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Prevalence and risk factors of firesetting behaviour

A TRAILS study

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Abstract

Firesetting is a serious problem behaviour, accounting for both property and physical damage. It appears to be a particular problem in adolescence, with half of the arson offences being conducted by juveniles. The aim of this study was to investigate the prevalence and determine risk factors of adolescent firesetting behaviour. Risk factors that had already been present since early adolescence were used as predictors for firesetting later on and Agnew's General Strain Theory and Gottfredson's and Hirschi's Self-Control Theory framed this study, as both had yet to be used to investigate firesetting behaviour.

The study sample derived from the TRAILS (TRacking Adolescents' Individual Lives Survey) study. TRAILS is an ongoing longitudinal study of the social, psychological and physical development of Dutch adolescents. As an addition to the population cohort, a clinical cohort was added to include more people with psychopathological symptoms. The longitudinal data and combination of a population and clinical cohort made this study a valuable contribution to theory building.

To capture firesetting behaviour across assessments, a firesetting chronicity scale was computed. Using three categories, we distinguished between adolescents that had never reported to have set fires during four waves of TRAILS, adolescents that had reported to have set fires during one wave and adolescents that had reported to have set fires during two or more waves, deeming them the chronic firesetters.

We found significant effects for divorce of biological parents and number of children on one-time firesetting in the clinical cohort and chronic firesetting in the population cohort. Internalizing problem behaviour also predicted one-time firesetting in the clinical cohort. Overall, little support was found for risk factors, likely caused by firesetting more often being an expression of curiosity and innocent fire play, as opposed to expected underlying problem behaviour. With the prevalence of firesetting in this study being low, suggestions for future research are to extend research on firesetting behaviour in population samples and distinguish clearly between fire play out of curiosity and firesetting as a problem behaviour.

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Introduction

Firesetting is a serious delinquent behaviour. In 2013 in The Netherlands, 35,447 fires were registered and every year, firesetting accounts for millions of Euros of damage, many wounded and occasionally the loss of lives (Centraal Bureau voor de Statistiek, 2014). Even though the overall prevalence of firesetting in the regular population is not very high compared to other types of crime, of all arson offences in the US, UK and New Zealand, 40-55% are reported to be fires set by juveniles (Arson Prevention Bureau; Puzzanchera, Adams & Kang; Statistic New Zealand, as cited in Lambie, Ioane, Randell & Seymour, 2013). It is remarkable that, considering the severity, the construct of firesetting behaviour and the underlying possible risk factors have not been as thoroughly investigated as other types of delinquent behaviour.

Even though previous literature on firesetting is not voluminous, support for a strong gender effect associated with firesetting is usually found, with males engaging more often in firesetting behaviour than females (Chen, Arria & Anthony, 2003; Del Bove, Caprara, Pastorelli & Paciello, 2008; Lambie et al., 2013; MacKay et al., 2006; MacKay, Paglia-Boak, Henderson, Marton & Adlaf, 2009), as well as adolescent firesetting behaviour being predicted by various factors already present during (early) childhood (MacKay et al., 2006; MacKay et al., 2009). Moreover, the limitations of previous research are often similar as well. Most studies use cross-sectional data from clinical samples, which makes it difficult to state conclusion over a longer period of time as well as generalizing the results to a broader population.

The sample used in this study originated from the TRAILS (TRacking Adolescents' Individual Lives Survey) study. This is a longitudinal, multidisciplinary research, which started in 2001. In 2004, TRAILS Clinical Cohort was added to complement the population cohort of TRAILS with respondents that had attended a psychiatric outpatient clinic. For studying risk factors of deviant behaviour, the TRAILS data is unique and can be of high importance, due to its longitudinal nature, the fact that it contains both a clinical and population cohort and that multiple sources were used for gathering

information; self-reports, parental reports and teacher reports and even peer and sibling reports in the earliest assessments.

This study aimed to investigate the prevalence of firesetting behaviour during adolescence and examine risk factors hypothesized to be associated with firesetting, as well as general deviant behaviour. Firesetting has yet to be studied in the light of criminological theories, which is why two general theories of crime, Agnew's General Strain Theory (1992) and Gottfredson's and Hirschi's Self-Control Theory (1990) frame this study. All in all, there is little research on the topic of firesetting, which makes this thesis an important contribution to existing knowledge on firesetting behaviour and expanding the empirical support of recognized theories.

Theoretical background

This study used two general theories of crime as the theoretical framework for explaining firesetting behaviour: the Self-Control Theory (Gottfredson & Hirschi, 1990) and the General Strain Theory (Agnew, 1992). These two theories were chosen because they complement each other in focussing on both individual and social explanations of criminal activity. Also, they are extensively tested and highly recognized, as well as supported by voluminous empirical evidence.

First, a description of Self-Control Theory (Gottfredson & Hirschi, 1990) is given. Second, General Strain Theory (Agnew, 1992) will be described. After each theoretical explanation, the firesetting risk factors considered to be related to self-control and strain are discussed. Last, there are some remaining risk factors, not relating to the two theories, but still worth mentioning because in the past they have been identified as significant risk factors for both delinquency in general and firesetting.

Self-Control Theory

Self-control is the ability to control one's emotions, behaviour and desires while being faced with external demands in order to function properly in society. By being able to control oneself, an individual is able to control their impulses which makes one able to delay short-term gratification in favour of long-term outcomes. Moreover, individuals with high self-control take into consideration the

long-term consequences of their behaviour as opposed to those with low self-control. Self-control is usually learned before the age of eight, through being properly parented, and once learned this behaviour highly unlikely to change (Gottfredson & Hirschi, 1990).

Low self-control can present itself in multiple ways. First, Gottfredson and Hirschi (1990) described how self-control develops during childhood and becomes a stable characteristic of a person. The second is the Criminal Spin Theory (Ronel, 2011) that describes the reduce self-control to occur in two ways: first, as an acute, one-time only event which is out of character for the individual, then as a chronic state where eventually criminal activities become a vital part of the individual's everyday life.

Moffit et al. (2011) call the Self-Control Theory "an umbrella construct that bridges concepts and measurements from different disciplines" (p. 2693). In their study, they present a summary of how various fields of science have used Self-Control Theory in their research. For example, neuroscientists found brain structures and systems in the frontal cortex of participants that exert self-control (Hare, Camerer & Rangel, 2009), behavioural geneticists examined self-control as having both a genetic and environmental cause (Bouchard, 2004), psychologists have uncovered population patterns of self-control during lifetime and described how children can learn it (Kochanska, Coy & Murray, 2001; Mischel, Shoda & Rodriguez, 1989; Jackson et al., 2009) and sociologists found links between self-control and unemployment and criminality (Caspi et al., 1998; Gottfredson & Hirschi, 1990). Moffit et al. (2011) themselves investigated twin children from the Dunedin birth cohort and found significant outcomes of low self-control for various factors, including more health problems, higher substance dependence, lower incomes, more single parenthood and more criminal convictions.

Other studies that thoroughly examined the effects of individual self-control during childhood and adolescence are the Stanford marshmallow experiment (Mischel, Ebbesen & Raskoff Zeis, 1972) and several follow-up studies (Ayduk et al., 2000; Mischel et al., 1989; Schlam et al., 2013; Shoda, Mischel & Peak, 1990). During the first test, children were offered a marshmallow or another small reward, with the option to double their reward if the first reward remained untouched as the researcher left the room. The children who showed higher levels of self-control, thus did not touch the first reward

and earned a second one, showed various better life outcomes in the follow-up studies during adolescence and adulthood, such as higher SAT scores (Mischel et al., 1989) and better abilities to cope with stress and frustration (Shoda et al., 1990).

When a lack of self-control has an effect on one's ability to control impulses and immediate gratification is sought by these individuals, it is possible that they will turn to delinquency because the threshold to it is lower for them (Gottfredson & Hirschi, 1990). Long term goals and the gratification that comes with achieving these goals are usually accomplished by hard work and not immediately receiving the results. If for example achieving financial success is the someone's goal, the long term plan of action could be working hard in a regular job and climbing the ladder of success. But if there is little self-control, gratification is wanted immediately, and one is not able to properly foresee the consequences of one's actions, this person could turn to delinquent means such as theft and robbery to get rich in a faster way.

Various empirical studies and meta-analyses have confirmed that having low levels of self-control is one the strongest predictors of delinquent behaviour (Pratt & Cullen, 2000; Vazsonyi & Belliston, 2007). The establishment of the Self-Control Theory being a general theory of crime, comes from Gottfredson & Hirschi themselves. In their book, A General Theory of Crime (1990), they claim that low self-control is a single mechanism that would account for "all crime, at all times"; varying from vandalism to homicide and rape to white collar crime (p. 117).

Thus far Self-Control Theory has been used to investigate violence (Longshore, Turner Rand & Stein, 1996; LaGrange & Silverman, 1999), substance and alcohol abuse (Moffitt et al., 2011; Tangney, Baumeister & Boone, 2004), property offenses (LaGrange & Silverman, 1999), intimate violence (Sellers, 1999), and even internet crime (Hinduja, 2006) successfully. In most empirical studies that aimed to test the Self-Control Theory, crime or delinquency is examined in general, in contrast to a specific type (Baron, 2003; Evans et al., 1997). The Self-Control Theory too has yet to be used as a framework to investigate firesetting behaviour. It remains unclear if this model is the right theoretical model to explain firesetting behaviour, which makes this study a valuable contribution to the empirical

evidence of Gottfredson & Hirschi's theory. If it is indeed a general theory like they claim, Self-Control Theory should explain firesetting.

Risk factors related to self-control

Gender differences in self-control are noticeable from early childhood until adolescence and through adulthood (Moffitt et al., 2011). An explanation for gender differences in delinquent behaviour could thus be a difference in levels of self-control and with low self-control being linked to delinquency, this could be the reason why males more often commit crimes than females (Bennet & Farrington, 2005). The question then arises if this effect also applies to firesetting, assumedly that men set fires more often than women. Another reason why boys could be drawn to fire more than girls is because girls could be less interested in fire and possibly more afraid of it (Block, Block & Folkman, 1976). Previous literature also supports the presence of a gender effect in firesetting behaviour, where males are often described to set significantly more fires than females (Chen et al., 2003; Dadds & Fraser, 2006; Del Bove et al., 2008; Kolko & Kazdin, 1991; Lambie et al., 2013; MacKay et al., 2006; MacKay et al., 2009; MacKay, Feldberg, Ward & Marton, 2012; Martin, Bergen, Richardson, Roeger & Allison, 2004; Santilla, Häkkänen, Alison & Whyte, 2010; Strachan, 1981). Theoretical assumptions and previous empirical findings lead to the first hypothesis to be tested in the present study:

H_1: Firesetting is more common in male than female individuals.

Internalizing problem behaviour covers multiple traits, including withdrawn behaviour, anxiety, depression, and somatic complaints (Chen et al., 2003; Del Bove et al., 2008). Moffitt et al. (2010) described individuals with low self-control to have an increased risk on several health problems, including mental health problems. Because internalizing problem behaviour covers mental health problems such as depression and anxiety in this study, individuals showing these behaviours might engage in delinquency and firesetting because internalizing problem behaviour probably co-occurs with lower levels of self-control and the negative effects related to low self-control. Internalizing problem behaviour and firesetting could both be symptoms of the same underlying characteristic: low self-

control, as low self-control is linked to internalizing problem behaviour as well as delinquency.

In this study, internalizing problem behaviour refers to shyness, anxiety, sadness, and depression. In relation to firesetting, previous literature supports both shyness (Chen et al. 2003; Del Bove et al., 2008) and anxiety (Del Bove et al., 2008; Hoertel, Schuster, LeStrat & Limosin, 2011), as well as sadness and depression (Dadds & Fraser, 2006; Del Bove et al., 2008; Pollinger, Samuels & Stadolnik, 2005; Moore, Thompson-Pope & Whited, 1996).

Shyness was also a prominent factor in the Woodlawn project research. The results found in a community sample by various researchers show that the combination of shy and aggressive behaviour during childhood leaves children at an increased risk of delinquent behaviour in adolescence (Ensminger, Kellam & Rubin, 1983; Kellam, Branch, Agrawal & Ensminger, 1975; Kellam, Brown & Fleming, 1982; Kellam, Brown & Rubin, 1982). From there it is plausible to hypothesize firesetting as correlate of shyness, because it may be one expression of delinquent behaviour (Chen et al., 2003), as well as examining whether shyness alone also has an effect on delinquency and, in this study specifically, firesetting.

Another reason why internalizing problem behaviour might function as a risk factor for firesetting is because individuals with mental health problems often set more fires than individuals without mental health problems (Becker et al., 2004; Devapriam, Raju, Singh, Collacott & Bhaumik, 2007; Kolko & Kazdin, 1986). Firesetting behaviour could also show more in children with internalizing problem behaviour because it might be a cry for help or attention, because of loneliness and a feeling of worthlessness (Devapriam et al., 2007) or maybe even out of suicidal motives (Canter & Fritzon, 1998; O'Donoghue et al., 1998), by means of self-immolation.

Chen et al. (2003) were the first to investigate whether shyness and anxious behaviour influenced firesetting in childhood and adolescence. Even though they did not find a significant effect in their research, they themselves state that eliminating the shortcomings of their research, which are only using clinical and cross-sectional data, could reveal stronger associations in the future. Therefore it is of importance to investigate the effect of shyness, anxiousness, depression and other internalizing problem

behaviour further, which is why the second hypothesis is:

H_2: Firesetting is more common in individuals who show internalizing problem behaviour.

Lower levels of self-control are related to the various facets of externalizing problem behaviour in multiple ways. First, individuals with lower self-control are more often angry and aggressive because they struggle with controlling their emotions (Tangney et al., 2004). This could make them lash out faster compared to individuals with higher levels of self-control, who are able to properly cope with situations where they experience anger or aggression. Second, individuals that show lower levels of self-control usually seek out immediate gratification and fulfilment of their needs and desires. For this, delinquency might be a useful strategy, referring to the example previously given, of gaining money faster through robbery compared to working hard for a salary. In previous literature, individuals with lower self-control have been shown to present with more signs of deviant behaviour (Gottfredson & Hirschi, 1990).

In this study, externalizing problem behaviour covers aggressiveness, anger, delinquency, problem behaviour, and conduct problems. Previous literature has found support for associations between firesetting and aggressiveness and anger (Chen et al. 2003; Hickle & Roe-Sepowitz, 2010; Kolko & Kazdin, 1991; Pollinger et al., 2005; Sakheim & Osborn, 1999), delinquency (Del Bove et al., 2008; Hoertel et al., 2011; MacKay et al., 2009; MacKay et al., 2012; McCarty & McMahon, 2005; Santilla et al., 2010), and conduct problems (Hoertel et al., 2011; Jacobson, 1985; Moore et al., 1996).

Externalizing problem behaviour increases the risk of firesetting behaviour, because externalizing problem behaviour and delinquent behaviour such as firesetting are probably both symptoms of low self-control (Gottfredson & Hirschi, 1990; Moffitt et al., 2011). Therefore, there is a high chance that they are related. Individuals who set fires usually show a history of problem behaviour and severe antisocial behaviour (Becker et al., 2004; Kolko & Kazdin, 1991; MacKay et al., 2006; Martin et al., 2004; Sakheim & Osborn, 1999). Moreover, a history of behavioural problems in early childhood also indicates firesetting behaviour in adolescence (Simpson & Hogg, 2001), as well as the fact that it is known that problem behaviour in early life and childhood is a strong predictor for repeated

problem behaviour in later life (Del Bove et al., 2008; Hoertel et al., 2011; MacKay et al., 2009; MacKay et al., 2012; Santilla et al., 2010). According to Martin et al. (2004) firesetting is a severe deviant act, usually preceded by other, smaller delinquent activities. Therefore it is likely that individuals who show externalizing problem behaviour have a higher chance of setting fires because they have shown other types of problem behaviour and smaller delinquent activities already in the past. Because of these previous findings, the third hypothesis to be tested is:

H_3: Firesetting is more common in individuals who show externalizing problem behaviour.

Self-control and specifically lower levels of self-control are also associated with hyperactivity. Hyperactivity is one of the most common behavioural problems in childhood, with Attention Deficit Hyperactive Disorder (ADHD) being one of the most diagnosed mental disorders worldwide (Hammerschlag et al., 2014), with an estimated prevalence of ~5% (Polanczyk, de Lima, Horta, Biederman & Rohde, 2007). ADHD, according to the DSM-IV, consists of three subtypes: predominantly inattentive, hyperactive-impulsive or combined (American Psychiatric Association, 2000). The first signs of hyperactivity usually show during childhood and persist into adolescence and adulthood (Chen & Taylor, 2013). Hyperactive behaviour is also associated with several types of problem behaviour, for example anger/aggression and criminal involvement (Hinshaw, Henker & Whalen, 1984; Babinski, Hartsough & Lambert, 1999), and several studies have supported the persistence of these behavioural, interpersonal and social problems into adolescence and adulthood (Hoy, Eiss, Minde & Cohen, 1978; Weiss, Hechtman, Perlman, Hopkins & Wener, 1979). According to Self-Control Theory, lower levels of self-control are associated with delinquent and impulsive behaviour (Gottfredson & Hirschi, 1990). Hyperactivity is also associated with impulsivity and acting without considering the full severity of the consequences of one's actions. Lower levels of self-control might result in elevated risk for various disorders presenting with unwanted or unruly behaviour, such as hyperactivity and impulsivity, as well as considering lower self-control as a result or part of those disorders (Strayhorn, as cited in Chen & Taylor, 2013). Hyperactivity might therefore also be a risk factor for delinquency and firesetting behaviour, because it is associated to lower self-control as either

the source or the outcome of it.

Firesetting is known as a generally impulsive act (Kolko & Kazdin, 1991; McCarty & McMahon, 2005; Sakheim & Osborn, 1999), it often occurs unplanned and unexpected. The act of firesetting is often performed without considering the risks and a hyperactive child might be at risk to give in to the urge to set a fire, as immediate gratification and satisfaction is sought by these children, since they are generally impulsive (American Psychiatric Association, 2000). As mentioned before, it is also possible that hyperactivity and firesetting are two symptoms of the same trait of low self-control. Other studies as well have found connections between firesetting and hyperactivity (Del Bove et al., 2008; Kafry, 1980; Kaufman, Heims & Reiser, 1961; Kuhnley, Hendren & Quinlan, 1982; McCarty & McMahon, 2005; Wooden & Berkey, 1984). Because of these previous results and theoretical relevance, the fourth hypothesis is:

H_4: Firesetting is more common in individuals who are hyperactive.

General Strain Theory

Strain is a negative affective state that is often the result of negative relationships, pressuring individuals into taking corrective action to alleviate the negative affect (Agnew, 1992). The General Strain Theory might play a role in explaining firesetting behaviour because corrective action as a response to strain caused by negative relations is usually performed through using illegitimate means to achieve goals, attack or escape from the source of strain and/or escaping the situation by substance abuse (Agnew, 1992). There have been various theories involving strain and delinquency. Strain was first mentioned by Robert Merton (1957) who created a framework that described how the society's structure may pressure individuals into delinquency. Society puts pressure on individuals by the establishment of socially accepted goals, for example the American Dream which describes how anyone who is willing to work hard would be able to achieve desired goals, and when individuals lack the means to reach this, this leads to strain (Merton, 1957). Crime or delinquent behaviour can then occur because one could feel like it is not possible to live up to society's expectations by legal means, but

those goals may be accessible through illegal ways.

According to Agnew, Merton's theory needed revision because it only focused on one type of negative relationships with others, namely others preventing the individual from achieving positively valued goals (Agnew, 1992). He then developed the General Strain Theory, where he described three types of strain which could lead to delinquent behaviour: (1) others prevent the individual from achieving positively valued goals, (2) others (threaten to) remove positively valued stimuli from the individual or (3) (threaten to) present the individual with negatively valued stimuli (Agnew, 1992). Using this strategy, General Strain Theory distinguishes itself from other general theories of crime, such as Social Control Theory (Gottfredson & Hirschi, 1990) and Social Learning Theory (Bandura, 1971), as the General Strain Theory is the only one to explicitly focus on negative relationships with others and consider delinquency as a result of pressure rather than a desire or drift (Agnew, 1992).

According to Agnew (1992), different types of strain lead to different emotions, which in turn lead to different responses. Strain increases the likelihood of an individual reacting with negative emotions, such as disappointment, anger, despair, depression, aggression or fear. Through these negative emotions, individuals could resort to delinquency to achieve their positively valued goals in illegal ways, try to prevent, retrieve or make up for the lost positively valued stimuli or seek revenge against others that took positive stimuli away or inflicted negative stimuli on the individual (Agnew, 1992).

In the past, the General Strain Theory has been used to investigate numerous types of delinquent behaviour, including violence (Warner & Fowler, 2003), theft, vandalism and truancy (Agnew, Brezina, Wright & Cullen, 2002). Therefore, it has been supported by vast empirical evidence and could be considered a general explanation for criminal behaviour. However, General Strain Theory has not yet been used to investigate firesetting behaviour. Until now it remains unclear if the General Strain Theory is the right theoretical model to explain firesetting in (pre)adolescence, but if General Strain Theory is indeed a general theory for crime, it should also be able to explain firesetting. Therefore, this study will

not only contribute to theory-building and knowledge on firesetting behaviour, but could also expand the empirical evidence for the General Strain Theory even further.

Risk factors related to strain

The General Strain Theory might be related to firesetting through a number of risk factors, specifically the ones related to the child's environment, contrary to the individual factors discussed before. Agnew (1992) argued that social support is of significant importance for adolescents, because it makes them more able to cope with strain in a non-delinquent way. Meanwhile, the impact of family stressors is greatest on young adolescents and negative relations with peers are an important stressor during adolescence (Compas & Phares, 1991). In this study, we divided environmental risk factors in family risk factors and peer risk factors.

Family risk factors. An important family risk factor for firesetting is parental rejection. As with other deviant behaviour, parental support is of key importance to the behaviour of children, adolescents and even adults. When children are rejected by their parents, this situation might be straining for them and result in negative emotions with which they need to cope (Agnew, 1992). When the coping goes wrong, children could react to the perceived strain with delinquent behaviour, in this case firesetting. Strain through rejection might give them a feeling of anger, frustration or abandonment (Dadds & Fraser, 2006; Kolko & Kazdin, 1990, Lambie et al., 2013; Sakheim & Osborn, 1999) which are, according to Agnew (1992), states of negative emotionality that make one vulnerable to delinquent behaviour.

Second, as well as more commonly seen in deviant behaviour, individuals report more firesetting in adolescence when being from a single parent home (Pollinger et al., 2005; Hickle & Roe-Sepowitz, 2010). Being from a single parent family, thus lacking a mother or father role model, might be perceived as straining for the child and thus result in negative emotions. When children are unable to cope with these emotions, this might result in a delinquent response (Agnew, 1992). Another explanation why children that grew up in single parent homes are at a higher risk for delinquency, is that they might

receive less parental supervision thus delinquent behaviours that would have been adjusted when there would have been two parents present, are now left uncorrected (Kolko & Kazdin, 1990; Sakheim & Osborn, 1999).

A third family risk factor that might induce strain and negative affect on the child could be the divorce of biological parents. The effects of divorce have been thoroughly studied in the past and previous literature shows several long term negative effects for the children involved, including adolescent delinquency (Amato, 2001; Amato & Keith, 1991; D'Onofrio et al., 2005). Divorce is often a stressful event and could be straining for the child because they might blame the remaining parent for the loss of the other parent and feel frustrated, angry and maybe even vengeful because of this. When they have problems to cope with these negative emotions, they could respond with delinquent behaviour, expressed through setting fires. The effects of having experienced divorce during childhood on firesetting behaviour have yet to be investigated. However, considering how divorce is often an underlying cause for adolescent problem behaviour, it is plausible that this also includes firesetting.

Having experienced a death in the family could also be a family risk factor for firesetting behaviour. Naturally, the death of a loved one is a severe traumatic experience for a child. The loss of a family member could be perceived as the loss of positively valued stimuli (Agnew, 1992) and to this loss a child might respond with delinquency when they are unable to properly cope with the negative emotions resulting from losing a family member. Previous research also supports that the death of a parent leaves children at risk for firesetting behaviour (Nurcombe, as cited in Chen, 2003). Therefore, it might be interesting to investigate the effects of having experienced a death in the family on firesetting further because this association has not been thoroughly researched in the past.

Being from a large family could feel straining and result in negative emotions for the child, with which they would need to cope, because among multiple other siblings, they could feel like they are left out or do not receive enough attention from their parents (Bobashev & Anthony; Gaynor, as cited in Chen et al., 2003). Delinquency could then be a cry for attention, a way to express needs or desires or rebellious behaviour, when the child cannot effectively cope with the straining situations they

experience when there are a large number of children in their family. Previous literature only describes how children from a larger family are at a higher risk for delinquency (Bobashev & Anthony; Gaynor, as cited in Chen et al., 2003). There is no previous literature that specifically associates being from a larger family with an elevated risk for firesetting, which makes this an interesting topic to study.

Other family risk factors influencing firesetting behaviour could be low parental socioeconomic status (SES) (Chen et al. 2003; Strachan, 1981) and parental unemployment (Strachan, 1981). These risk factors might contribute to the negative environment of the child by providing a lower SES for the child as well and possible lack of structure in daily life due to the unemployment. Low parental SES accounts for more problem behaviour in their children (Kalff et al., 2001). Being from a family where parents are unemployed and have an overall low SES could also apply strain on the child, to which a child might respond with delinquency when they are unable to effectively cope with the negative emotions resulting from the perceived strain, when the child is rejected by its environment for being from a lower class. This could happen when low family SES and unemployment results in poor living conditions for the child, which might put them on a lower status level than their peers and leave them vulnerable to bullying and rejection, as well as disabling chances other children with higher parental SES's and employed parents have. These could be opportunities for a better living environment, nicer clothes, and more toys. When being born into a lower SES family, it might be difficult for a child to excel in life. They could thus feel like they cannot live up to society's expectation of them nor achieve their goals and desires through hard work and then turn to delinquent measures (Agnew, 1992), including firesetting. They could also feel frustrated when they compare themselves to peers, which is a common motive for firesetting (Devapriam et al., 2007). Because of the theoretical importance of investigating family risk factors for firesetting further, the following hypotheses are:

H_{5a}: Firesetting is more common in individuals who are rejected by their parents.

H_{5b}: Firesetting is more common in individuals who have divorced parents.

H_{5c}: Firesetting is more common in individuals who are from a single parent family.

H_{5d}: Firesetting is more common in individuals who experienced a death in the family.

H_{5e}: Firesetting is more common in individuals who are from larger families.

H_{5f}: Firesetting is more common in individuals who are from a family with a low SES.

H_{5g}: Firesetting is more common in individuals who have unemployed parents.

Peer risk factors. The final environmental risk factor for firesetting behaviour is peer rejection. Peer rejection might be straining for children because by not having positive relations with peers and being disliked or victimized, a child could feel frustrated, angry, disappointed and sad – all negative emotions one needs to cope with and when a child cannot cope properly, they might respond to the source of their strain with delinquency (Agnew, 1992). When children experience their relations with their peers as strain, a possible response could be eliminating these ties. Agnew (1992) explained how one of the responses to strain, in this case peer rejection, is trying to terminate the negative stimuli. Moreover, while peer rejection could be a negative stimuli in itself, the rejection by one peer could have a chain effect through bullying, with the removal of even more positively valued ties to others. When peer rejection spreads through the child networks, the initial negative stimuli thus becomes one that also removes positively valued stimuli from the child.

Peer rejection and firesetting are thus far only investigated by Chen et al. (2003) but is a concept worth exploring because of all the negative consequences linked to peer rejection, such as delinquency and problem behaviour in late adolescence (Kretschmer, Sentse, Dijkstra & Veenstra, 2014). To expand empirical support for the association between peer rejection and firesetting, the sixth hypothesis is:

H_6: Firesetting is more common in individuals who are often rejected by their peers.

Other risk factors

The following risk factors have been found to predict delinquency and firesetting behaviour, without being explicitly discussed in the general theories, which is why it is interesting to investigate these as well in this study.

IQ. Specifically a lower IQ could be a risk factor for firesetting behaviour for several reasons. First, children could be stigmatised by their peers for their low IQ, leaving them hurt and frustrated. Devapriam et al. (2007) named a general feeling of frustration or even the need to feel like a hero as a

motivation for firesetting, reported by firesetters with intellectual disabilities.

People with lower IQ's are usually also more gullible and highly suggestible (Devapriam et al., 2007). They are more susceptible to peer pressure and therefore can be more easily persuaded by their peers to set fires. It is likely that they have experienced rejection by their peers before, as individuals with lower IQ's are more likely to be victims of bullying (Martlew & Hodson, 1991). Therefore, children might also be more likely to follow their peers in what they are doing or what they suggest, to avoid future bullying. These actions might include deviant behaviour and delinquency.

Lower IQ is also linked to showing more impulsive behaviour (Menting, van Lier, Koot, Pardini & Loeber, 2015). Fires could thus be set out of a thoughtless impulse, because at the time it seemed fun, interesting, others did it too and it could be a way to fit in with peers. Fire could play an important role in this because of its destructive nature; it makes more of a statement than vandalism or theft because of the severity and danger (Martin et al., 2004). In their desire to be seen as heroes or feel strong or important (Devapriam et al., 2007), children could consider fire the most interesting method because it will make them look more daring than other delinquent activities.

In earlier studies, samples of firesetters were restricted to people with lower IQ's, mental retardation and intellectual disabilities (Burton et al., 2012; Devapriam et al., 2007). It is considered that people with intellectual disabilities account for a higher prevalence of firesetters than the general population (Bradford & Dimmock, 1986; Räsänen, Hirvenoja, Hakko & Vä Isänen,1994; Walker & McCabe, 1973). Because of the theoretical significance of investigating IQ as a risk factor for firesetting, the seventh hypothesis in this study is:

H_7 Firesetting is more common in individuals with a lower IQ.

Social skills. Social skills deficits are associated with poor self-esteem in children (Percell, Berwick & Beigel, as cited in Michelson, Sugai, Wood & Kazdin, 2013), as well as bullying (Fox & Boulton, 2005) and mental health problems such as depression (Segrin, 2000), anxiety, and social phobia (Segrin & Flora, 2000; Spence, Donovan & Brechman-Toussaint, 1999). Communication is one of the most important skills and opportunities in life could be limited for one with poor

communicational abilities (Fox & Boulton, 2005). When an individual did not properly develop social skills, they might seek out other ways to communicate or resort to delinquency to achieve their goals. Previous research has shown that social skills programmes for children are effective to prevent delinquency in adolescence (Beelmann & Lösel, 2006), which means that if social skills remain uncorrected and deteriorate into a poor state, children are at risk for delinquent behaviour later in life.

Limitations in the ability to communicate needs, ask for help or the desire for attention could thus also pose a risk for firesetting (Del Bove et al., 2008; Heath, Hardesty, Goldfine & Walker, 1983; Kolko & Kazdin, 1988; Sakheim, Vigdor, Gordon & Helprin, 1985; Sakheim & Osborn,1986; Sakheim & Osborn, 1999). Social skills and firesetting have only recently been researched by Del Bove et al. in 2008 and are thus an interesting and under-studied topic. To enlarge the knowledge on social skills as a risk factor for firesetting behaviour, the final hypothesis of this study is:

H_8: Firesetting is more common in individuals with poorly developed social skills.

The present study extends the literature on firesetting risk factors and prevalence in adolescent firesetting behaviour in several ways. First, the use of the TRAILS study, a longitudinal study with 2773 respondents from both a population and clinical cohort, makes it possible to overcome the limitations often listen in previous literature; the use of cross-sectional data and studying only a clinical sample. Second, using a chronicity scale to investigate firesetting behaviour distinguished this study from most of the available literature on firesetting behaviour, because researchers were often limited by cross-sectional data to investigating firesetting behaviour as a one-time event or occurring over a short period of time. In this study, the use of longitudinal data created the possibility of combining firesetting items from every assessment into a chronicity scale of firesetting behaviour. This is important because using a chronicity scale makes it possible to investigate whether firesetting behaviour only occurs for a short period of time or is a repetitive behaviour causing problems throughout adolescence.

Methods

This study is based on the TRAILS (TRacking Adolescents' Individual Lives Survey) project. TRAILS is an ongoing Dutch longitudinal study, consisting of two cohorts: TRAILS and TRAILS Clinical Cohort. This study was primarily administered to investigate the social, psychological and physical development of Dutch pre-adolescents towards adolescence and adulthood (De Winter et al., 2005). The TRAILS study is a combination of multiple measuring methods, such as questionnaires, face-to-face structured interviews and biological, neurocognitive and social measurements, varying per assessments. The study gathers information from different sources, including self-reports from the participants as well as information from their parents, teachers and classmates (De Winter et al., 2005).

TRAILS (n = 2230; 50.8% female) started in 2001 with children who were 10 to 12 years old (M = 11.11) at the time, with the expectation to asses them until they are at least 24 years old. It now consists of five completed assessments, taken approximately every two years, and is currently conducting the sixth assessment.

Sample selection for the first wave consisted of two steps. First, five municipalities in the North of The Netherlands were selected and asked to give the names and address information of all inhabitants born between 10-01-1989 and 09-30-1990 (two municipalities) or 10-01-1990 and 09-30-1991 (three municipalities), which delivered a potential 3483 participants. Next, the primary schools within the chosen municipalities were asked to participate in the study. This meant access to students' lists, providing information about children's school performance and behaviour and allowing administration of questionnaires in the class and individual testing on neurocognitive, intelligence and physical levels. Of the 135 approached schools, 122 agreed to participate in TRAILS (De Winter et al., 2005).

Once schools agreed to participate, the participants and their families were approached through a brochure with information about the study and a visit at school by a TRAILS staff member. Around one week later, a TRAILS interviewer phoned the participants' family to answer questions, give additional information and ask whether or not the child would participate. To avoid refusal for temporary reasons,

if the parents did not agree, they were asked permission to be contacted again in two months. If parents agreed to let their child participate in the TRAILS study, they were scheduled for an interview and an informed consent form was signed. Exclusion of children occurred because of the restriction of mental retardation, a physical illness or a disability or because of the absence of a Dutch speaking parent or caretaker. From the 3145 children attending schools that agreed participation, 6,7% were excluded because of mental, physical or verbal limits, which resulted in a sample of 2935. Then, 76% of the remaining children were eventually enrolled in TRAILS, which resulted in a sample of 2230 participants (De Winter et al., 2005). The participants who were not enrolled, were so because either a child or parent did not consent. They were, however, offered to fill in a brief non-response questionnaire. This also contained a question if parents approved of teachers filling in a questionnaire about their children. If parents agreed, teachers would also answer the general, emotional and behavioural questions about the child.

Because of the low prevalence of psychopathology in the TRAILS population sample, a Clinical Cohort was added (n = 543, 34.1% female) in 2004. Participants for CC were recruited from the database of University Centre of Child and Youth Psychiatry Accare, when they were between 10 and 12 years old (M = 11.11) and had attended at least one psychiatric outpatient clinic in the north of The Netherlands. This yielded 1264 possible participants, of which 642 refused participation, 45 exceeded the inclusion deadline and 34 could not be reached. This resulted in a CC sample of 543 children, 43% of the total number of approached individuals (De Winter et al., 2005).

Sample

The sample for this study consisted of 2773 respondents (47.5% female), from which 2230 originated from TRAILS and 543 from CC. It was possible to compare the population and clinical cohort only by using the first four assessments in this study, because a fifth measuring moment of the clinical cohort was not yet completed during the time of this study.

Measures

All the measures used in the analyses are questionnaire based. The risk factors were all assessed at the first assessment of the TRAILS study, for both the population and clinical cohort. The firesetting chronicity scale was created by using data from assessments one to four.

Outcome measure. To properly capture chronicity and to be able to examine whether risk factors present during the first wave can predict chronicity and firesetting during adolescence, data from all four waves and both for the population and clinical cohort was used. For the outcome measure an item from the Anti-Social Behaviour Questionnaire (ASBQ) was used (Moffit & Silva, 1988). Respondents were asked whether they had set a fire in the past 12 months, on which they could answer *never* (0), *just once* (1), *two or three time*s (2), *four to six times* (3) or *seven times or more often* (4). From all waves, these scores where then recomputed into a firesetting chronicity scale, with 0 = *never reported to have set fires*, 1 = *reported to have set fires during one wave* and 2 = *reported to have set fires during two or more waves*.

Predictors of firesetting. Gender is a variable from the general information part of the written questionnaires for children. It was dummy coded with 0 = *female* and 1 = *male*.

Internalizing and externalizing problem behaviour were measured using the Youth Self Report (YSR) questionnaire, developed to assess child and adolescent psychopathology (Achenbach, 1991). This questionnaire consisted of 112 items in total, such as withdrawn/depressed behaviour and anxious/depressed behaviour, in which the participants rated the presence of emotions and behaviours as *not at all* (0), *a little or sometimes* (1), or *clearly or often* (2) present. The internalizing problem behaviour scale consisted of 31 items (Cronbach's $\alpha_{PC} = 0.87$; Cronbach's $\alpha_{CC} = 0.86$). The externalizing problem behaviour scale consisted of 32 items (Cronbach's $\alpha_{PC} = 0.85$, Cronbach's $\alpha_{CC} = 0.87$), with higher scores indicating higher levels of problem behaviour.

Hyperactivity was measured using one item from the Teacher's Checklist of Psychopathology (TCP), a teacher questionnaire developed by TRAILS to reduce the respondent burden for teachers because teachers usually had a number of students in their class to report on (De Winter et al., 2005).

The TCP consisted of nine vignettes of behaviour, such as social problems and activity/impulsivity**,** with which the teacher rated emotional and behavioural problems of the children in their class on a five point Likert scale of *not at all applicable* (0), *rarely applicable* (1), *a little applicable* (2), *clearly applicable* (3) and *absolutely applicable* (4). These items were adapted to be consistent with the coding of other reports, such as the CBCL and YSR (De Winter et al., 2005). The activity/impulsivity vignette was used as the hyperactivity variable in this study. A higher score indicated more hyperactive behaviour.

For family risk, several items were used, originating both from the children and parental questionnaires. Parental rejection was an item from the EMBU-C section of the children questionnaire, consisting of paternal warmth, rejection and protection. The parental rejection scales described ways of being treated by their parents, which the children could describe as *never* (1), *sometimes* (2), *often* (3) or *almost always* (4) occurring. They were separate for rejection by mother and father and consisted of 17 items each ($\alpha_{PCfather} = 0.84$; $\alpha_{PCmother} = 0.84$; $\alpha_{CCfather} = 0.87$; $\alpha_{CCmother} = 0.82$), such as 'does your mother/father ever hit you'. A higher scores means more maternal or paternal rejection.

Other environmental risk factors were taken from the parental questionnaires. These included number of parents (1 = *one parent*, 2 = *two parents*), number of children in the family, death of a parent or sibling (0 = *no*, 1 = *yes*), divorce of biological parents (0 = *no*, 1 = *yes*), employment status of father and mother (0 = *has a paid job*, 1 = *unemployed*) and family SES. Employment status originally followed the construct of *having a paid job for the past two years* (0), *have lost their job in the past two years* (1) or *never had a paid job* (2). This was recomputed to a binary variable with categories *employed* (0) and *unemployed* (1). Family SES was constructed using five indicators: family income and the education and occupation of both parents. The SES variable was computed by averaging the standardized scores of the five items (Cronbach's $\alpha = 0.84$) (Veenstra et al., 2005).

The peer rejection variables originates from a sub-study within the first wave of the population cohort of TRAILS, the Peer Nominations ($n = 1065$). This was only assessed in classrooms with at least 10 TRAILS participants, in which children in special education (5.6%), small schools (6.4%), who repeated or skipped a grade (16.9%; 2.2%) where excluded. Therefore it limits the generalisation to pre-

adolescents in a regular elementary school who did not skip or repeated a grade (De Winter et al., 2005). The peer nominations were assessed in the classroom during regular lessons with a TRAILS staff member present. The participants received the questionnaire and a list of names of their classmates. They could then nominate classmates on a range of domains, with no limits to the number of classmates they could choose. Nominations were divided by the number of children in the class, which was the maximum number of possible nominations, to create proportion scores ranging from 0 to 1, while taking class sizes into account (Kretschmer et al., 2014). For this study, two items from the peer nominations were used to measure peer rejection: the percentages of nominations of being disliked by peers and being victimized by peers. A higher score meant being victimized or disliked more.

During the first wave, researchers performed two intelligence sub-tests for verbal and special intelligence, following the Wechsler Intelligence Scale for Children (WISC-R). A deviant quotient score was then calculated using the normalised standardized scores of the subtests with a correction for age, according to the WISC-R manual (Silverstein, 1972). These deviations quotient scores ranged from 45 to 149.

Teacher reports were also used for the examination of social skills. The social skills items were taken from the Social Skills Rating System (SSRS), a questionnaire developed to study children who have behavioural and interpersonal skills problems (Gresham & Elliott, 1990). Teachers were presented with vignettes of behaviour and asked if they had *never* (0), *sometimes* (1) or *always* (2) seen certain behaviour in the children over the past two months. The three items that were used were cooperation with the teacher (10 items, $\alpha_{PC} = 0.90$; $\alpha_{CC} = 0.85$), assertion (10 items, $\alpha_{PC} = 0.88$; $\alpha_{CC} = 0.87$) and self-control (10 items, $\alpha_{PC} = 0.91$; $\alpha_{CC} = 0.87$). These included vignettes such as ‘this child pays attention during class’ and ‘this child makes new friends easily’. For this study, the three scales were combined into one scale ($\alpha_{PC} = 0.81$; $\alpha_{CC} = 0.71$), where a higher score meant better social skills.

Analytic strategy

For this study, multinomial logistic regression models were used to estimate the strength of the

associations between the outcome measure of firesetting chronicity and the risk factors gender, internalizing problem behaviour, externalizing problem behaviour, hyperactivity, IQ, social skills, peer rejection and several family risk factors, including rejection by mother and father, divorce of biological parents, number of children in the family, number of parents in the family, death in the family, family SES and unemployment of mother and father. A research design was chosen to include only those with complete data on the firesetting variable (n = 1720, 48,4% female) to ensure that firesetting chronicity was captured correctly.

For firesetting chronicity, the aim was to create a scale consisting of three groups: absolute abstainers, that is, adolescents that had never reported to have set fires during any of the waves, the one-time firesetting group, the children that at one assessment reported that they had set at least one fire and chronic firesetting, the children that reported to have set fires at two or more assessments. The original firesetting question was ‘have you set a fire (for example in a shed or a basement) in the last twelve months?’, to which the participant could answer *never* (0), *just once* (1), *two or three times* (2), *four to six times* (3) and *seven times or more often* (4), for each assessment. These variables where then added up if a respondent scored one, two, three or four, creating a variable with categories zero to four, in accordance with the amount of assessments respondents had answered the firesetting question positively, meaning they reported to have set one or more fires during that wave. These were then computed into the firesetting chronicity scale with three categories, the *abstainers* (0) if they had never reported to have set fires, the *one-time firesetters* (1) if they reported to have set fires during one wave in the 12 months preceding that wave, and the *chronic firesetters* (2), if they reported to have set fires during two or more waves in the 12 months preceding the waves.

For this study, multinomial logistic regression was used because the outcome variable of firesetting contains three categories. The reference category was set to be 0 because this is the largest, most common category (69.1%). The 0 category resembles abstainers, whereas the other two categories represent a certain severity of shown firesetting behaviour. The population and clinical cohorts were analysed separately.

Four different multinomial logistic regression models were computed. The first two models contained the personal risk factors (gender, internalizing and externalizing problem behaviour, hyperactivity, IQ, social skills) separately for the population cohort and clinical cohort. The third and fourth models contained the family risk factors (parental rejection, divorce of biological parents, number of children, single parenthood, death in the family, parental unemployment, family SES) and peer rejection for the population cohort and just the family risk factors for the clinical cohort, as peer nominations were not a part of this cohort.

Results

Descriptive Statistics

Table 1 shows the distribution of the items that were computed into the firesetting chronicity scale. In both the population and clinical cohort, the percentage of severe firesetting behaviour decreased per assessment. Also, firesetting occurs less in the clinical cohort compared to the population cohort, with percentages of never having set fires being lower in the clinical cohort from the first to third wave. Only in the fourth wave the participants from the clinical cohort show more firesetting behaviour compared to the population cohort.

The firesetting chronicity scale mean is low in both population and clinical cohort, with the majority of the participants having abstained from firesetting throughout the four assessments. When conducting independent *t*-tests, the means of firesetting chronicity were not found to be significantly different between population and clinical cohort ($t = 1.42$, $p = .16$). Therefore, it cannot be concluded that firesetting behaviour is lower in clinical cohort participants, compared to the population cohort. Also, when comparing firesetting chronicity means for males and females, *t*-tests did not show the means to be significantly different ($t = 0.94$, $p = .35$).

Table 1

Distribution of the firesetting variable, in percentages

	Population cohort				Clinical cohort			
	T1	T2	T3	T4	T1	T2	T3	T4
N	2199	2083	1656	1653	538	433	416	358
Never	78.1	82.2	89.4	95.3	84.2	88.5	90.1	93.6
Once	13.2	9.9	6.6	2.7	10.4	7.8	5.5	2.2
2-3	4.5	5.0	2.5	1.5	3.2	2.1	3.4	3.5
4-6	2.0	0.8	0.8	0.3	1.3	1.2	.	0.3
7 or more	2.1	2.0	0.7	0.2	0.9	0.6	1.0	0.5
	n	Range	*M (SD)*		*n*	Range	*M (SD)*	
Firesetting chronicity	1419	0 – 2	0.50 (0.79)		301	0 – 2	0.43 (0.77)	

Note: Question: "Have you set fires in the past 12 months?" with categories 0 (*never*), 1 (*one time*), 2 (*two or three times*), 3 (*four to six times*) and 4 (*7 times or more often*).

Table 2 describes the personal risk factors and the outcome measure. In this study, respondents from the population cohort are 49% male and overall show little signs of problem behaviour and hyperactivity, as well as having relatively good social skills and an IQ close to society's average score of 100 (Hunt, 2011). Of the clinical cohort, 66% of the respondents were male and showed slightly higher scores of problem behaviour than the population cohort's participants, as well as being hyperactive more often, having poorer social skills and a lower IQ than the population cohort, though the difference between the average IQ of the population and clinical cohort is but tiny.

Furthermore, while examining independent *t*-tests comparing the means of individual predictors between cohorts, the means of internalizing problem behaviour ($t = -3.35$, $p < 0.01$), externalizing problem behaviour ($t = -4.89$, $p < 0.01$), hyperactivity ($t = -11.49$, $p < 0.01$) and social skills ($t = 14.81$, $p < 0.01$) were found to be significantly different between the population and clinical cohort. This means that indeed participants of the clinical cohort showed more signs of internalizing and externalizing problem behaviour, were more hyperactive and had poorer social skills, compared to the participants of the population cohort. However, there was no statistical evidence that participants of the

clinical cohort had significantly lower IQ's ($t = 0.65$, $p = 0.52$) than the participants of the population cohort.

Table 2

Descriptive statistics of outcome measure and personal risk factors

	Population cohort			Clinical cohort		
	N	Range	*M (SD)*	*n*	Range	*M (SD)*
Ordinal variables						
Internalizing problem behaviour	2171	0 – 1.42	0.36 (0.24)	534	0 – 1.23	0.40 (0.24)
Externalizing problem behaviour	2188	0 – 1.22	0.27 (0.20)	536	0 – 1.22	0.32 (0.22)
Hyperactivity	1928	0 – 2	0.36 (0.53)	490	0 – 2	0.72 (0.65)
IQ	2221	45 – 149	97.19 (15)	543	58 – 142	96.72 (15.52)
Social skills	1928	1.13 – 3	2.35 (0.38)	490	1.33 – 3	2.10 (0.34)
Nominal variable			Percentage			Percentage
Gender = 1	2230	0 – 1	49%	543	0 – 1	66%

Table 3 describes the environmental risk factors. In the population cohort, scores for parental rejection are close to the scale minimum, similar to family SES and peer rejection. There are on average 2.53 children per family. Other factors in Table 2 are categorical and show that most of the participants from the population cohort live with two parents, have biological parents that are not divorced, have not encountered a death of a sibling or parent and have parents that are employed-. Means for parental rejection in the clinical cohort where slightly higher than for the population cohort. The mean for family SES is the same and on average there are 2.55 children per family. Similar to the population cohort, most participants from the clinical cohort were from families with two parents, with biological parents

that are not divorced, they have not encountered a death in the family and have employed parents.

With computing independent *t*-test to compare means between cohorts, it was found that the means of rejection by mother ($t = -5.30$, $p < 0.01$) and rejection by father ($t = -7.15$, $p < 0.01$) significantly differed for the population and clinical cohort. This means that participants of the clinical cohort felt more rejected by their parents, compared to the population cohort. Comparing the percentages of the nominal variables, percentages for employment of father ($t = -2.75$, $p < 0.01$) and divorce of biological parents ($t = -2.19$, $p < 0.05$) differed significantly between cohorts, meaning that fathers of participants of the clinical cohort were more often unemployed compared to the population cohort's participants. However, for the other variables, no significant differences in means between cohorts were found.

Table 3

Descriptive statistics of environmental risk factors

	Population cohort			Clinical cohort		
	N	Range	*M (SD)*	*n*	Range	*M (SD)*
Ordinal variables						
Paternal rejection	2141	1 – 3.59	1.48 (0.34)	526	1 – 3.65	1.62 (0.42)
Maternal rejection	2194	1 – 3.94	1.48 (0.33)	538	1 – 3.24	1.57 (0.36)
Number of children[a]	2188	1 – 13	2.53 (1.07)	541	1 – 10	2.55 (1.24)
Family SES	2188	-1.94 – 1.73	-0.05 (0.80)	541	-2.23 – 1.72	-0.05 (0.74)
Disliked by peers	1065	0 – 0.85	0.13 (0.13)	.	.	.
Victimized by peers	1065	0 – 0.63	0.04 (0.08)	.	.	.
Nominal variables[b]			Percentage			Percentage
Number of parents = 2	2195	1 – 2	1.84	541	1 – 2	1.83
Divorce of biological parents = 1	2230	0 – 1	21%	541	0 – 1	26%
Death in family = 1	2186	0 – 1	3%	541	0 – 1	4%

Employment mother = 1	2181	0 – 1	25%	541	0 – 1	27%
Employment father = 1	1842	0 – 1	6%	444	0 – 1	11%

Note. Peer nominations were not measured in the clinical cohort. a. Number of children is number of children in a family, including the respondent. b. Nominal variables are coded so the value '1' means a higher risk; parents are divorced, respondent did experience a death in the family, mother/father is unemployed.

Bivariate statistics

Table 4, the correlation table for the population cohort, shows a few strong significant correlations (above 0.5) between risk factors. The strongest correlation is between the number of parents and divorce of biological parents, which is natural as a divorce often results in single parenthood. Another strong correlation is between externalizing and internalizing problem behaviour, which means that when an individual shows signs of internalizing problem behaviour, they are likely to also show signs of externalizing problem behaviour. A similar effect shows between rejection by mother and rejection by father, meaning that adolescents that feel rejected by their mother also feel more rejected by their father.

Moderate correlations occurred between hyperactivity and gender, internalizing and externalizing problem behaviour and rejection by mother and father, being victimized and disliked by peers, IQ and SES and between social skills and gender, hyperactivity, SES, being disliked by peers and IQ. This means that the presence of internalizing/externalizing problem behaviour is linked to being rejected by mother and/or father, that when one is more disliked by peers this is linked to being also more victimized by peers and that higher IQ is linked to a higher SES. In a similar way, poorer social skills are more often present in males and linked to being more often disliked by peers, as well as better social skills being linked to a higher scores for IQ and family SES, as well as being less hyperactive.

The correlations of the clinical cohort show similar patterns compared to the population cohort. Again, the strongest correlation is the one between number of parents and divorce of biological parents, with similar associations between rejection by mother and rejection by father and internalizing problem behaviour and externalizing problem behaviour.

Moderate correlations occur similar to the population cohort, with gender and hyperactivity

correlating with each other, as well as rejection by mother and father and internalizing and externalizing problem behaviour, SES and IQ and hyperactivity and social skills. Correlations that do not occur in the population cohort, are the moderate correlations between SES and number of parents and divorce of biological parents. This means that a lower SES is linked to families with one parents and families with divorced parents.

Table 4

Correlations of risk factors

	FC	G	IPB	EPB	Hyp	RF	RM	NC	NP	DBP	DF	EM	EF	SES	DIS	VIC	IQ	SS
FC	.	-.02	.04	-.02	.07	-.06	-.06	-.02	-.06	.09	.03	.06	.02	0	.	.	.10	-.03
G	-.02	.	-.13**	.13**	.32**	.11*	.04	.04	.09*	-.12**	-.06	-.10*	-.04	.10*	.	.	.13**	-.03
IPB	-.03	-.11**	.	.51**	-.05	.26**	.28**	.03	.01	.03	-.04	.06	.04	-.01	.	.	.07	.03
EPB	0	.18**	.53**	.	.22**	.31**	.42**	.07	.02	-.04	.01	0	-.04	.01	.	.	.04	-.11*
Hyp	.01	.29**	.05*	.21**	.	.11*	.10*	-.05	-.01	-.01	-.01	-.02	-.05	-.04	.	.	-.03	-.44*
RF	0	.10**	.39**	.37**	.12**	.	.55*	-.02	.05	-.05	-.05	-.06	-.03	.01	.	.	-.03	-.04
RM	.02	.10**	.39**	.42**	.16**	.68	.	.02	.03	-.03	-.03	-.01	-.05	-.03	.	.	-.03	-.03
NC	.01	-.02	.04	.06**	.04	.09	.06	.	.09*	-.07	.07	.06	-.08	.12**	.	.	.06	.03
NP	.01	.01	-.03	-.04	-.09**	.05	-.01	.14	.	-.63**	-.03	-.13**	.[a]	-.27**	.	.	.04	-.09
DBP	.01	-.01	0.03	.06**	.09**	-.03	.02	-.12	-.65**	.	.04	.07	.02	-.25**	.	.	-.03	-.05
DF	-.01	.01	0.01	-.03	0	.04	.07**	0	-.18**	.02	.	-.01	0	.05**	.	.	.01	.06
EM	-.01	0.2	0	-.03	.03	.02	-.01	.16**	-.04*	.01	.03	.	.07	-.21**	.	.	-.03	.04
EF	.04	.02	0.01	-.03	.04	-.01	-.01	.04	.01	.08**	.01	.09**	.	-.10*	.	.	0	.04
SES	-.02	-.03	-.04*	-.05*	-.18**	-.05*	-.05*	.01	.23**	-.26**	-.02	-.23**	-.22**	.	.	.	.34**	.11*
DIS	-.04	.21**	.07*	.16**	.31**	.14**	.14**	.03	-.11**	.12**	.03	.02	.05	-.13**	.	.	.	.
VIC	0	.07*	.10**	.04	.13**	.08**	.06*	.02	-.04	.06	.02	.01	.04	-.11**	.46**	.	.	.
IQ	-.01	.06**	0.03	0.02	-.17**	.02	-.01	-.05*	.10**	-.12**	-.03	-.11**	-.15**	.39**	-.05	0	.	.06
SS	0	-.29**	-.05*	-.18**	-.57**	-.13**	-.14**	-.04	.13**	-.14**	0	-.07**	-.10**	.31**	-.36**	-.18**	.30**	.

Note. Correlations below diagonal are from the population cohort. Correlations above diagonal are from the clinical cohort. Peer nominations were not included in the clinical cohort. Abbreviations: FC = Firesetting chronicity. G = Gender. IPB = Internalizing problem behaviour. EPB = Externalizing problem behaviour. Hyp = Hyperactivity. RF = Rejection by father. RM = Rejection by mother. NC = Number of children. NP = Number of parents. DBP = Divorce of biological parents. DF = Death in family. EM = Employment mother. EF = Employment father. DIS = Disliked by peers. VIC = Victimized by peers. SS = Social skills. * p<.05 level (2-tailed). ** p<.01 level (2-tailed). a. Cannot be computed when correlating number of parents and employment of father in the clinical cohort, only cases remain where number of parents = 2. Because this variable is constant, no correlations can be computed.

Multicollinearity

Multicollinearity was examined to ensure that there were no strong linear relationships between two or more predictors in the multiple logistic regression model. If there is multicollinearity in regression, regression coefficients become unreliable, the model variance is limited and it is difficult to assess the individual importance of predictors (Field, 2009). Therefore, *tolerance* and *Variance Inflation Factors (VIF)* were computed for these analyses by running a multiple regression with all predictors in SPSS. When examining the *tolerance* and *VIF* values from this analysis, no *tolerance* value approached 0.1 and no *VIF* value exceeded 10 or -10 (Myers, in Field, 2009). Thus, there was no multicollinearity between the risk factors. This means that for the multiple logistic regression analyses, the regression coefficients are trustworthy, the model variance is not limited and the individual importance of predictors is measurable.

Table 5

Collinearity statistics of firesetting risk factors

	Tolerance	*Variance Inflation Factor*
Gender	0.79	1.27
Internalizing problem behaviour	0.58	1.73
Externalizing problem behaviour	0.61	1.63
Hyperactivity	0.61	1.64
IQ	0.80	1.26
Social skills	0.53	1.89
Rejection by father	0.46	2.18
Rejection by mother	0.48	2.09
Number of children	0.88	1.14
Divorce of biological parents	0.93	1.08
Family SES	0.78	1.28
Death in family	0.97	1.03
Employment mother	0.88	1.13
Employment father	0.93	1.07
Peer rejection	0.84	1.20

Note: Due to missing data, all cases for number of parents have the value '2'. Therefore, tolerance and VIF scores cannot be computed, because number of parents is a constant variable.

Multinomial Logistic Regression

Individual risk factors. As shown in Table 6, the only significant predictor is internalizing problem behaviour for the first firesetting category in the clinical cohort. This means that individuals from the clinical cohort who show internalizing problem behaviour were 2.3 times more likely than the individuals without internalizing problems to have set fires at least once during adolescence. However, the 95% *confidence interval* of the *odds ratio* of internalizing problem behaviour is really wide. This indicates a lower level of precision of the *odds ratio* and may suggest that the sample size is too small. Therefore, this result should be interpreted with caution.

Table 6

Results of the multinomial logistic regression for personal risk factors

	Population cohort[1] (n = 1202)				Clinical cohort[2] (n = 264)			
		95% CI for Odds Ratio				*95% CI for Odds Ratio*		
	B (SE)	*Lower*	*Odds Ratio*	*Upper*	*B* (SE)	*Lower*	*Odds Ratio*	*Upper*
One time firesetters vs. Abstainers								
Intercept	-1.32 (0.81)				-5.61 (2.45)*			
Gender = 0	-0.12 (0.19)	0.62	0.89	1.28	-0.37 (0.58)	0.22	0.69	2.17
Internalizing problem behaviour	-0.07 (0.44)	0.40	0.93	2.20	2.30 (1.15)*	1.05	9.96	94.93
Externalizing problem behaviour	0.21 (0.54)	0.43	1.23	3.57	-2.19 (1.48)	0.01	0.11	2.05
Hyperactivity	-0.05 (0.20)	0.64	0.95	1.41	0.39 (0.43)	0.64	1.48	3.42
IQ	0 (0.01)	0.99	1	1.01	0.03 (0.02)	1	1.03	1.06
Social skills	0.014 (0.29)	0.58	1.01	1.78	0.01 (0.80)	0.21	1.01	4.84
Chronic firesetters vs. Abstainers								
Intercept	-1.62 (0.74)*				-4.27 (1.73)*			
Gender = 0	0.06 (0.17)	0.76	1.06	1.47	0.43 (0.38)	0.73	1.54	3.26
Internalizing problem behaviour	-0.43 (0.40)	0.30	0.65	1.43	0.82 (0.82)	0.45	2.27	11.37
Externalizing problem behaviour	0.23 (0.50)	0.48	1.26	3.31	-0.86 (0.99)	0.06	0.43	2.96
Hyperactivity	0.17 (0.18)	0.84	1.19	1.69	0.46 (0.30)	0.88	1.59	2.87
IQ	0 (0.01)	0.99	1	1.01	0.02 (0.01)	1	1.02	1.04
Social skills	0.06 (0.17)	0.76	1.26	2.10	0.12 (0.57)	0.73	1.12	3.40

a. Too few valid cases remain for this variable to compute this result. *Note:* model 1: R^2 = .003 (Cox & Snell), .003 (Nagelkerke). Model $X^2(12) = 3,40$, $p = .99$. model 2: R^2 = .05 (Cox & Snell), .07 (Nagelkerke). Model $X^2(12) = 14.75$, $p = .26$.; *$p < .05$.

Environmental risk factors. Significant environmental predictors were number of children in the family and having divorced biological parents in the population cohort, for abstainers compared to chronic firesetters. Thus, by being from a larger family, an individual from the population cohort had a 21% higher chance of chronic firesetting behaviour (= having reported to have set fires during at least two waves) compared to individuals from smaller families. As the coefficient for not having divorced parents is negative, adolescents from the population cohort who have biological parents that are not divorced have a 95% lower chance of setting fires chronically, compared to adolescents with divorced biological parents. Divorced parents and being from a larger family are also significant predictors for one time firesetters in the clinical cohort. However, when examining the chronic firesetting group, neither of the predictors are significant in the clinical cohort.

When combining all environmental predictors in one regression model, the cases with missing data on at least one of the predictors were not included in the analysis. This caused the small numbers of participants with one parent and participants that have encountered a death in the family in both population and clinical cohort, to decrease further, which resulted in problems with computing the *odds ratios* and *confidence intervals* for these predictors throughout the analysis. In the population cohort, one case remained with one parent and six cases remained for having experienced a death in the family, causing very large *confidence intervals* for both variables. In the clinical cohort, there are no problems with the death in the family variable. However, no cases remain for having one parent, thus *odds ratios* and *confidence intervals* cannot be computed at all.

Table 7

Results of the multinomial logistic regression for environmental risk factors.

	Population cohort[1] (n= 563)				Clinical cohort[2] (n = 246)			
		95% CI for Odds Ratio				*95% CI for Odds Ratio*		
	B (SE)	*Lower*	*Odds*	*Upper*	*B* (SE)	*Lower*	*Odds*	*Upper*
One time firesetters vs. Abstainers								
Intercept	-1.98 (1.45)				-18.80 (1.72)*			
Rejection by mother	0.52 (0.55)	0.57	1.68	4.97	-.08 (1)	0.13	0.92	6.53
Rejection by father	0.03 (0.52)	0.37	1.03	2.88	-.22(0.85)	0.15	0.81	4.62
Number of children	0.06 (0.11)	0.85	1.06	1.32	0.40 (0.15)*	1.11	1.49	1.99
Number of parents = 1	19.65 (7740.15)	0	[b]	[a]	.	.	.	.
Divorce of biological parents = 0	-.14 (0.49)	0.33	0.87	2.28	-1.22 (0.6)*	0.09	0.30	0.96
Death in family = 0	0.17 (1.12)	0.13	1.18	10.56	16.64 (0)	[d]	[d]	[d]
Employment mother = 0	0.27 (0.30)	0.73	1.31	2.38	-0.31 (0.58)	0.23	0.73	2.30
Employment father = 0	-.62 (0.59)	0.17	0.54	1.72	0.58 (1.09)	0.21	1.78	14.95
Family SES	-.25 (0.17)	0.56	0.78	1.09	0.48 (0.35)	0.81	1.61	3.19

Disliked by peers	-1.56 (1.10)	0.02	0.21	1.81	.	.	.	.
Victimized by peers	1.93 (1.63)	0.29	6.91	166.96	.	.	.	.
Chronic firesetters vs. Abstainers								
Intercept	-16.08 (1013.13)				1.03 (1.39)			
Rejection by mother	-.03 (0.5)	0.37	0.97	2.56	-.21 (0.82)	0.16	0.81	3.99
Rejection by father	0.29 (0.45)	0.56	1.34	3.21	-.5 (0.75)	0.14	0.61	2.66
Number of children	0.21 (0.09)*	1.04	1.24	1.48	-.04 (0.18)	0.67	0.96	1.37
Number of parents = 1	-.84 (0)	0.43	0.39	0.43	.	.	.	.
Divorce of biological parents = 0	-.96 (0.39)*	0.18	0.39	0.82	-.04 (0.53)	0.34	0.96	2.60
Death in family = 0	14.70 (1013.12)	0	c	a	-.78 (0.78)	0.1	0.46	2.11
Employment mother = 0	0.29 (0.28)	0.77	1.34	2.33	-.59 (0.4)	0.25	0.55	1.22
Employment father = 0	-.10 (0.63)	0.26	0.90	3.13	-.16 (0.61)	0.26	0.85	2.84
Family SES	-.03 (0.16)	0.71	0.97	1.32	0.02 (0.26)	0.61	1.02	1.69
Disliked by peers	-.67 (1)	0.07	0.51	3.59	.	.	.	.
Victimized by peers	0.23 (1.70)	0.05	1.26	35.25	.	.	.	.

Note. Nominal variables are computed according to the value '1' meaning a higher risk; 1 parent, parents are divorced, experienced a death in the family, mother/father is unemployed. a. Too few valid cases remain for this variable to compute this result. b. Value 341,876,739.70. c. Value is 2,409,594.37. d. Value is 16,828,876.62. Model 1: R^2 = .05 (Cox & Snell), .06 (Nagelkerke). Model $X^2(22) = 27.48$, $p = .19$; model 2: R^2 = .08 (Cox & Snell), .10 (Nagelkerke). Model $X^2(16) = 19.68$, $p = .24$.

Discussion

With this study, our goal was to examine risk factors and prevalence of adolescent firesetting behaviour. This was executed through the use of two multinomial logistic regression models: one for individual risk factors (gender, internalizing problem behaviour, externalizing problem behaviour, hyperactivity, IQ, social skills) and one for environmental risk factors (paternal rejection, maternal rejection, number of parents, number of children, family SES, paternal employment, maternal employment, divorce of biological parents, death in the family, peer rejection).

The study sample consisted of participants of the TRAILS project. TRAILS contained two cohorts, a population cohort and clinical cohort, and is a longitudinal study of which four assessments were used here. Multinomial logistic regression models were used to test associations between various risk factors and firesetting behaviour. To thoroughly grasp firesetting behaviour, the firesetting questions from each assessment were computed into a scale that described the chronicity of firesetting behaviour by either placing participants in the never, just once, or twice or more categories of firesetting over the four waves.

Divorce of biological parents predicted firesetting in both the population and clinical cohort, in both firesetting subgroups, internalizing problem behaviour was a significant predictor for one-time firesetting in the clinical cohort and a larger number of children in the family was a significant predictor for the one-time firesetting group in the clinical cohort and the chronic firesetting group in the population cohort. A remarkable, yet unanticipated finding was the absence of a significant gender effect throughout the analyses.

Summary of findings of the individual risk factors

The first hypothesis suggested males setting more fires than females. Unexpectedly, gender was not a significant predictor in this study. Previous results on firesetting risk factors indicated strong support for a gender effect , with males usually outnumbering females (Chen

et al., 2003; Dadds et al., 2006; Del Bove et al., 2008; MacKay et al., 2006, 2009, 2012, Martin et al., 2004). This contrasting result could be explained by males and females in this dataset not differing much with respect to engagement in firesetting, thus males in the TRAILS data might set just as few fires as females.

We expected that individuals who showed more internalizing problem behaviour also set more fires. Internalizing problem behaviour did predict one-time firesetting behaviour in the clinical cohort, however, this result has to be interpreted with caution because of the large confidence interval. Internalizing problem behaviour was not a significant predictor in the population cohort. This could be because children in the population cohort might be less influenced by experiencing internalizing problem behaviour and have other coping strategies, compared to individuals from the clinical cohort who might be more vulnerable to the effects of internalizing problem behaviour. A number of the clinical cohort's participants have been diagnosed with a psychiatric disorder (though this does not apply to all clinical participants) and individuals with disorders are more influenced by stress than those without (Thoits, 1995).

Similarly, we hypothesized that externalizing problem behaviour in participants would increase one's risk for firesetting. However, no significant associations were found between externalizing problem behaviour and firesetting. This might be because no participants showed signs of externalizing problem behaviour that would account for a severe delinquent act as firesetting, or that externalizing problem behaviour is generally low in these participants.

The expectation for this study was that hyperactive children would lack self-control and resort to firesetting behaviour to establish their needs. However, in this study, hyperactivity was not a significant predictor for firesetting behaviour. An explanation for this result might be that previous literature mainly investigated ADHD and firesetting (Becker et al., 2004; Dadds et al., 2006). ADHD, however, differs from hyperactive behaviour by also

containing an attention deficit component. Therefore it is possible that only hyperactivity in combination with the attention deficit component is a predictor for firesetting and hyperactive behaviour with attention difficulties is not.

We also expected that participants with lower IQ's would have a higher risk for firesetting behaviour. Yet, IQ did not significantly predict firesetting behaviour in this study.. Most literature on IQ and firesetting focussed on participants with severe mental disabilities and mental retardation. In the TRAILS study, the IQ variable was based on an intelligence test and respondents who had the diagnosis of mental retardation were excluded from participation (De Winter et al., 2005). Therefore it could be that mental retardation can predict firesetting behaviour, as e.g. Devapriam et al. (2007) found, but that this relation did not exist for firesetting and IQ, or that this association only exists at the extreme end.

It was expected that lower levels of social skills would cause higher risk of firesetting behaviour. However, poor social skills were not a significant predictor for firesetting behaviour. The expectation was that by being limited in their communicational abilities, individuals would resort to other ways of communication through delinquency (Devapriam, 2007). By this effect not occurring in this study, it is likely that these participants have found different ways of coping with their poor social skills, that their lack of social skills was not experienced as a (severe) strain or no participants had really poor social skills, considering that the average in both cohorts was close to the maximum score.

Summary of findings of the environmental risk factors

For the environmental risk factors, the first hypothesis expected higher firesetting risk to show in individuals that were more often rejected by their mother and/or father. For neither maternal nor paternal rejection, however, significant links with firesetting behaviour were found. The assumption was that rejection would fuel anger and vengeance, but it could be that this anger does not result in such a severe response as firesetting and that children respond to

the experienced distress in other ways.

It was also expected that children from larger families would experience higher risk for firesetting. In this study, it was found that number of children in a family indeed significantly predicted chronic firesetting in the population cohort and one-time firesetting in the clinical cohort. This result is in accordance with results from previous literature (Chen et al. 2003; Devapriam et al., 2007). Being from a larger family with more children thus accounted for higher firesetting risk for both population and clinical cohorts.

Next to number of children, it was also expected that number of parents in a family would be associated with firesetting, in that firesetting risk would be higher in single parent families. Yet, number of parents was not a significant predictor of firesetting behaviour in the population cohort, as there were very few respondents that had one parent. In the clinical cohort, there were even too few participants with one parent to conduct analyses and draw conclusions.

It was hypothesized that respondents with divorced parents would have a higher risk for firesetting behaviour. Divorce of biological parents was indeed a significant predictor for chronic firesetting in the population cohort and for one-time firesetting in the clinical cohort. Previous literature also found similar results with regard to having divorced parents and showing delinquent behaviour (Amato, 2001; Amato & Keith, 1991; D'Onofrio et al., 2005), though the effects of divorce on firesetting behaviour had yet to be investigated. In this study, divorce of biological parents showed to be predictive of higher firesetting risk for both cohorts.

When participants had experienced a death of a parent or sibling, it was expected that they would have a higher risk for firesetting behaviour, but in this study, this what not the case. This could be due to the low number of children that have had this experience; only 76 in the population cohort and 23 in the clinical cohort, which caused problems conducting the regression analyses.

Further, we hypothesized that family death would be a stressor, which resulted in problem behaviour, including firesetting. However, it is possible that children responded in other ways to this stressor than by getting angry, vengeful and turning to delinquency, or had positive stimuli that could neutralize the negative effects of a death to some extent, for example supportive family or friends (Procidano & Heller, 1983; Weber & Fournier, 1985).

Last, it was expected that parental unemployment would account for a higher firesetting risk in children, similar to a lower family SES causing higher firesetting risk. However, neither employment of mother nor of father was a significant predictor of firesetting behaviour, as well as family SES not being able to significantly predict firesetting in this study. The assumption was that unemployment of parents and low SES would cause stress and stigmatise the child for being from a low-class family and that they are unlikely to achieve society's expectations. However, unemployed individuals usually live in areas with relatively cheap houses, commonly rental or social housing (Dohmen, 2005; Battu, Ma & Phimister, 2008) and unemployment is often associated with low SES (Mossakowski, 2008) and lower education (Brunello, 2001). It is likely children from unemployed parents and families with lower socioeconomic statuses will go to school in the same neighbourhood, interacting with mostly children from situations similar to their own, which could mean they are less likely to be stigmatised and to experience stress.

Firesetting was not significantly predicted by being rejected by peers. Being more disliked or victimized did not account for higher risk of firesetting behaviour. In previous literature, significant results for being reject by peers and firesetting were found by Chen et al. (2003). They showed that a combination of shyness, aggressiveness, and feelings of peer rejection were related to firesetting behaviour, as well high levels of peer rejection alone, compared to low levels. Previous literature explains that being rejected by peers is linked to delinquency (Kretschmer et al., 2014). It might be that even though experiencing higher levels of peer rejection accounts for delinquent behaviour, it does not account for behaviour as

extreme as firesetting. It is also possible that the association between firesetting and peer rejection works the other way around. Children could be rejected by their peers for multiple reasons, e.g. bullying, not fitting in, being shy, or being mean, cruel, or scary. Another possibility is that these individuals are not setting fires because they were rejected, but that they were rejected because they already showed forms of deviant behaviour which scared their peers away.

General findings

While investigating the data, we discovered that firesetting prevalence is relatively low in the cohorts of this study. This could be caused by the study sample mainly consisting of children that show little signs of previous problem behaviour, as even the individuals in the clinical cohort were selected to participate because they had visited at least one psychiatric institution, not that a diagnosis was set, compared to samples of previous studies that usually were clinical samples of in-patient facilities (MacKay et al., 2009) or respondents that had shown problem behaviour in the past **(**Del Bove et al., 2008, MacKay et al., 2006**)**. As firesetting is often described as severe antisocial behaviour (Martin et al., 2004), it is plausible that this behaviour can predominantly be observed in individuals with more problem behaviour to begin with, compared to a general sample as used in this study.

Problem behaviour not being an underlying explanation for firesetting behaviour could also be an explanation for the absence of significant risk factors in the study. TRAILS is a study consisting of children from the northern Netherlands. This is a rural area and many of the municipalities used for collecting data for the population cohort were in the countryside (De Winter et al., 2005). Compared to urban areas, there is less criminal activity in rural areas (Glaeser & Sacerdote, 1996). Therefore, problem behaviour does not necessarily have to be the explanation for firesetting behaviour. Firesetting could also be explained by children's curiosity and innocent fire play. In this study, the method of measuring firesetting behaviour

was limited in not differentiating between innocent fire play or curiosity and intentional destructive firesetting. Many children experiment with fire as a form of relatively innocent mischief (MacKay et al., 2006) but this behaviour might not last during adolescence and into adulthood. Firesetting behaviour is commonly a one-time event, that might not be relevant enough for children to consider it a delinquent act, thus not reporting it in the TRAILS questionnaires. Moreover, as children age, they might simply lose interest in firesetting. We also observed this in this sample, as numbers of firesetting were highest during the first wave (age 10-12), for both population and clinical cohort, and quite abruptly decreased at the second wave (age 13-15) and during further assessments. Therefore, firesetting might not be a continuous problem caused by underlying problem behaviour, as hypothesized.

With only few risk factors being able to predict firesetting, it appears that both Agnew's General Strain Theory (1992) and Gottfredson and Hirschi's Self-Control Theory (1990) are not the right theoretical frameworks to predict firesetting behaviour. This might be caused by risk factors not covering strain and self-control in a valid way, the prevalence of firesetting behaviour being generally low and not caused by underlying problem behaviour, or them just not being fitting frameworks.

Methodological discussion

For every risk factor studied here, different measures from the TRAILS dataset were used. To provide reliable results with little risk for self-report bias, we chose to use the information from both children self-reports, parental reports and teacher reports depending on which would provide the potentially most reliable information on the respective risk factor. For certain individual factors, self-reports would be the most beneficial in terms of reliability, as parents and teachers often do not know the whereabouts and behaviour of their children thoroughly (Del Bove et al., 2008). Considering the precautions that were taken to provide privacy, anonymity and confidentiality, it is plausible that children would have answered

sensitive questions about problem behaviour and family problems truthfully.

We used self-reports for the internalizing and externalizing problem behaviour, because this behaviour best described by children themselves as it is plausible that at the age of 10-11 children do not share everything they do with their parents anymore and parents are thus not aware of their children's misbehaviour (Del Bove et al., 2008). They also might play down their child's behaviour.

We used teacher reports to examine social skills and hyperactivity, because they have extensive knowledge on children' behaviour by being qualified as a teacher and can observe the children in comparison to and interacting with their peers. Teachers may also have a more objective view on the child, compared to possibly subjective parents and children. However, with not every teacher participating in TRAILS, this lead to missing data on the hyperactivity variable. Also, for social skills the teacher report questions mainly focussed on classroom behaviour and interaction with the teacher. To thoroughly capture one's social skills, these questions might not have been extensive enough.

TRAILS staff members measured IQ during the first assessment by conducting two intelligence sub-tests for verbal and special intelligence, in accordance with the Wechsler Intelligence Scale for Children (WISC-R). Following the WISC-R manual, researchers then calculated a deviant quotient score with a correction for age (Silverstein, 1972). The WISC-R is a generally accepted way to measure IQ in children, as well as a valid method (Kaplan & Sacuzzo, 2005). By performing these intelligence tests under supervision of TRAILS researchers, chances for bias and subjectivity were minimized.

We used combination of child and parent reports for family risk items. Parental rejection originated from the child questionnaires, as reporting bias would likely occur if parents would answer the questions about rejecting their child themselves. The items concerning family composition (number of parents and children, divorce, death in the family) and parental SES and employment are only added to the parent questionnaire.

The peer rejection items of victimization by peers and being disliked by peers originate from the peer nominations data, a sub-study in which children in classrooms with more than 10 TRAILS-participants were asked to rate their peers, concerning whether they liked or disliked someone or whether they were bullied or not. It is a valid way to treat peer nominations because by taking the questionnaires under supervision of a TRAILS researcher and disabling the opportunity for children to see each other's nominations, they are encouraged to answer honest and true. Also, the procedure for peer nominations, calculating proportion scores that take class size into account by dividing the number of nominations by number of children in the class, is a commonly accepted and reliable method for peer nominations (Bukowski & Hoza, in Kretschmer et al., 2014). The sole problem with using peer nominations in this study is that no data were available for the clinical cohort, thus peer rejection scores and the association with firesetting could not be compared between cohorts.

Limitations of the present study

We created a firesetting chronicity scale using the firesetting items of each assessment. By doing so, this scale described in how many assessments the respondents had set a fire: never, just once or twice or more. We chose this distribution because one time firesetters were believed to maybe have engaged in innocent fire play, having set fires out of, for example, curiosity or peer pressure. But, when firesetting occurred in two or more assessments, it became less likely to be petty delinquency out of curiosity as opposed to a more serious problem, caused by underlying risk factors. However, by computing the firesetting chronicity scale this way, it was only possible to investigate repeated firesetting behaviour. The firesetting chronicity scale investigated whether a respondent had set at least one fire during a wave, not how often fires were set during an assessment or across assessments. It disables examining the severity of firesetting behaviour and the number of fires that were set by participants.

Certain measures in this study resulted in high numbers of missing data. While examining the data, few participants were living in single parent households or had experienced a death in the family. When performing analyses and combining multiple risk factors, these numbers decreased further, and for number of parents and death in the family they got too low to compute scores for. To more accurately investigate the effects of number of parents and death in the family on firesetting behaviour, it might be useful to study firesetting behaviour in a study sample with higher prevalence of one parent families and death in the family, or use multiple imputation methods that account for missing data.

In this study, problem behaviour was not a significant predictor of firesetting. It was argued that in rural areas, criminal activity is generally lower (Glaeser & Sacerdote, 1996) and firesetting behaviour might just be innocent fire play instead of delinquency caused by underlying problem behaviour. Therefore, studying firesetting behaviour in more urban areas when the same risk factors apply, might generate different results than this study.

Future research

In this study, the prevalence of firesetting behaviour was low. Considering that only few risk factors could predict firesetting behaviour, it might be interesting to investigate the meaning of firesetting behaviour more thoroughly, by differentiating between innocent and curious fire play and purposely destructive firesetting. Previously, fire play during childhood has been used to predict adolescent destructive firesetting (MacKay et al., 2006; 2009). By further investigating this differentiation and considering two types of firesetting, innocent and destructive, future studies could examine not if the one predicts the other, but if risk factors have a different effect on fire play and firesetting.

Other possibilities for future research mostly concern extending research of firesetting behaviour in population samples. Adolescent firesetting was predominantly studied in clinical samples before (Chen et al., 2003; Del Bove et al., 2008; MacKay et al., 2009), this study is

one of the first to also examine a population sample and combine the population and clinical cohort of the TRAILS study. By exploring firesetting behaviour, its risk factors and prevalence further in future research, more stable results could be provided.

Certain measures were not able to thoroughly cover the risk factors they were supposed to. Hyperactivity was measured by teacher reports, however this accounted for a high number of missing data as not every teacher agreed to participate in TRAILS. Also, the overall prevalence of having experienced a death in the family was low in this study. For future research, it therefore might be profitable to use different reports on hyperactive behaviour or a combination of teacher and parent reports, as well as investigating a dataset with more respondents that have experienced a death in the family included.

Conclusion

In this study we aimed to investigate the prevalence of firesetting behaviour in adolescence and determine risk factors that had already been present during early adolescence. All in all, we can conclude that in this study, the prevalence of firesetting in children is low and that only internalizing problem behaviour, having experienced a divorce of one's biological parents and number of children in the family predicted firesetting behaviour during adolescence to some extent. These results were not able to support the General Strain Theory and Self-Control Theory as the most suitable theoretical frameworks for firesetting as a facet of delinquency and crime. In the future, there are possibilities for extending research on firesetting behaviour, by more thoroughly capturing the function of firesetting and extending research of firesetting in population studies.

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