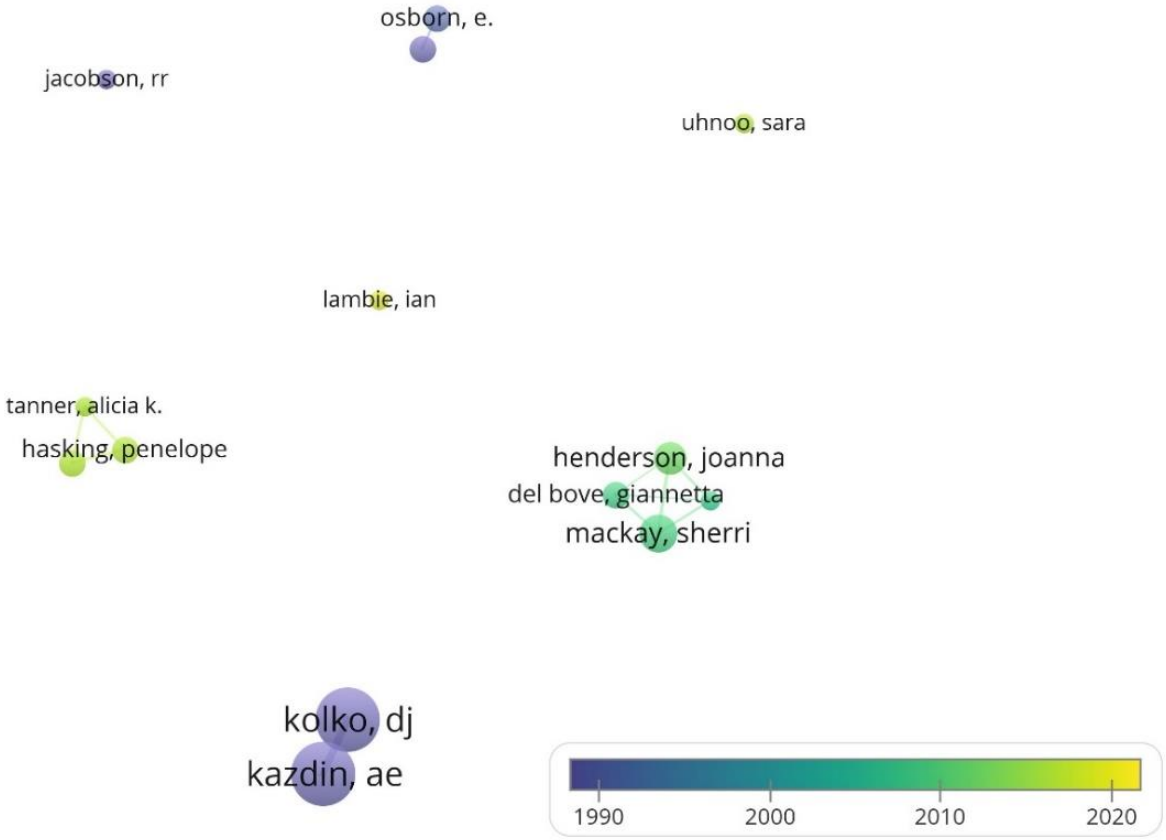

Figure 3 Visualization of co-authorship among authors who have written two or more articles included in the review. The size of the circles corresponds to the frequency of the author`s occurrence.

Thereafter, a keyword analysis was performed using VOSviewer. This analysis includes keywords that appeared in two or more articles, as illustrated in Figure 4. The figure shows the interconnections among the keywords and the size of the circles corresponds to the frequency of the keyword. Initially, 58 words met the criteria of appearing in two or more studies. After removing a set of general terms, such as “fire setting”, “humans”, “child” and “sample” 15 words remained.

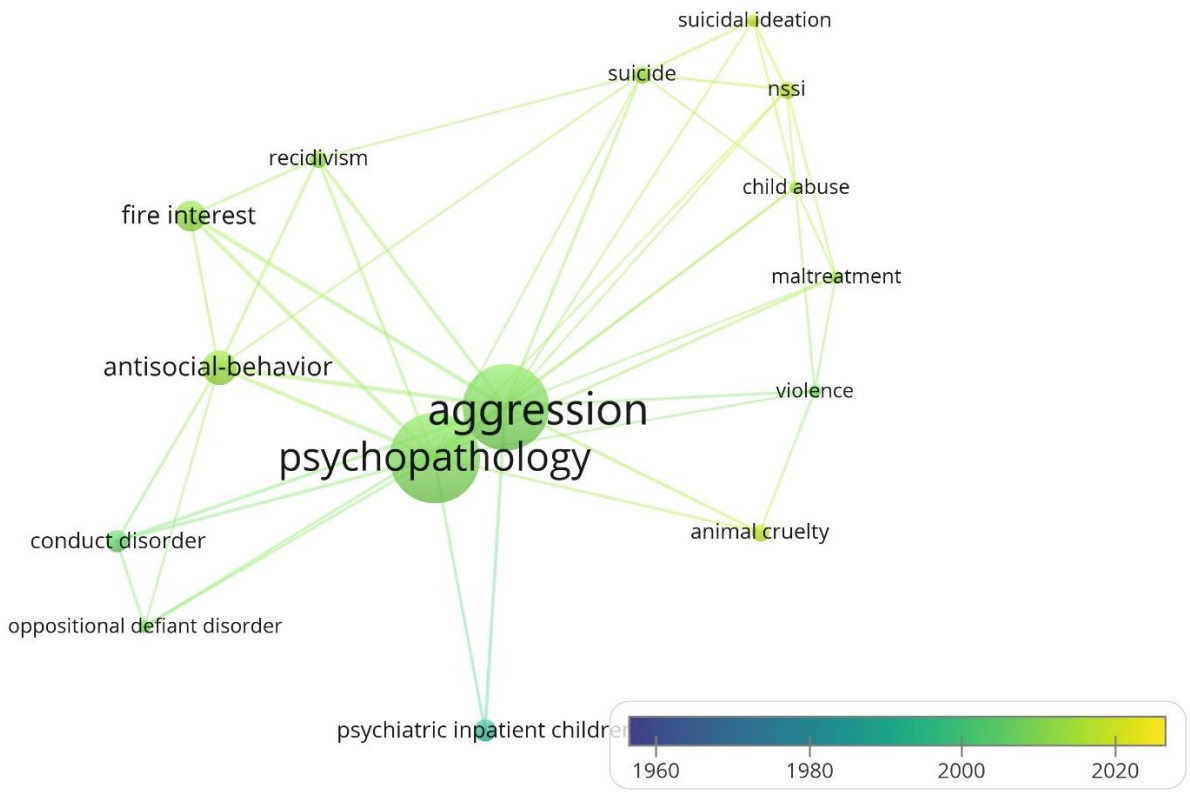

Figure 4 Visualization of keywords that appears in two or more studies among the retrieved articles. A general set of keywords such as “fire setting” and “child” has been removed and the size of the circles correspond with the frequency of the keyword. NSSI stands for non-suicidal self-injury.

3.2 Literature review

In this section, the main findings from the 71 retrieved articles are presented. Initially, an overview of the articles is provided, highlighting the methods used, countries of study populations, and self-reported biases. Thereafter, an overview of the key findings from the articles is conducted.

3.2.1 Analytical overview

A total of 327,616 individuals were included in the retrieved articles. The majority of the studies examine relatively small samples, with 23% involving 3 to 50 participants, 31% examining 51 to 200 participants, 20% involving 201 to 400 participants and 23% of the studies including 401 participants or more. However, three reports were not included in these calculations since the number of participants were not specified in the reports. It is also uncertain if some individuals occurred in multiple articles. The gender distribution was 67% boys and 33% girls, but ten reports did not include information about gender.

Recent articles tend to examine larger samples and more balanced proportions of boys and girls compared to older studies, which often focused on boys and had smaller samples. Ages of participants in the studies range from 0 to 21. However, one report includes a 33-year-old, see section “2. Methods” for an explanation of why this was included. The articles were

published between 1961 and 2023 as no exclusion criteria were set based on the publication year.

The majority (55%) of the articles had a study population from the US, as illustrated in Figure 5. However, it is noteworthy that 11 of the articles from the US were written by the same authors, namely Kolko and Kazdin. It is also unclear if some of the articles by Kolko and Kazdin referred to the same study population. After year 2000, the country distribution was more even. The overrepresentation of studies from the US would not have been as high if reports written before year 2000 were excluded. Figure 5 also shows that no studies had a study population from, for example, Asia or Africa. This limitation could have been due to the inclusion criteria to only consider studies in English. This will probably limit the generalizability of the results.

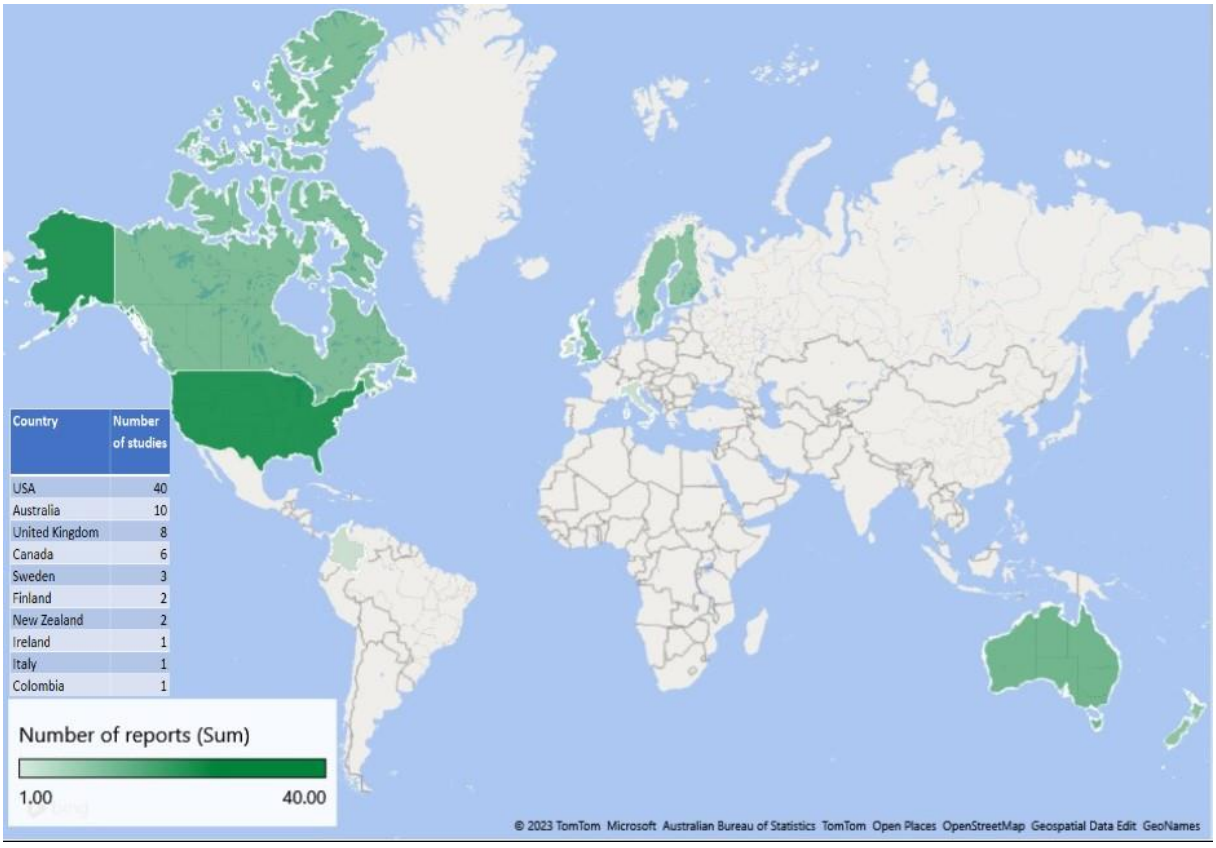

Figure 5 The country of the study population and the frequency of occurrence in the reviewed articles. Note that one article included study populations from several countries.

Figure 6 presents the methods that were used in the retrieved articles, note that some of the studies use several methods. The most used method was interviews and thereafter different types of surveys. Interviews and surveys have been consistently used over the years in the studies, and in some articles as a compliment to other methods. Document analysis refers to reviewing different kinds of files such as doctor notes and notes from psychiatric examinations. This method was used only before 1995 in the reviewed studies and mostly in clinical samples. Case file analysis refers to examining different types of cases such as police reports from specific cases. This method occurs only from the year 2000 and onwards in the reviewed articles. A psychological test called “Stroop test” was used in some studies. In these

tests fire related and non-fire related images or words were viewed on a computer to see if the reaction time differed between the fire related and non-fire stimuli (Gallagher-Duffy et al., 2009). The purpose of the test, in the reviewed studies, was to examine fire interest.

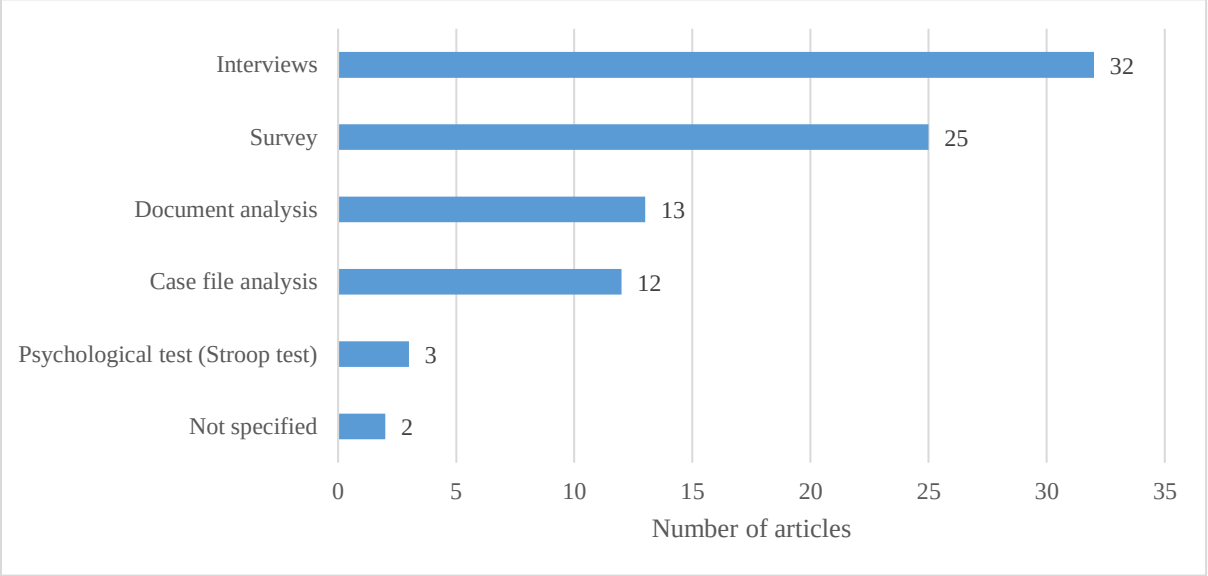

Figure 6 The different methods used and their frequency of occurrence in the reviewed articles. Note that some articles use several methods, which have been added to different categories. As a result, the sum is higher than the total number of articles.

Clinical samples refer to samples where the participants are patients in mental health clinics, including both inpatients and outpatients. Community samples consists of juveniles recruited from specific communities, often sourced from schools or through advertisement. Forensic sample refers to samples where participants are charged or suspected of various crimes. The treatment/prevention program sample refer to juveniles participating in a program to address their fire setting behaviour. Treatment programs share some similarities with clinical samples. However, treatment programs do not necessarily require a clinical setting and the treatment is generally less intense. Two studies focus on child welfare samples. Additionally, one study examines cases included in a fire and rescue service database. Finally, one article includes a sample where mothers and their children were recruited from a women`s shelter. Clinical samples are most common in the articles, followed by community and forensic samples, as illustrated in Figure 7. It is worth noting that some studies include multiple sample types.

All the reviewed articles that were published before 1989 had clinical samples. However, over the years there has been a declined trend to examine clinical samples and instead an increased focus has been on examining samples from treatment or prevention programs. This shift may reflect the changes of how fire setting is viewed in society over time. Among the retrieved articles, the inclusion of a community sample is a recent trend. Forensic samples have been examined more evenly over the years.

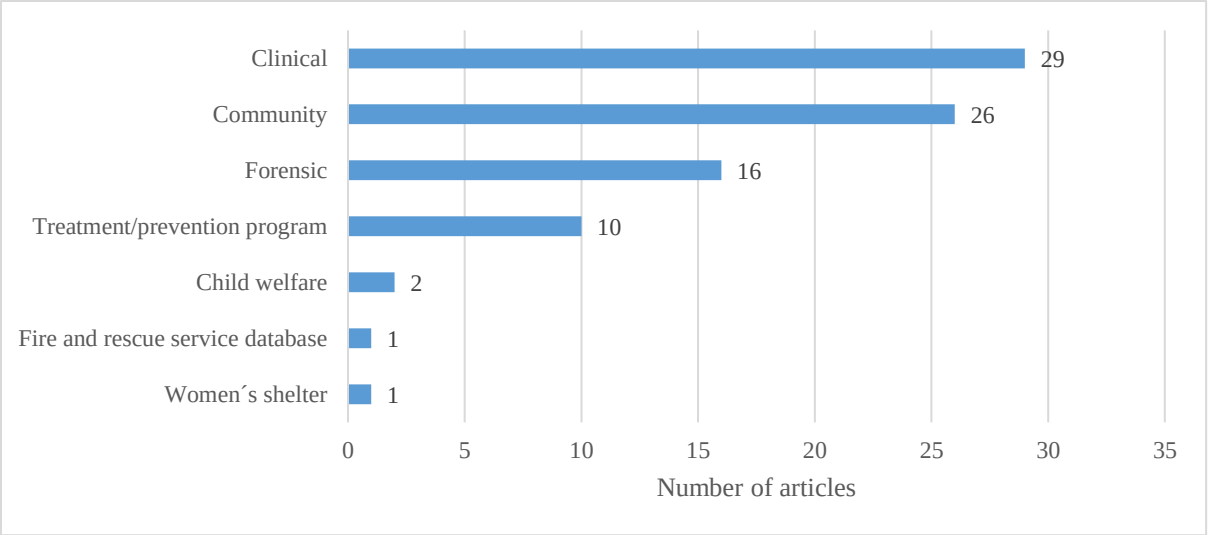

Figure 7 The different types of samples that have been studied and their frequency of occurrence in the reviewed studies. Note that some articles examine several sample types resulting in a higher sum than the total number of articles.

The limitation that was most frequently reported among the retrieved studies was uncertainty regarding the generalizability of the results, as presented in Figure 8. The second most described limitation was a limited sample size. What is reported as a small sample size varies across studies, ranging from 3 to 138 individuals with an average of 57 individuals. Another limitation that was frequently reported in the studies was related to data gaps. This refers, for example, to situations where a limited number of questions were asked to the participants or where fire setters were classified based on a single question. Data accuracy and interpretation, including biases, were other concerns that was described by many studies. Furthermore, a limited number of studies reported missing data and old data as limitations. Limitations reported in only one study were not included in the figure.

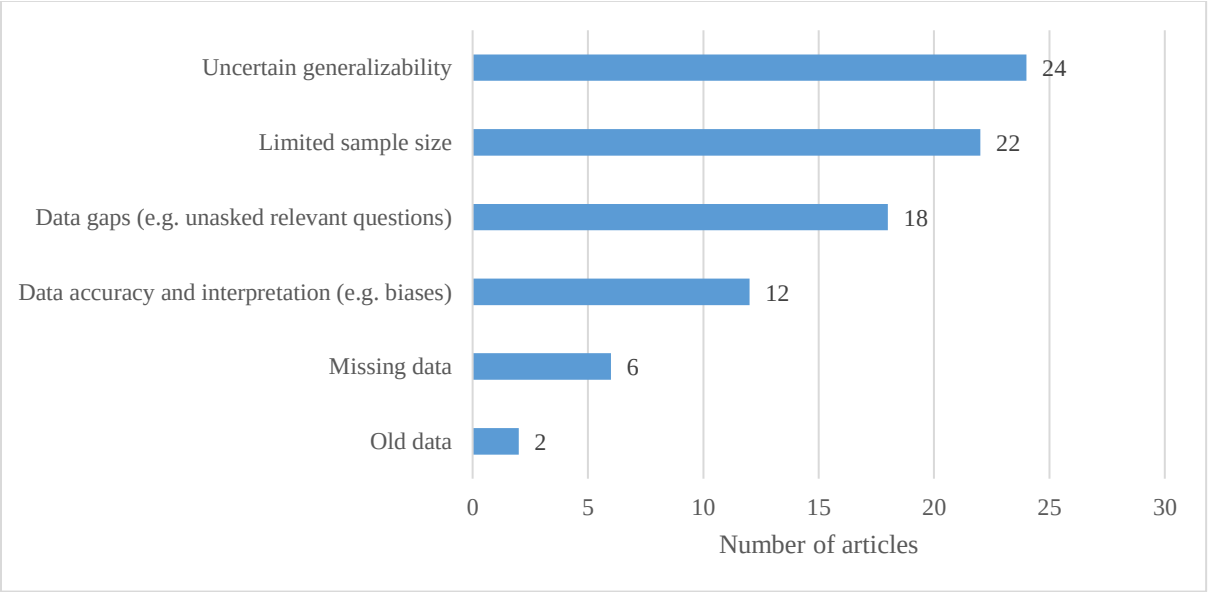

Figure 8 Self-reported study limitations and the frequency of their occurrence in the reviewed articles. Limitations reported in only one study were not included in the figure.

3.2.2 Prevalence of fire setting behaviour

Assessing the prevalence of fire setting behaviour among juveniles and comparing results across different studies was challenging. In this context, prevalence refers to the frequency or occurrence of fire setters within a given sample. The prevalence varies among the different studies and depends for example on the type of sample that are under consideration. The method of measuring the behaviour also varies, with some reports classifying fire play and/or match play as fire setting, leading to higher prevalence rates.

Six of the reviewed studies was chosen to assess prevalence rates of fire setting behaviour among juveniles. They were selected because they had a relatively high number of participants (ranging from 136 to 4595). Additionally, all of them had samples within a community setting, recruited either from schools or through a survey-based dataset. Furthermore, they were all based on self-report. Table 1 provides a summary of the chosen studies and the prevalence rates of fire setting behaviour within those studies.

Table 1 Summary of study results on the prevalence rates of fire setting behaviour in six different studies

Study	N	Country	Recruitment	Age	Classification of fire setting	Percentage fire setting behaviour
(Tanner et al., 2015a)	2356	Australia	School	12-18	"How many times have you set fire to something you were not supposed to?" ("Ranging from never to 6 or more")	29.3% (10.3% had been involved in three or more acts of fire setting)
(MacKay et al., 2009)	3965	Canada	School	11-19	"Fire setting during the past 12 months"	27%
(Del Bove et al., 2008)	567	Italy	School	11-18	'I have set fires"	29%
(Chen et al., 2003)	4595	USA	Data from "1995 National Household Survey on Drug Abuse (NHSDA)"	12-17	"I set fires" (Within the past 6 months)	6.3%
(Howell Bowling et al., 2013)	1158	USA, Columbia, Australia, and United Kingdom	Data from a national survey dataset from 1999	11-18	"I set fires" (Within the past 6 months)	4.6%
(Watt et al., 2015)	136	Australia	School	12-19	"Have you ever started a fire?" Part of "Youth Fire Behaviours and Interests Scale"	37.5%

The prevalence rates within the given samples range from 4.6% to 37.5%. One explanation for the variation could be that the low prevalence rates only consider fire setting within the past 6 months, while the studies with high prevalence rates do not set a time constraint. However, this is not applicable to one of the studies, where the prevalence rate of fire setters is 27% and the fire setting event must have occurred within the past 12 months.

The classification of fire setters is often based on relatively broad questions, such as “I have set fires”. This could lead to different individuals interpreting the question in various ways, as recognized by, for example, Watt et al. (2015) and Howell Bowling et al. (2013). Additionally, the studies rely on self-report which could lead to a misinterpretation of prevalence rates (Watt et al., 2015; Chen et al., 2003). Moreover, several of the authors of the studies express concern about the generalizability of their findings to other groups of juveniles (Watt et al., 2015; MacKay et al., 2009; Tanner et al., 2015a).

In studies where children`s fire setting behaviour was examined by asking both the child and their parents/guardians separately, children typically reported more incidents of fire setting than their parents/guardians (Dadswell et al., 2023; Kolko & Kazdin, 1991a; Howell Bowling et al., 2013). An explanation of this could, according to Howell Bowling et al. (2013), be because the parents/guardians might not be fully aware of their child`s activities.

When examining studies that compare community and clinical samples, clinical samples appear to have a higher prevalence of fire setting behaviour. For example, in a study with 2133 participants aged between 11 and 18 the prevalence of fire setting behaviour in the past 6 months was 4.6% in the community sample and 12% in the clinical sample (Howell Bowling et al., 2013). In another study with 138 youths between ages 6 to 13, the prevalence of fire setting behaviour in the community sample was 40% and 52.6% in the clinical sample (Kolko & Kazdin, 1992).

When comparing a community and a forensic sample, the forensic sample had higher prevalence of fire setting behaviour. For example in a sample of 274 adolescents between ages 12 and 19, the prevalences were 67.4% in the forensic sample and 37.5% in the community sample (Watt et al., 2015). However, note that there are few studies within the reviewed articles that compare different types of samples.

3.2.3 Motives

This section of the review is exploring the most prevalent motives for juvenile fire setting. It is a common approach among the reviewed studies to categorize fire setters based on their motives. Furthermore, certain similarities are found between different studies that are examining motives, for example many studies have curiosity as a category. However, it is important to note that most articles describing motives do so in various ways and there may be instances where they use the same terminology but mean different thing. Additionally, many studies fail to provide an explanation of each category and the reasons why they categorize juveniles in that way. This makes it challenging to compare different studies.

Figure 9 provides a simplified summary of the motives for juvenile fire setting that are mentioned in the reviewed studies. It is important to note that the figure indicates how many articles that describe each motive, and it does not necessarily reflect the frequency of each motive. For instance, curiosity may not be the most prevalent motive in juvenile fire setting, rather it is only mentioned as a motive in the most articles. The “Other” category in the graph consists of motives that are mentioned in only one article. These include “fire creates calm”,

"antisocial", "vandalism", "attempt to transfer to another treatment", "political", and "no reason". It is worth noting that two of these motives are discussed in the same article.

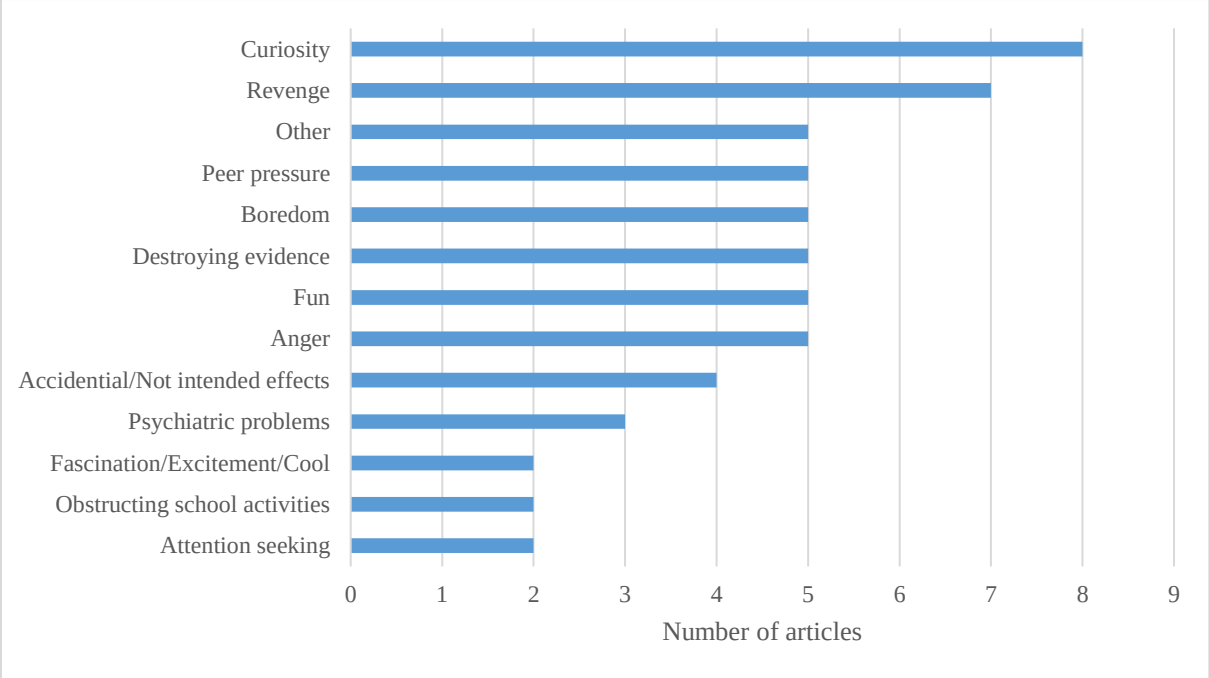

Figure 9 The motives for juvenile fire setting behaviour identified in the reviewed studies and the number of articles that describe each motive.

Curiosity can be described by "wanting to see what happens" and the motive have been found in all age categories of juvenile fire setters (Ellithy et al., 2022; Bailey et al., 2001; Kolko & Kazdin, 1994). The motive can lead to the perception that this subgroup is non severe. However, indications have shown that juveniles with a high fire curiosity are associated with more severe and a more frequent fire setting behaviour (Kolko & Kazdin, 1991; MacKay et al., 2006). Therefore, the motive should not be seen as something insignificant (Kolko & Kazdin, 1991; MacKay et al., 2006).

Revenge is found in some articles as a relatively common motive for fire setting behaviour among adolescents, with prevalence rates around 14% to 20% in specific samples (Perks et al., 2023; Uhnoo, 2016; Santtila et al., 2003; Swaffer & Hollin, 1995). However, some articles either do not identify revenge as a motive or find very low prevalences. For example, one study with 273 individuals aged 12 to 19 found the motive in only 2.8% of the cases (Watt et al., 2015). Revenge can be characterized by a known victim, a personal conflict, a triggering event and in some cases prior threats (Santtila et al., 2003; Uhnoo, 2016).

Peer pressure or peer influence is a frequently mentioned motive among juveniles engaging in group fire setting (Uhnoo, 2016). However, this will be further analysed in section 3.2.5 titled "Peer fire setting". Boredom as a motive is more likely for adolescents than for children (Lambie et al., 2023). Fun is another motive more prevalent in older children and adolescents compared to younger children (Ekbrand & Uhnoo, 2015). Fun and boredom are in some

articles combined as one motive, suggesting that lighting a fire can become a way to create destructive fun when juveniles are bored (Ekbrand & Uhnoo, 2015; Watt et al., 2015).

Psychiatric problems are in some studies categorised as a motive and in others as a risk factor. This category mainly consists of adolescents and is more common among female fire setters compared to male fires setters (Santtila et al., 2003). Fire setting can serve as a way of reducing anxiety or be a cry for help in this subgroup (Ekbrand & Uhnoo, 2015; Santtila et al., 2003). The fire setting act within this group is typically carried out alone (Ekbrand & Uhnoo, 2015; Santtila et al., 2003).

Fire setting to destroy evidence mainly consists of adolescent fire setters and are most commonly used to achieve other criminal goals (Perks et al., 2023; Uhnoo, 2016; Santtila et al., 2003). Anger has been identified as a motive in several articles and all age categories are represented. An interesting finding in a study is that maltreated children are more likely to light a fire out of anger compared to non-maltreated children (Root et al., 2008). In some articles anger is defined as a risk factor rather than a motive.

There are indications that children that have multiple motives simultaneously may be associated with more behavioural dysfunction. For instance, a study involving 133 children aged 6 to 13 found that a combination of curiosity and anger was linked to a higher risk of behavioural dysfunction compared to those with only one motive (Root et al., 2008). However, a limited amount of the reviewed studies have explored multiple motivations simultaneously, making it challenging to draw conclusions.

3.2.4 Risk factors

Many of the reviewed studies explore risk factors linked to juvenile fire setting. In this section the most frequently identified risk factors among the studies are presented, as illustrated in Figure 10. The risk factors are categorised into sociodemographic factors, family school and other environmental factors, behaviour and psychological factors, and fire specific risk factors. It is important to note that this section provides an overview of commonly found risk factors and that some risk factors, such as those only found in a single study or with uncertain results, might not be included.

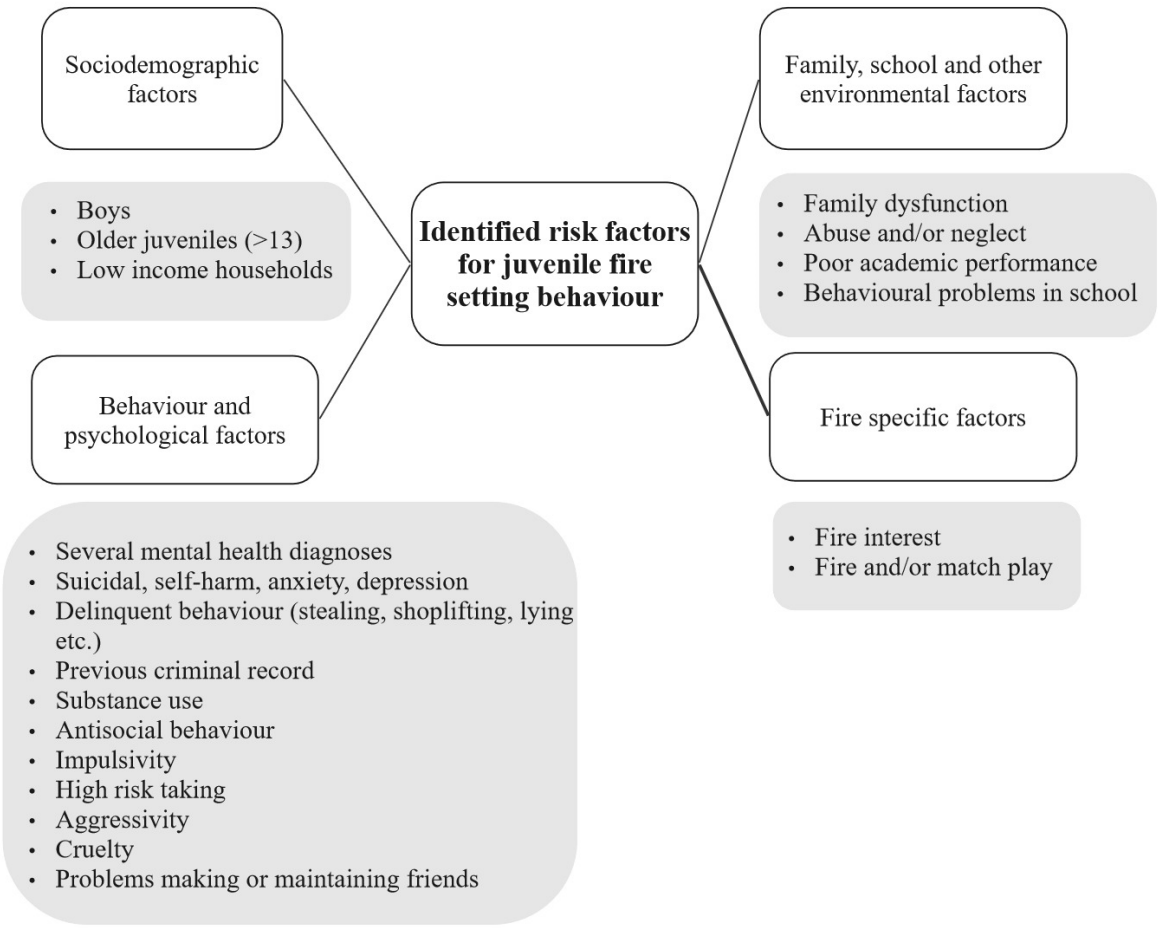

Figure 10 An overview of commonly identified risk factors linked to juvenile fire setting behaviour in the reviewed studies.

3.2.4.1 Sociodemographic factors

The prevalence and characteristics of fire setting behaviour among juveniles depend on multiple sociodemographic factors. The behaviour differs for example among boys and girls and in different age categories (Lambie et al., 2023; Pooley & Ferguson, 2017). Therefore, it can be problematic to only consider juvenile fire setters as one group without considering how age, for example, impact an individual's behaviour.

A few reports have examined the age at which individuals first express fire setting behaviour. The age of onset varies among different studies, with some studies reporting instances of children as young as 1 to 3 years old engaging in fire setting behaviour (Pollack-Nelson et al., 2006; Ellithy et al., 2022; Lambie et al., 2023). Other articles provide a more detailed view of the range of onset among fire setters. For example, in a study with 192 boys aged 6 to 17 following a fire setting treatment program, 26% of the sample had their first fire setting incident before the age of 6 (MacKay et al., 2006). An earlier onset of fire setting behaviour appears to be associated with an increased number of fire setting episodes, more school related problems (Del Bove & Mackay, 2011), and a heightened interest in fire (Hoerold & Tranah, 2014). However, it's important to note that there is a limited amount of research on this topic.

Fire setting behaviour seems to be more common among adolescents (above age 13) compared to younger children (Pooley & Ferguson, 2017; MacKay et al., 2009; Dadds & Fraser, 2006). One article, examining 26380 incident reports from the fire and rescue service database in Australia involving children aged 0 to 16, found that 2.4% of fires were caused by children between age 0 and 5, 16.9% by children between age 6 and 12, and 52% by adolescents between ages 13 and 16 (Pooley & Ferguson, 2017). However, these are incidents reported to the fire and rescue service database, and there were likely more cases of fire setting that did not require the attention of the fire and rescue services.

Children under the age of 6, showing a fire setting behaviour, often ignite fires in their own homes and during the day (Pooley & Ferguson, 2017; Lambie et al., 2023; Pollack-Nelson et al., 2006). This tends to occur when parents are home (Ellithy et al., 2022; Pollack-Nelson et al., 2006), and often involves targeting small objects or furniture (Ellithy et al., 2022), often within their own bedroom (Pollack-Nelson et al., 2006). When studying fire setting behaviour in somewhat older children (6- to 12-year-olds), it appears that incidents typically occur in the afternoon and away from home and tend to target public property rather than private property (Pooley & Ferguson, 2017). Another noteworthy finding from a study conducted by Henderson & MacKay (2009) indicates that children as young as eight were reported to use matches or lighters which they had personally bought from a store. There are also indications that children (under 12 years) engaging in fire setting behaviour may have experienced more neglect, have more hyperactivity problems and experience more negative feelings when lighting fires, compared to adolescents (Lambie et al., 2023). Adolescents (13 years and older) engaging in fire setting appear to have an increased probability of having previous criminal records, using accelerants during fire setting incidents, and being driven by boredom compared to children (Lambie et al., 2023). Additionally, the behaviour of adolescents aged 12 to 16 was often characterized by engaging in fire setting activities during the late evening, away from their home, and on public property (Pooley & Ferguson, 2017).

The consensus in most of the reviewed studies is that engaging in fire setting behaviour is more common among boys compared to girls (Ellithy et al., 2022; Tanner et al., 2015; MacKay et al., 2009; Dadds & Fraser, 2006; Martin et al., 2004; Santtila et al., 2003; Rasanen et al., 1995; Fitzgerald & Ohanlon, 1991; Grolnick et al., 1990). However, some studies suggest otherwise. For example, one article involving 32 juveniles aged 14 to 15 who discussed fire setting argued that both boys and girls were equally involved in both fire setting and fire play (Lilja, 2020). Another interesting find comes from a study with 3965 individuals aged 11 to 19, where a majority (61.5%) of girls reported being involved in fire setting in their lifetime but only a few (8.5%) indicated participation in a fire setting event in the past 12 months (MacKay et al., 2009). The result suggests that an escalation of fire setting behaviour is not as common for girls as it is for boys.

Most research has mainly focused on boys' fire setting behaviour compared to that of girls. Only a few studies have directly compared boys and girls, with only one article in the reviewed literature solely focusing on girls' fire setting behaviour. Some similarities have been found when researchers have compared boys' and girls' fire setting behaviour. For

instance, when analysing 114 girls and 214 boys who had been arrested for fire setting, similarities were found concerning family instability, negative peer influences, limited parental supervision, and committing arson in a group (Roe-Sepowitz & Hickle, 2011).

Girls, compared to boys, seems to be more likely to set fires as a cry for help and have problems with anxiety or depression (Roe-Sepowitz & Hickle, 2011; Dadds & Fraser, 2006; Santtila et al., 2003). It has also been found that girls engaging in fire setting are more likely to be experiencing an ongoing crisis (Roe-Sepowitz & Hickle, 2011). Female juvenile fire setters have also reported more perceived school failure compared to boys (Martin et al., 2004; Roe-Sepowitz & Hickle, 2011). When examining differences between group and solo female juvenile fire setters, it was found that solo fire setters had lower school enrolment, experienced more home instability, and felt more angry or upset (Hickle & Roe-Sepowitz, 2010).

Boys, in comparison to girls, who engage in fire setting behaviour, seems to be more likely to show prior delinquency and to have participated in multiple arson events (MacKay et al., 2009; Roe-Sepowitz & Hickle, 2011). They also seem more prone to express antisocial behaviour (Dadds & Fraser, 2006; Santtila et al., 2003). Additionally, boys are more likely than girls to demonstrate hyperactivity, cruelty to animals, and have a higher likelihood for engaging in thrill-seeking behaviour (Dadds & Fraser, 2006). More serious drug use, suicidal plans, and suicidal attempts have also been observed to be more prevalent among boys engaging in fire setting compared to girls (Martin et al., 2004).

There are indicators that many juvenile fire setters come from low-income households. For instance, in one study 46% of fire setters were found to come from a low-income household (Henderson & MacKay, 2009). An other study revealed that 64% of child fire setters (under age 12) and 47 % of adolescent fire setters come from economically challenged households (Lambie et al., 2023).

3.2.4.2 Family, school, and other environmental factors

The risk factor that is the most frequently mentioned in the reviewed studies is that juveniles who engage in fire setting often come from homes with significant instability. This instability can be characterized by family dysfunction (Martin et al., 2004), an unstable living situation (Hickle & Roe-Sepowitz, 2010), instances of family violence (Ellithy et al., 2022; Becker et al., 2004), harm to pets by parents (Becker et al., 2004), heavy parental alcohol consumption (Fitzgerald & Ohanlon, 1991), poor parental supervision or involvement (MacKay et al., 2009), and serious conflicts within the family (Tanner et al., 2015; Kolko & Kazdin, 1992).

Additionally, juvenile fire setters seems to be more likely to have experienced maltreatment and/or abuse compared to non-fire setters (Martin et al., 2004; McCarty & McMahon, 2005), including both physical and sexual abuse (Moore et al., 1996). However, some studies have not found any correlations between fire setting and sexual abuse (Becker et al., 2004). In a sample of 1790 juveniles aged 3 to 17 enrolled in a fire setting treatment program, 40% of children (under age 12) and 37% of adolescents reported experiencing abuse or neglect

(Lambie et al., 2023). Another interesting finding in a sample of 4155 children aged 0 to 18 is that there is a higher probability that the child engage in fire setting behaviour the more trauma the individual experiences (Lyons et al., 2010). It has also been found that neglect or abandonment is much more frequently observed in severe fire setters (persistent and deliberate behaviour) than in minor cases (accidental, curiosity or playing) (Sakheim & Osborn, 1999).

Poor academic performance is another risk factor that seems to be linked to fire setting behaviour among juveniles. Fire setters appear to be more likely to struggle in school compared to non-fire setters (Del Bove et al., 2008; Kolko & Kazdin, 1991a). Especially if they also exhibit a negative attitude towards the school (Howell Bowling et al., 2013). Poor attendance and difficulties keeping up with schoolwork also seem to be risk factors for fire setting behaviour (Tanner et al., 2015). Additionally, high rates of behavioural problems in school have been observed among juvenile fire setters (Sakheim & Osborn, 1999; Santtila et al., 2003; Gruber et al., 1981).

3.2.4.3 Behaviour and psychological factors

Juvenile fire setting have been associated with several mental health diagnoses, including conduct disorder (CD) (Becker et al., 2004; Bailey et al., 2001; Sakheim & Osborn, 1999), depression (Tanner et al., 2016), attention deficit hyperactivity disorder (ADHD), and oppositional defiant disorder (ODD) (Becker et al., 2004).

Self-harm behaviours, suicidal thoughts, and suicidal attempts have also been linked to fire setting behaviour (Martin et al., 2004; Moore et al., 1996), especially for girls who engage in fire setting (Hickle & Roe-Sepowitz, 2010). When juveniles engage in both non-suicidal self-harm and fire setting, they have reported more suicide ideation and attempts compared to children only engaging in fire setting or only engaging in non-suicidal self-harm (Tanner et al., 2016). An other notable finding is that aggressive juvenile fire setters appear to experience more anxiety and had more depressive symptoms compared to aggressive youths not engaging in fire setting behaviour (Del Bove et al., 2008; Kolko & Kazdin, 1991b).

Juvenile fire setters appear to be much more likely to report delinquent behaviour, including activities such as stealing, shoplifting, and lying, compared to non-fire setters (Del Bove et al., 2008; MacKay et al., 2009). Moreover, many adolescent fire setters have a previous criminal record (Bailey et al., 2001; Santtila et al., 2003), involving offenses such as theft, burglary, vandalism, stealing cars (Santtila et al., 2003), and driving drunk (Rasanen et al., 1995).

Alcohol and/or drug use have also been correlated with fire setting among adolescents (MacKay et al., 2009). Additionally, it has also been observed that alcohol dependency is prevalent among adolescents engaging in fire setting (Repo & Virkkunen, 1997; Moore et al., 1996). Moreover, some studies have reported a high prevalence of adolescents being under the influence of alcohol during the act of fire setting (Rasanen et al., 1995; Uhnoo, 2016).

Fire setting among juveniles seems to be correlated with serious antisocial behaviour (Martin et al., 2004; Kolko et al., 2001), high impulsivity (Sakheim & Osborn, 1999) and high risk

taking (Martin et al., 2004). Furthermore, when compared with non-fire setters, fire setters appear to express more aggression (Kolko & Kazdin, 1991a; Stickle & Blechman, 2002). Features such as bad moods, having a temper, and being easily upset seem to be representative for many juvenile fire setters (Hickle & Roe-Sepowitz, 2010). Additionally, there have been findings that fire setters perceive themselves as more aggressive and engage in more aggressive behaviours than their parents think (Del Bove et al., 2008).

Cruelty towards other children or animals have also been found to be more prevalent among juvenile fire setters compared to their non-fire setting peers (Moore et al., 1996). Fire setters who demonstrate cruelty to animals or other children also seems to be more likely to engage in more severe fire setting behaviour (Slavkin, 2001; Sakheim & Osborn, 1999).

Many juvenile fire setters appear to struggle with making or maintaining friends (Tanner et al., 2015; Kaufman et al., 1961). Additionally, juveniles engaging in fire setting appears to experience more serious arguments or fights with friends (Tanner et al., 2016) and have less social competence compared to non-fire setters (Kolko et al., 1985). Poor social anticipation was also found to be more prevalent in a group of severe fire setters compared to minor fire setters (Sakheim et al., 1991). Additionally, when comparing juvenile fire setters with aggressive children, fire setters reported having more social problems and withdrawn behaviour (Del Bove et al., 2008).

3.2.4.4 Fire specific factors

Underage fire setters appear to have a greater interest in fire compared to non-fire setters (Kolko & Kazdin, 1989). Additionally, when comparing severe (persistent and deliberate behaviour) and minor fire setters (accidental, curiosity or playing), severe fire setters tend to have a greater interest and attraction to fire (Sakheim & Osborn, 1999). Moreover, juvenile fire setters tend to think more about fires (Watt et al., 2015) and have greater knowledge of what types of things can burn compared to non-fire setters (Kolko & Kazdin, 1992). However there are studies that have not found any group differences when fire interest is compared between fire setters and non-fire setters (Hoerold & Tranah, 2014).

Furthermore, juvenile fire setters compared to non-fire setters tend to participate more in fire play and match-play (Sakheim & Osborn, 1999), as well as other fire related activities such as pulling fire alarms (Kolko & Kazdin, 1992). Juvenile fire setter also seem to be more likely to carry lighters or matches compared to their non-fire setting peers (Hoerold & Tranah, 2014). In a study with 268 juveniles aged 6 to 13, it was found that match play was a predictor for fire setting at a 2-year follow-up (Kolko et al., 2001). Another interesting find was in a study involving 770 individuals aged 6 to 14, where it was found that children who reported playing with fire had higher exposure to activities in the home that involved fire (Grolnick et al., 1990).

3.2.5 Peer fire setting

Juvenile fire setting is often characterized by the involvement of multiple offenders and peer influence is a common factor (Santtila et al., 2003). Peer fire setting appears to be more common among juvenile fire setters compared to adult fire setters (Santtila et al., 2003). Several of the reviewed studies suggest that over half of juvenile fire setters have engaged in peer fire setting (Ellithy et al., 2022; Roe-Sepowitz & Hickle, 2011; Hickle & Roe-Sepowitz, 2010; Henderson & MacKay, 2009; Santtila et al., 2003; Bailey et al., 2001; Kolko & Kazdin, 1994). In some cases, reports suggest prevalence rates of peer fire setting among juvenile fire setters as high as 70% or 80%. For instance, in a study examining 66 fire setting events where the offenders were between ages 6 to 17, it was found that 71% of the cases involved more than one offender (Santtila et al., 2003). In another study, examining 45 juveniles aged 8 to 17 enrolled in a fire setting treatment program, 79% reported being involved in fire setting events in the company of others (Henderson & MacKay, 2009).

When examining 60 cases of juvenile group fire setting it was found that the offenders often were friends who socialized frequently with each other (Uhnoo, 2016). Furthermore, it was common with alcohol and drug consumption within the sample and 40% were under the influence of alcohol or drugs during the fire setting event (Uhnoo, 2016). Another finding in the study was that juveniles could need support from the group in form of encouragement or persuasion to be able to engage in the fire setting act (Uhnoo, 2016). The study also highlighted instances where the person with the least power in the group started the fire. It's worth noting, however, that none of the other reviewed articles solely examined peer fire setting, making it challenging to draw general conclusions on the topic due to a lack of research.

There seem to be a common perception among adolescents that fire setting is a group activity and engaging in fire setting alone is viewed as something weird or strange (Lilja, 2020; Reilly & Johnson, 2016). A Swedish report, which involved 32 individuals aged 14 to 15 in a community sample, showed a consensus among the juveniles that fire setting is a group activity (Lilja, 2020). The participants expressed that if someone were to engage in fire setting alone, it would be perceived as strange and unsupported (Lilja, 2020). Similar findings emerged in another report involving three 16-year-old males who had all engaged in fire setting behaviour. These individuals highlighted the social aspect as a core function of fire setting, emphasizing that fire setting without a peer involved was not socially supported (Reilly & Johnson, 2016).

When exploring the prevalence of peer fire setting across different age categories, limited research exists, and the available studies show different results. In one study it was reported that it was more common for children under age 11 to be involved in peer fire setting compared to those over the age of 11 (Jacobson, 1985). In contrast, another study found that peer fire setting was more common among children over the age of 10 (Stewart & Culver, 1982). A more recent article, involving 57 young children aged 2 to 6 enrolled in a fire setting treatment program, found that 72% of the children had been involved in peer fire setting.

Furthermore, the same study revealed that children with a higher frequency of fire setting incidents were more likely to have a companion during these events (Ellithy et al., 2022).

4 Discussion

Juvenile fire setting behaviour appears to be linked to aspects such as family instability, abuse, school problems, several mental health diagnoses, cruelty, aggressivity, substance use and high fire interest. However, the factors are observed on a group level, and it is important to understand that not all individuals engaging in fire setting behaviour have all the identified risk factors. Many of the reviewed studies lack a comparison group, making it challenging to analyse the study's result. It can be determined whether there is a high or low prevalence of certain factors, but information on how high it is compared to other groups is not available in those studies. A comparison group can, for example, be used to analyse behaviours among fire setters and non-fire setters and help identify what can be consider as a normal behaviour. Furthermore, a comparison group can examine the risk factors that distinguish the fire setting group.

Some of the reviewed studies only have one source of information. For example, they rely only on information from either the parent/guardian or solely from the child. In contrast, some studies combine multiple sources of information. Parents/guardians and the child might have different views and perspectives, leading to a more complete picture if multiple sources are used rather than relying on one. Furthermore, information from the parent/guardian can provide better insight into, for example, family dynamic and the child's early years. However, parents might not be fully aware of their child's behaviour which can result in a lower prevalence rate of fire setters within a sample if only parents/guardians are questioned. Other methods, such as examining case files, would likely benefit of using multiple sources of information, such as combining case files and interviews with the juveniles. However, this could be difficult and time consuming to accomplish.

Furthermore, many of the articles included in the review focus on relatively small samples of individuals, with 73% of the studies examining less than 400 participants. Several of the reports with a low number of participants, ranging from 3 to 138 individuals, acknowledge this as a limitation and express concern about its potential impact on the generalizability of the results. However, larger samples do not necessarily guarantee better results as bigger samples might lead to less information are collected per participant. The sample size should depend on what is examined. Larger sample sizes are probably beneficial when examining prevalence of fire setting behaviour. However, a smaller sample size gives the researcher an opportunity to do a more detailed examination.

Given the limited amount of relevant scientific studies on juvenile fire setting behaviour, a decision was made to not set time constraints when selecting studies for inclusion. As a result, articles published between 1961 and 2023 were included in the review. However, it could be questioned whether it is relevant to include studies from the 60s or 70s. For example, many countries have undergone significant changes in perspectives on factors such as family dynamics and the discipline of children since the 60s. However, the aim of this review was to give an overview of the current knowledge on the subject. Therefore, no exclusion criteria based on publication time was set to include more relevant articles. It could have been interesting to examine how the focus has shifted over the years, for example if earlier studies

concentrated more on psychological aspects compared to modern research. However, this type of analysis was not conducted due to time constraints.

Biases may have affected the responses in the reviewed studies, as acknowledged in several studies as a potential limitation. These biases can include individuals hesitating to categorize themselves or their children as fire setters and potentially lead to lower prevalence rates. Conversely, if fire setting is perceived as something appealing among juveniles, it can also lead to juveniles wanting to be classified as fire setters. Potentially leading to inaccurate results. Moreover, there is a possibility that the samples are not representative of the general group of juvenile fire setters. For instance, if only more severe cases of juvenile fire setting are examined, it may create the impression that certain motives or risk factors are more likely than they actually are. The phrasing of questions is another factor that can be challenging. For example, a broad statement like "I have set fires" may give positive responses from both children who have lit camping fires or candles, as well as those who have set fires to furniture or buildings.

Juvenile fire setting appears to have a relatively high prevalence rate, as indicated by the reviewed articles. Prevalence rates, within specific samples, also tend to increase with the age of the child. Moreover, there appears to be more boys engaging in fire setting behaviour compared to girls. However, it is worth noting that many fire incidents, especially small incidents, may not require the involvement of fire services. This challenges the assessment of prevalences through traditional means, such as conviction rates or fire service statistics and highlights the importance of scientific research in providing a more nuanced understanding of the subject. However, it can be challenging to compare different studies because they measure different aspects and classify fire setting differently. For instance, some studies require incidents to have occurred within a specific period such as within the previous 12 months. Moreover, there are differences in what is considered as fire setting behaviour. Some studies include actions like lighting paper or playing with matches, while other restrict it to more significant acts such as igniting furniture. Standardizing methods of measuring fire setting behaviour would be beneficial and make it easier to compare the results of different studies.

A common approach when classifying juvenile fire setters is to categorize individuals based on motive. Articles using this strategy typically examine the latest or most severe fire setting incident and examine the motive behind it, while some researchers attempt to identify a more general motive for the child's fire setting behaviour. It is important to note, however, that there is uncertainty regarding whether all articles use the same terminology consistently. Additionally, many studies lack detailed explanations of the various terms that they use, potentially making it difficult to compare studies.

The motive of curiosity is the most common in the reviewed studies, often assigned a separate category. Curiosity may appear insignificant, but studies suggest a noteworthy connection between high levels of curiosity in fires and more frequent and/or severe fires (Kolko & Kazdin, 1991; MacKay et al., 2006). Additionally, there are indications that many juveniles have problems with determining the effects that a fire can have (Perks et al., 2023; Henderson & MacKay, 2009; Grolnick et al., 1990). An example of this is in a study with a community

sample of 770 juveniles aged 6 to 14, where the results revealed that 55% of primary students, 66% of elementary students, and 80% of junior high school students believed that one match had the potential to burn down a house (Grolnick et al., 1990). A combination of a high fire curiosity and a poor risk perception may potentially lead to large fires, as a child playing with fire may not fully understand the potential effects of their behaviour.

An other challenge when examining the diverse motives that juveniles may have for engaging in fire setting is that an individual can have different motives for different acts of fire setting, as acknowledged by Watt et al. (2015). Additionally, individuals can have multiple motives for a fire setting act which is a factor that several of the reviewed studies fail to consider. Furthermore, there may be biases in categorization, with researchers often personally categorising juveniles into different groups.

Many of the identified risks in juvenile fire setters are similar to those found for other children showing problematic behaviour (Stickle & Blechman, 2002). What appears to be the key risk factors associated with juvenile fire setting behaviour and mentioned in 20 or more of the reviewed articles include an unstable family or living situation, experiences of abuse and/or neglect, challenges in school, and depression, anxiety, self-harm and/or suicidal ideations or attempts. It is crucial to recognize that these risk factors are identified within specific samples and that not every juvenile fire setter have these risk factors. Therefore, it is important to individually assess each case in a treatment or intervention setting. Identifying common risk factors associated with juvenile fire setting could also help to provide a better understanding of the complexity of the behaviour. However, studies examining risk factors often overlook the potentially coexistence of multiple risk factors and how they can impact fire setting behaviour among juveniles. For instance, individuals facing both an unstable family situation and have a history of abuse may have a higher likelihood of engaging in fire setting compared to those that only have one risk factor.

4.1 Future research

To easier compare prevalence rates of fire setting among different samples it would be beneficial to develop a standardized method for measuring this behaviour. Furthermore, conducting more longitudinal studies to explore juvenile fire setting behaviour over longer periods could provide valuable knowledge. Although there are a few such studies within the reviewed literature, with the latest dating back to 2001, the available research is limited. Moreover, juvenile fire setting appears to often involve multiple offenders. However, few studies directly investigate how peer fire setting is characterized and how group influence or group pressure impacts individual behaviour. Additionally, exploring factors such as how peer fire setting differs among age categories and among genders would be interesting areas for future research.

The reviewed studies have mostly been focused on boys' behaviour, since more boys compared to girls are involved in fire setting. However, the available evidence suggests that the behaviour differ among boys and girls, highlighting the importance to conduct more gender specific research in this field.

An area that has not been explored in the reviewed studies is comparing juvenile fire setting within different community contexts or different geographic areas. For example, exploring potential differences between rural and urban areas or across different countries. There are indications that many juvenile fire setters come from low-income households, suggesting a need for closer examination of socioeconomic factors and its impact on this behaviour.

Examining co-occurrent motives and/or risk factors for juvenile fire setting behaviour is another area that could be interesting to examine further. Additionally, investigating the influence of different types of external factors such as media influence or cultural norms could contribute to valuable insight.

4.2 Biases and potential sources of error

This review is not without limitations, biases, and potential sources of error. Firstly, a limited set of 71 articles was included in the review and a more complete picture of the subject could have emerged if more studies were analysed. Moreover, it is possible that keywords were missed during searches, potentially leading to relevant studies being overlooked. Biases may have occurred during the selection process where a single person decided whether the inclusion and exclusion criteria were met. Additionally, the decision to only include studies in English led to the exclusion of relevant studies in other languages. This could potentially have limited the scope of the review and geographic spread of the included studies. Additionally, coding errors are possible, given that the process was conducted by a single person. Finally, personal biases might have influenced the results. For example, it is possible that the exclusion criteria and the results chosen to be presented was influenced by personal interests. These limitations should be considered when interpreting the results and conclusions of the review.

5 Conclusions

In summary, juvenile fire setters seems to be a very diverse group with a wide range of motives and risk factors. Determining the prevalence of juvenile fire setting behaviour by analysing results from different studies proved challenging due to, for instance, varied research methodologies. The prevalence rates of fire setting behaviour within community samples ranged from 4.6% to 37.5% when analysing six different studies.

The motives driving juvenile fire setting are diverse, including motives such as curiosity, revenge, peer influence, boredom, anger, and psychiatric problems. This highlights the complexity of understanding and addressing the problem. It is crucial to recognize that the motives may not always reflect the severity of the fire setting behaviour. Additionally, there is a possibility that there are multiple motives for a fire setting act, something that is not looked at in most studies.

Juvenile fire setting often involves multiple offenders and there are indications that it is more common for juvenile fire setters to engage in peer fire setting than it is for adult fire setter. Boys are more commonly involved in fire setting acts compared to girls. Gender differences in motives and behaviour patterns have been noted in the reviewed studies. Beyond gender differences, older children tend to engage more in fire setting behaviour. Additionally, factors such as low socioeconomic status, family dysfunction, having experienced abuse or neglect, difficulties making or keeping friends, challenges in school, various mental health diagnoses, cruelty, delinquent behaviour, previous criminal record, substance use, and anti-social behaviour appears to be risk factors correlating with juvenile fire setting behaviour. Heightened fire interest and engagement in fire related activities such as pulling fire alarms or carry lighters are also identified as risk factors. Additional research can be essential to provide a more informed understanding and to develop prevention and intervention strategies. Recommendations of future research include standardizing prevalence measurements, conducting more longitudinal studies, exploring geographic variances, examining co-occurring risk factors and motives, analysing influences of external factors, and further exploring gender and age differences.

6 References

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Appendices

Appendix 1 – Search strings

Scopus (702 results) search date 2023-10-09:

(TITLE-ABS-KEY (arson OR firesett* OR "fire sett*" OR fire-sett* OR pyromania* OR fireplay OR "sett fire*" OR "light fire" OR "fire interest" OR "fire light*") AND TITLE-ABS-KEY (underage OR youth OR adolescent OR child* OR juvenile* OR minor* OR "young adult*" OR teenage*))

Web of science (378 results) search date 2023-10-09:

ALL= ((arson OR firesett* OR "fire sett*" OR fire-sett* OR pyromania* OR fireplay OR "sett fire*" OR "light fire" OR "fire interest" OR "fire light*") AND (underage OR youth OR adolescent OR child* OR juvenile* OR minor* OR "young adult*" OR teenage*))

PubMed (369 results) search date 2023-10-09:

(arson OR firesett* OR "fire sett*" OR fire-sett* OR pyromania* OR fireplay OR "sett fire*" OR "light fire" OR "fire interest" OR "fire light*") AND (underage OR youth OR adolescent OR child* OR juvenile* OR minor* OR "young adult*" OR teenage*)

Appendix 2 – Information extraction template

Information of the report	
Author(s)	
Title	
Year of the report	
Country or countries of study population	
Date and duration of the study	
What method(s) was used?	
Population under consideration	
Who answered the questions?	
Number of participants	
Categorization of participants	
Percentage engaging in fire setting behaviour	
Sampling	
Recruitment	
Age group	
Gender	
Comorbidity	
Risk factors	
Family situation	
School situation	
Peer fire setting	
Experienced abuse and/or neglect	
Suicidal, self-harm, anxiety, depression	
Other (aggression, anti-social behaviour, animal cruelty, substance misuse etc.)	
Socio-economic status (target population)	
Community context	
Aim and results	
What was the purpose/aim of the study?	
What was the classification of fire setting behaviour?	
How was fire setting behaviour identified?	
Main findings of the study	
Self-reported study limitations and biases	

Appendix 3 – Dataset of extracted information

An Excel file containing the extracted information from the 71 reviewed studies can be accessed through the following link:

https://zenodo.org/doi/10.5281/zenodo.10600911