

## Firesetting among 18-23 year old un-apprehended adults: A UK community study

Journal:	<i>Journal of Criminological Research, Policy and Practice</i>
Manuscript ID	JCRPP-06-2021-0026.R1
Manuscript Type:	Empirical Paper
Keywords:	firesetter, arson, deliberate firesetting, fire lighting, youth, adolescent, un-apprehended, fire interest

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## MANUSCRIPT DETAILS

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## ABSTRACT:

This study assesses the prevalence of firesetting in a sample of young UK adults age 18 to 23 years and compares their characteristics with non-firesetting individuals.

Two-hundred and forty male (n = 119, 49.6%) and female (n = 121, 50.4%) participants were recruited through Prolific Academic. Comparisons were made between self-reported firesetting and non-firesetting participants on a range of demographic, fire-related, and personality measures. Factors predictive of firesetting status were examined using hierarchical logistic regression.

Twenty-five percent of participants (n = 60) reported igniting a deliberate fire. Logistic regression was used to examine the ability of parental supervision and behavioural issues (e.g., witnessing domestic violence, experimenting with fire before age 10, and family history of firesetting), antisocial behaviours (e.g., having criminal friends, impulsivity, teenage access to fire paraphernalia, skipping class more than once per week, taken any illegal drugs, participation in criminal behaviour), and fire-related interests, attitudes, and propensities in predicting firesetting status. Factors found to distinguish firesetting and non-firesetting participants included: experimented with fire before 10 years of age, family history of firesetting, impulsivity, teenage access to fire paraphernalia, participation in criminal behaviour, and the Fire Setting Scale.

CUST\_RESEARCH\_LIMITATIONS/IMPLICATIONS\_\_(LIMIT\_100\_WORDS) :No data available.

The results provide key information about potential risk factors relating to un-apprehended firesetting in the general population.

CUST\_SOCIAL\_IMPLICATIONS\_(LIMIT\_100\_WORDS) :No data available.

This research adds to the small body of literature examining firesetting in the general population. It refines previously used methodologies, presents the first research study to examine the prevalence of firesetting behaviour in emerging adults, and enhances our understanding of un-apprehended firesetting.

**Firesetting among 18-23 year old un-apprehended adults: A UK community study**

## Abstract

### Purpose

This study assesses the prevalence of firesetting in a sample of young UK adults age 18 to 23 years and compares their characteristics with non-firesetting individuals.

### Design/Methodology

Two-hundred and forty male ( $n = 119$ , 49.6%) and female ( $n = 121$ , 50.4%) participants were recruited through Prolific Academic. Comparisons were made between self-reported firesetting and non-firesetting participants on a range of demographic, fire-related, and personality measures. Factors predictive of firesetting status were examined using hierarchical logistic regression.

### Findings

Twenty-five percent of participants ( $n = 60$ ) reported igniting a deliberate fire. Logistic regression was used to examine the ability of parental supervision and behavioural issues (e.g., witnessing domestic violence, experimenting with fire before age 10, and family history of firesetting), antisocial behaviours (e.g., having criminal friends, impulsivity, teenage access to fire paraphernalia, skipping class more than once per week, taken any illegal drugs, participation in criminal behaviour), and fire-related interests, attitudes, and propensities in predicting firesetting status. Factors found to distinguish firesetting and non-firesetting participants included: experimented with fire before 10 years of age, family history of firesetting, impulsivity, teenage access to fire paraphernalia, participation in criminal behaviour, and the *Fire Setting Scale*.

### Originality

This research adds to the small body of literature examining firesetting in the general population. It refines previously used methodologies, presents the first research study to

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2  
3 examine the prevalence of firesetting behaviour in emerging adults, and enhances our  
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5 understanding of un-apprehended firesetting.  
6

### 7 **Implications**

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9  
10 The results provide key information about potential risk factors relating to un-apprehended  
11  
12 firesetting in the general population.  
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14  
15 Key words: *firesetter, arson, deliberate firesetting, fire lighting, youth, adolescent, un-*  
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17 *apprehended, fire interest*  
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The Fire and Rescue Service in England attended 65,146 deliberate fires between April 2019 and the end of March 2020 which resulted in 55 fatalities and 1,024 non-fatal injuries (Lader, 2021). However, detection rates are low with only approximately 8% of perpetrators identified and even fewer convicted of arson (Arson Control Forum, 2003). Given the significant human costs associated with intentional firesetting, practitioners, government agencies, and policy makers are rightly concerned with preventing and reducing deliberate fires. It is therefore important to understand the prevalence, nature, and correlates of firesetting in the general population, to be able to design and implement effective prevention strategies.

### **Prevalence of un-apprehended firesetting**

Most research on firesetting has utilised apprehended samples (i.e., individuals detained in prison or secure hospitals) or individuals convicted of arson (Dickens and Sugarman, 2012). However, an emerging body of research has focused on understanding the prevalence and characteristics of un-apprehended firesetting individuals (i.e., those who have not been arrested or convicted). Blanco *et al.* (2010) and Vaughn *et al.* (2010) conducted secondary analyses of the Wave 1 National Epidemiological Survey of Alcohol and Related Condition (NESARC) survey; a nationally representative US survey. The NESARC included a single question asking participants if they had ever set a fire. Based on responses to this question, Blanco *et al.* (2010) and Vaughn *et al.* (2010) estimated that between 1 to 1.13% of adults have a lifetime history of deliberate firesetting (Blanco *et al.*, 2010; Vaughn *et al.*, 2010). However, this is likely to be an underestimation as respondents were questioned face to face and may therefore have been reluctant to answer the firesetting question truthfully for fear of reprisals (Dickens and Sugarman, 2012; Gannon and Barrowcliffe, 2012).

Barrowcliffe and Gannon built on the NESARC study by improving the specificity and operationalisation of the firesetting screening question and enabling anonymous

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3 responding. In a series of studies, Barrowcliffe and Gannon examined the prevalence and  
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5 characteristics of un-apprehended firesetting individuals in the UK. Using their refined  
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7 methodology, Barrowcliffe and Gannon identified that between 11% and 17.8% of UK adults  
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9 self-reported having set at least one deliberate fire since the age of 10 years (Barrowcliffe and  
10  
11 Gannon, 2015, 2016; Gannon and Barrowcliffe, 2012). These figures are notably higher than  
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13 the prevalence of firesetting reported in the NESARC studies and highlights the need to  
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15 further understand factors associated with firesetting in un-apprehended individuals.  
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### 18 19 **Characteristics of adults who set fires**

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21 Most research has focused on identifying the psychological characteristics of  
22  
23 apprehended adolescents and adults who set fires. Commonly reported characteristics include  
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25 lack of parental supervision and involvement, and ineffectual discipline (Kolko and Kazdin,  
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27 1986; McCarty and McMahon, 2005); a history of abuse (Dickens *et al.*, 2007; Root *et al.*,  
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29 2008); engagement in antisocial behaviour (Kolko *et al.*, 1985; McCarty and McMahon,  
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31 2005); an increased interest in fire, and increased levels of anger (Gannon *et al.*, 2013;  
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33 MacKay *et al.*, 2006; Watt *et al.*, 2015). Although there has been a focus on identifying  
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35 factors associated with firesetting, there has been less interest in identifying factors that may  
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37 prevent firesetting (e.g., protective factors; Gannon *et al.*, 2012). Understanding both factors  
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39 which are associated with as well as prevent firesetting are important for informing  
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41 prevention and early intervention.  
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### 46 47 **Characteristics of un-apprehended firesetting individuals**

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49 Little research has examined the characteristics of un-apprehended firesetting adults.  
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51 The majority of research has been conducted with community samples of children and/or  
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53 adolescents recruited from schools (e.g., Del Bove *et al.*, 2008) or community firesetting  
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55 intervention programmes (Del Bove and MacKay, 2011; MacKay *et al.*, 2009; Root *et al.*,  
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57 2008). Consequently, there is a lack of information on the characteristics of un-apprehended  
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3 adults who set fires. To date, only two studies have examined the psychological  
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5 characteristics of un-apprehended firesetting adults. Barrowcliffe and Gannon (2015)  
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7 examined demographic and background factors, offence characteristics, and fire-related  
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9 factors (e.g., fire interest, identification with fire, fire attitudes) in a sample of 157  
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11 community adults, recruited via a postal survey hand delivered to 5568 households, in a  
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13 single district within one UK county. Firesetting adults were significantly more likely than  
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15 non-firesetting adults to report having a family member with a history of firesetting, a history  
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17 of self-harm, and have a father with a diagnosed mental illness. Further, firesetting adults  
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19 reported significantly higher levels of fire interest, identification with fire, attitudes  
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21 supportive of firesetting, and a propensity to set fires.  
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26 Barrowcliffe and Gannon (2016) extended their 2015 study by including a wider range of  
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28 measures to examine in more detail the psychological characteristics of un-apprehended  
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30 firesetting adults. Relative to non-firesetting adults, un-apprehended firesetting adults were  
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32 significantly more likely to report a diagnosis of a behavioural problem, a mental health  
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34 diagnosis, a history of suicide attempts, having been suspended from school, having  
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36 experimented with fire before age 10, and having a family member who firesets. They also  
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38 scored significantly higher on measures of fire interest, propensity to set fires, anger,  
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40 provocation, boredom proneness and antisocial attitudes.  
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44 Whilst Barrowcliffe and Gannon's (2015, 2016) studies have provided important new  
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46 information about un-apprehended firesetting, the majority of participants in both studies  
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48 reported setting fires during adolescence only. Further, participants ages ranged from 18 to 72  
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50 years, meaning that firesetting behaviours were often being recalled over long periods of  
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52 time, which may have introduced recall biases. This study therefore seeks to address  
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54 limitations of previous research and examine the prevalence and characteristics of un-  
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56 apprehended firesetting in 18 to 23 year old UK adults. It also extends previous research by  
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3 examining the relationship between psychological characteristics associated with  
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5 apprehended firesetting in an un-apprehended sample; in particular, antisocial behaviour, fire  
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7 fascination, childhood disturbances, attachment style, parental supervision, anger, and  
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9 emotional loneliness.  
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## 15 Method

### 16 *Participants*

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18 Participants were recruited using the crowdsourcing website, Prolific Academic.  
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20 Crowdsourcing websites enable recruitment of participants across a wide geographic area and  
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22 generate samples that are more demographically diverse than university samples (Goodman  
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24 and Paolacci, 2017). Filters were applied so the study was only advertised to platform users  
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26 who are currently residing in the UK and age 18 to 23 years. Two hundred and seventy-six  
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28 participants accessed the online questionnaire and 270 completed the study (97.8%  
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30 completion rate). Thirty participants failed at least two of the three attention checks and  
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32 therefore their data was excluded. The final sample included 119 (49.6%) males and 121  
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34 (50.4%) females with a mean age of 19.98 years ( $SD = 1.41$ ). The majority of participants  
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36 identified as White British (74.6%,  $n = 179$ ) and had obtained five top grade GCSEs (e.g., A\*  
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38 to C) (89.5%), with 62.5% having three A level qualifications grades A\* to C.  
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### 46 *Measures*

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48 Participants completed an online battery of questionnaires comprising *demographic*  
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50 *and background factors, firesetting disclosure items, and personality measures*. Internal  
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52 reliability is reported in accordance with George and Mallery's (2003) criteria:  $\geq .90$   
53  
54 excellent,  $\geq .80$  good,  $\geq .70$  acceptable, and  $\geq .60$  questionable.  
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57 **Demographic and historical background factors.** This section captured  
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59 demographic information including gender, ethnicity, number of siblings, psychiatric history,  
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3 education level, and family background (e.g., parental psychiatric history, witnessing  
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5 domestic violence, family finances, and family history of firesetting).  
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8 **Firesetting disclosure.** Participants completed three sets of questions in this section  
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10 including previous firesetting behaviour, the Fire Setting Scale (FSS; Gannon and  
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12 Barrowcliffe, 2012), and the Fire Proclivity Scale (FPS, Gannon and Barrowcliffe, 2012).  
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15 Previous firesetting was assessed using the self-report question developed by Gannon  
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17 and Barrowcliffe (2012), which aims to assess the two most common pathways to firesetting:  
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19 *antisociality and fire interest*. Participants were asked whether they had ever deliberately  
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21 ignited a fire(s) to *annoy other people, to relieve boredom, to create excitement, for*  
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23 *insurance purposes, due to peer pressure or to get rid of evidence*. Participants were  
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25 requested to exclude any fires they had set before the age of 10 years, fires started  
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27 accidentally, or fires started for organised events such as bonfires. Participants who endorsed  
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29 this item were then requested to provide further information via a series of forced choice  
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31 questions including number of deliberate fires set, age at first and last firesetting incident, if  
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33 they had been formally apprehended or received therapy for their firesetting, factors  
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35 precipitating the firesetting (i.e., intoxication, planning), modus operandi (i.e., use of  
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37 accelerants, ignition points, distance of fire from home), motives and targets for the  
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39 firesetting, and response to the firesetting (i.e., attempts to extinguish the fire).  
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45 The FSS (Gannon and Barrowcliffe, 2012) contains two subscales, each comprising  
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47 10 items, measuring *Antisocial Behaviour* (e.g., *I like to engage in acts that are exciting and I*  
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49 *am a rule breaker*) and *Fire Interest* (e.g., *I am attracted to fire and I get excited thinking*  
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51 *about fire*). Items are rated using a 7-point Likert scale (1 = *not at all like me*, 7 = *very*  
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53 *strongly like me*). Gannon and Barrowcliffe (2012) report the FSS has good internal  
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55 consistency (overall  $\alpha = .86$ , *Antisocial Behaviour*  $\alpha = .80$ , *Fire Interest*  $\alpha = .85$ ). In the  
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present study, internal consistency ranged from good to excellent (overall  $\alpha = .90$ , *Antisocial Behaviour*  $\alpha = .81$ , *Fire Interest*  $\alpha = .94$ ).

The FPS (Gannon and Barrowcliffe, 2012) provides an indication of an individual's propensity to engage in firesetting. Participants read six hypothetical vignettes describing firesetting situations of varying degrees of severity, are asked to imagine themselves as the firesetting protagonist, and then respond to four questions using a 5-point Likert scale assessing: (1) *fascination* with the fire described (1 *not at all fascinated* to 5 *very strongly fascinated*), (2) *behavioural propensity* to act similarly (1 *would definitely not have done the same* to 5 *would definitely have done the same*), (3) *general arousal* to the fire described (1 *would not enjoy [watching it] at all* to 5 *would greatly enjoy [watching] it*), and (4) *general antisocialism* (1 *would not enjoy [watching others' reaction] at all* to 5 *would greatly enjoy [watching others' reaction]*). Gannon and Barrowcliffe (2012) report that the FPS and its subscales has questionable to good internal consistency (overall  $\alpha = .82$ , *fire fascination*  $\alpha = .82$ , *behavioural propensity*  $\alpha = .68$ , *fire arousal*  $\alpha = .83$ , and *general antisocialism*  $\alpha = .78$ ). In this study, internal consistency was excellent overall ( $\alpha = .90$ ), the *fire fascination*, *fire arousal*, and *general antisocialism* subscales were acceptable ( $\alpha = .78$ ,  $\alpha = .75$ ,  $\alpha = .74$  respectively), and the *behavioural propensity* subscale alpha was questionable ( $\alpha = .62$ ).

**Personality measures.** Personality factors identified in the literature as being associated with firesetting in adults or adolescents were assessed using single items and short questionnaires which were all measured using a 7 point Likert Scale (1 = *not at all like me*, 7 = *very strongly like me*).

Anger was assessed using three items: *I consider myself to be an angry person*, *I often get mad*, *I have a fiery temper*, which were combined to produce a single score of how anger is experienced. The resulting scale had good internal reliability ( $\alpha = .85$ ).

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3 Emotional loneliness was measured using two items: *I consider myself to be a lonely*  
4 *person*, and *I wish I had more friends*. The two single items relating to loneliness were  
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6 combined in the subsequent analyses and had an acceptable level of reliability ( $\alpha = .72$ ).  
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10 Assertiveness was measured using a single item: *I am an assertive person*.

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12 Boredom proneness was measured using a single item: *I get bored easily*.

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14 Criminal associates was measured using a single item: *I have friends who are*  
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16 *criminals*.  
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18  
19 Attachment was measured using the Relationship Questionnaire (RQ; Bartholomew  
20 and Horowitz, 1991). The RQ assesses adult's attachment styles across different relationship  
21 domains. Participants read four short paragraphs referring to attachment styles (e.g., *secure*,  
22 *preoccupied*, *fearful*, and *dismissing*) and indicated which style is most applicable to them. In  
23 addition, Likert scale responses provide a continuous rating of individuals' attachment pattern  
24 (1 = disagree strongly, 7 = agree strongly).  
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33 Parental bonding was measured using the Parental Bonding Instrument (PBI; Parker,  
34 Tupling and Brown, 1979). The *PBI* comprises 25 items measuring the perception of being  
35 parented up to age 16. Participants retrospectively comment on their perceptions of parental  
36 care (12 items relating to care, e.g., *my mother/father was affectionate to me*) and  
37 overprotection (13 items associated with overprotection, e.g., *my mother/father tried to*  
38 *control everything I did*) for their mother and father separately. Parental styles are rated using  
39 the headings (*very like*, *moderately like*, *moderately unlike* and *very unlike*) with higher  
40 scores indicating increased parental care or over protectiveness. The subscales of the PBI  
41 have been shown to have acceptable to good internal reliability (*maternal care*  $\alpha = 0.75$ ,  
42 *maternal control*  $\alpha = 0.82$ , *paternal care*  $\alpha = 0.80$ , and *paternal control*  $\alpha = 0.83$ ; Canetti *et*  
43 *al.*, 1997). In the current study, alpha coefficients ranged from good to excellent (*maternal*  
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3 care  $\alpha = 0.93$ , maternal over protection  $\alpha = 0.90$ , paternal care  $\alpha = 0.94$ , paternal over  
4 protection  $\alpha = 0.87$ , parental care  $\alpha = 0.95$ , and parental over protection  $\alpha = 0.90$ ).  
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8 Impression management was assessed using the Balanced Inventory of Desirable  
9 Responding – Impression Management (BIDR-IM; Paulhus, 1984; 1988). The BIDR-IM  
10 comprises 20 items rated on a 5-point Likert scale (1 = *not true*, 5 = *very true*). The BIDR-IM  
11 has established psychometric properties with acceptable to good internal consistency ( $\alpha$   
12 ranging from .75 to .86; Paulhus, 1988). In the current study internal consistency was  
13 acceptable  $\alpha = .75$ .  
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### 23 **Procedure**

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25 The research was approved by a University Research Ethics Committee (Reference:  
26 20153388). The study was advertised to Prolific Academic members aged 18 to 23 years and  
27 living in the UK. An information sheet appeared before the start of the questionnaire and  
28 participants were informed that continuing with the study indicated consent. Participants were  
29 requested not to disclose any personally identifying information about themselves or fires  
30 they may have ignited and informed their responses were anonymous. The questionnaire took  
31 approximately 15 to 20 minutes to complete and participants had a maximum of 50 minutes  
32 to complete the study and were paid £1.50 for their time. Three attention check questions  
33 were included which prompted participants to select a particular response. Participants were  
34 informed they needed to successfully answer the attention checks to receive payment. On  
35 completion of the study a written debrief was provided.  
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### 52 **Results**

#### 53 ***Firesetting Prevalence and Features***

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55 Twenty-five percent of participants ( $n = 60$ ) reported igniting a deliberate fire. The  
56 majority of firesetting participants identified as male ( $n = 43$ , 71.7%) and White British ( $n =$   
57 45, 75.0%). Firesetting and non-firesetting participants were similar in their level of  
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3 qualifications with 90% ( $n = 54$ ) of firesetting participants having achieved five top grade  
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5 GCSE qualifications (A\* to C) and 55% ( $n = 33$ ) having achieved three A Level  
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7 qualifications graded A\* to C (see Table I for an overview).  
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12 INSERT TABLE I HERE  
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17 On average, firesetting individuals reported igniting their most recent fire during mid-  
18 adolescence ( $M = 16$  years,  $SD = 3.09$ ), 35% ( $n = 21$ ) continued to ignite fires in adulthood  
19 (18 to 22 years), and one ignited their first fire in adulthood (age 19). Just over half ignited  
20 multiple fires (55%,  $n = 33$ ). Seventeen firesetting individuals (28.3%) self-reported igniting  
21 five or more fires.  
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24 Targets of deliberate fires were predominantly paper products ( $n = 15$ , 25%; e.g.,  
25 *paper and books*) followed by *grass, shrubbery, or dry leaves* ( $n = 14$ , 23.3%), *bins outside*  
26 ( $n = 9$ , 15.0%), and *toilet roll dispensers* ( $n = 8$ , 13.3%). The majority of firesetting  
27 participants ( $n = 38$ , 63.3%) reported igniting fires within one mile of their home (e.g.,  
28 walking distance). Ten (16.7%) reported copying a fire they had seen in the media. The  
29 majority of firesetting participants ignited their fires with other people ( $n = 39$ , 65.0%) and  
30 reported being sober at the time of ignition ( $n = 51$ , 85%) (see Table II).  
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46 INSERT TABLE II HERE  
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51 Although firesetting individuals reported engagement with criminal behaviour only  
52 three reported having criminal convictions; one for vandalism, one for antisocial behaviour,  
53 and one for antisocial behaviour and a violent crime. None reported having an arson  
54 conviction or having received any therapy for firesetting. The majority of firesetting  
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participants ( $n = 49$ , 81.7%) reported extinguishing their own fires, 16.7% ( $n = 11$ ) reported leaving the fire to burn itself out, none reported the fire service extinguishing their fires.

Firesetting participants reported multiple motivations for firesetting. The most frequently reported motives included *curiosity and experimenting with fire* ( $n = 48$ , 80%), *to create fun/excitement or alleviate boredom* ( $n = 47$ , 78.3%), and *a love of fire* (30%,  $n = 18$ ). Less common motivations included setting fire as part of a dare or prank (8.3%,  $n = 5$ ), due to stress or frustration (8.3%,  $n = 5$ ), to protect themselves (5%,  $n = 3$ ), for another reason not specified (5%,  $n = 3$ ), due to problems at home or school (3.3%,  $n = 2$ ), vandalism (3.3%,  $n = 2$ ), to cover up another crime/destroy evidence (1.7%,  $n = 1$ ). No participants reported being motivated by revenge, or for an insurance payout or financial gain.

In terms of preventative factors, 35% ( $n = 21$ ) of firesetting participants reported increased impulse control would have prevented them from firesetting. However, another third reported *nothing* would have prevented them from firesetting ( $n = 20$ ). Less frequently reported preventative factors included increased fire safety knowledge (13.3%,  $n = 8$ ), increased confidence to stand up to peers (10%,  $n = 6$ ), increased parental supervision (10%,  $n = 6$ ), being less bored (3.3%,  $n = 2$ ), and other factors (11.6%,  $n = 7$ ).

## Comparison of firesetting and non-firesetting participant characteristics

### *Demographic and historical variables*

Firesetting and non-firesetting participants could not be differentiated on the majority of demographic and historical factors (see Table I). Relative to non-firesetting individuals, those who set fires were more likely to report witnessing domestic violence  $\chi^2(1, n = 240) = 10.72, p \leq .001, \phi = .23$ , have easy access to fire paraphernalia as teenagers  $\chi^2(1, n = 240) = 10.47, p \leq .001, \phi = .22$ , and truanted more than once a week  $\chi^2(1, n = 240) = 8.96, p \leq .001, \phi = .21$ . In addition, firesetting participants were significantly more likely to report

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3 experimenting with fire before age 10  $\chi^2(1, n = 240) = 8.50, p \leq .001, \phi = .20$ , and have a  
4  
5 family history of firesetting  $\chi^2(1, n = 204) = 18.83, p \leq .001, \phi = .32$ .  
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8 Although firesetting and non-firesetting participants did not significantly differ on  
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10 self-reported criminal convictions there were some differences in terms of engagement in  
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12 illegal behaviour (See Table I). Firesetting individuals were significantly more like to report  
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14 having engaged in robbery  $\chi^2(1, n = 240) = 4.58, p \leq .03, \phi = .16$ , assault  $\chi^2(2, n = 240) =$   
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16  $11.53, p \leq .01, \phi = .24$ , shoplifting  $\chi^2(1, n = 240) = 11.05, p \leq .001, \phi = .27$ , property  
17  
18 vandalism  $\chi^2(1, n = 240) = 8.28, p \leq .001, \phi = .20$ , having taken cannabis or dope  $\chi^2(1, n =$   
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20  $240) = 11.25, p \leq .001, \phi = .23$ , and taking 'harder' drugs such as Cocaine, Ecstasy or Heroin  
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22  $\chi^2(1, n = 240) = 7.37, p \leq .001, \phi = .19$ .  
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### 28 *Personality measures*

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30 After applying Bonferroni adjustments ( $p \leq .007$ ), independent samples t-tests showed  
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32 firesetting participants scored significantly higher than non-firesetting participants on having  
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34 criminal friends  $t(81.53) = -3.45, p < .001$  (mean difference =  $-.97$ , 95% CI:  $-1.52, -.41, d =$   
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36  $.40$ ) and on their levels of impulsivity, with firesetting participants reporting significantly  
37  
38 higher levels of impulsivity compared to non-firesetting participants  $t(238) = -3.77, p < .001$   
39  
40 (mean difference =  $.85$ , 95% CI:  $-1.29, -.41, d = -.56$ ). There were no significant differences  
41  
42 between the groups on the level of supervision as teenagers, experiences of anger, boredom,  
43  
44 assertiveness, or emotional loneliness.  
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49 The BIDR-IM was significantly negatively correlated with the FSS and the FPS when  
50  
51 computed separately for both firesetting ( $r = -.47, r = -.34$  respectively) and non-firesetting  
52  
53 participants ( $r = -.34, r = -.24$  respectively). Therefore, this was included as a covariate in  
54  
55 subsequent analyses.  
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Mean scale scores were calculated for firesetting and non-firesetting participants, see Table III. Separate one-way between-groups multivariate analysis of covariance (MANCOVA) examined any differences between firesetting and non-firesetting participants on the FSS and FPS. None of the assumptions of normality, linearity, outliers, multicollinearity, and homogeneity of variance-covariance were violated. Firesetting individuals scored significantly higher than non-firesetting individuals on both the total FSS score  $F(2,236) = 11.13, p < .001$ ; Wilks'  $\Lambda = .91$ ;  $\eta_p^2 = .09$ ;  $d = .78$ , and the individual subscales (*Antisocial*:  $F(1,237) = 13.40, p < .001$ ;  $\eta_p^2 = .05$ ;  $d = .64$ ; *Fire Interest*:  $F(1,237) = 13.16, p < .001$ ;  $\eta_p^2 = .05$ ;  $d = .62$ ). Firesetting individuals also scored significantly higher than non-firesetting individuals on the total FPS score,  $F(4,234) = 4.74, p < .01$ ; Wilks'  $\Lambda = .93$ ;  $\eta_p^2 = .08$ ;  $d = .65$  and all subscales (*Fascination*  $F(1,237) = 9.65, p = .002$ ;  $\eta_p^2 = .04$ ;  $d = .55$ , *Behavioural Propensity*  $F(1,237) = 18.21, p < .001$ ;  $\eta_p^2 = .07$ ;  $d = .71$ , *Arousal Index*  $F(1,237) = 9.83, p = .002$ ;  $\eta_p^2 = .04$ ;  $d = .57$ , and *Antisocial Index*  $F(1,237) = 4.94, p = .008$ ;  $\eta_p^2 = .02$ ;  $d = .33$ ). Firesetting and non-firesetting participants did not significantly differ on the PBI or RQ.

INSERT TABLE III HERE

### ***Classifying firesetting and non-firesetting participants***

Firesetting and non-firesetting participants were distinguishable across 15 variables. To reduce the number of variables, some were collapsed into single overarching items (e.g., the drugs variables of Dope and Cannabis, and Cocaine, Ecstasy, or Heroin were combined as *taken any illegal drugs*; robbery, assault, shop theft, and vandalism were combined as *criminal behaviour*). The remaining nine variables could broadly be grouped as **parental supervision and behavioural issues** (e.g., witnessing domestic violence, experimenting with fire before age 10, and family history of deliberate firesetting), **antisocial behaviours** (e.g., having criminal friends, impulsivity, teenage access to fire paraphernalia, skipped class more

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3 than once a week, taken any illegal drugs, and participation in criminal behaviour), and fire  
4 related interests, attitudes, and propensities (e.g., *Fire Setting Scale* and *Fire Proclivity*  
5 *Scale*). Three hierarchical binary logistic regression models examined the association  
6  
7  
8 between each group of factors and firesetting status. The BIDR-IM was entered into block  
9  
10 one and the above-mentioned predictor variables were entered into block two.  
11  
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14 The model for parental supervision and behavioural issues was significant  $\chi^2(4, n =$   
15  $204) = 32.06, p < .001$  and therefore able to distinguish between firesetting and non-  
16  
17 firesetting participants. Overall, the model explained between 14.5% (Cox and Snell R  
18  
19 Square), and 22.2% (Nagelkerke R squared) of the variance in firesetting status, and correctly  
20  
21 classified 79.4% of cases overall, 26.1% of the firesetting participants, and 94.9% of the non-  
22  
23 firesetting participants. Having experimented with fire before age 10 (OR = 2.70) and having  
24  
25 a family history of deliberate firesetting (OR = 5.32) were significantly associated with  
26  
27 firesetting status, having witnessed domestic violence was approaching significance ( $p = .05,$   
28  
29 OR = 2.60) (see Table IV).  
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35 The model for antisocial behaviours was also significant  $\chi^2(7, n = 240) = 45.92, p <$   
36  
37  $.001$ , and therefore able to distinguish between firesetting and non-firesetting participants.  
38  
39 The overall model explained between 17.4% (Cox and Snell R Square), and 25.8%  
40  
41 (Nagelkerke R squared) of the variance in firesetting status, and correctly classified 79.2% of  
42  
43 cases overall, 31.7% of firesetting participants, and 95.0% of the non-firesetting participants.  
44  
45 Impulsivity (OR = 1.37), teenage access to fire paraphernalia (OR = 5.54), and criminal  
46  
47 behaviour (OR = 2.37) were statistically significant predictors of firesetting although odds  
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49 ratios were small (see Table IV).  
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54 The model for fire-related interests, attitudes, and propensities was also significant  $\chi^2$   
55  
56  $(3, n = 240) = 28.31, p < .001$ , and therefore able to distinguish between firesetting  
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58 participants and non-firesetting participants. The model explained between 11.1% (Cox and  
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3 Snell R Square) and 16.5% (Nagelkerke R squared) of the variance in firesetting status, and  
4  
5 correctly classified 75.8% of cases overall, 15% of firesetting participants and 96.1% of the  
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7 non-firesetting participants. However, only the *Firesetting Scale* (OR = 1.03) was a  
8  
9 statistically significant predictor of firesetting status (see Table IV).  
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15 INSERT TABLE IV HERE  
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### 19 Discussion

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21 This study sought to extend understanding of the prevalence and psychological  
22  
23 characteristics associated with un-apprehended firesetting in a sample of 18 to 23 year old  
24  
25 UK adults; **representing the first empirical investigation of firesetting in an emerging adult**  
26  
27 **population**. Twenty-five percent of participants self-reported having set at least one deliberate  
28  
29 fire since the age of 10 with just over half reporting having set multiple fires. Just under two  
30  
31 thirds reported only setting fires in adolescence, however, just over a third reported continued  
32  
33 firesetting in adulthood. The prevalence of un-apprehended firesetting identified in the  
34  
35 current study is notably higher than that reported in both the NESARC survey (1-1.3%;  
36  
37 Blanco *et al.*, 2010; Vaughn *et al.*, 2010) and in Barrowcliffe and Gannon's previous studies  
38  
39 with UK community adults (11% to 17.8%; Barrowcliffe and Gannon, 2015, 2016; Gannon  
40  
41 and Barrowcliffe, 2012). However, it is more aligned with those reported in community  
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43 samples of adolescents (e.g., 27 to 29%; Del Bove *et al.*, 2008; MacKay *et al.*, 2009). It is  
44  
45 therefore possible that by restricting recruitment to those age 18 to 23 years, potential recall  
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47 biases that may have occurred in previous studies were addressed and therefore this study  
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49 provides a more accurate representation of the prevalence of un-apprehended firesetting in  
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51 emerging adults.  
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3 In terms of offence characteristics, the targets of firesetting tended to be small items  
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5 such as paper, grass and bins and fires were set in the presence of others. If fires were  
6  
7 extinguished, this was by the individual rather than the fire service. These findings are  
8  
9 consistent with previous un-apprehended firesetting research (e.g., Barrowcliffe and Gannon  
10  
11 2015, 2016); however, in contrast, apprehended firesetting adults are reported to set fires  
12  
13 alone and to property/buildings of personal or public significance (e.g., Canter and Fritzon,  
14  
15 1998; Ritchie and Huff, 1999; Rix, 1994). These subtle differences in fire behaviours may  
16  
17 explain why some individuals go un-apprehended for firesetting, as their fires are smaller,  
18  
19 less emotionally salient, and likely to be extinguished by the individual.  
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23  
24 In terms of psychological characteristics, firesetting participants significantly differed  
25  
26 from non-firesetting participants on levels of impulsivity, teenage access to fire  
27  
28 paraphernalia, participation in un-convicted criminal behaviour, elevated fire interest and  
29  
30 antisocial behaviours and an increased propensity to set fires, experimentation with fire  
31  
32 before 10 years of age, and having a family history of firesetting. Having a family history of  
33  
34 firesetting and teenage access to fire paraphernalia were variables most strongly associated  
35  
36 with firesetting status. These findings are broadly consistent with research of both  
37  
38 apprehended firesetting adults and adolescents (e.g., Del Bove *et al.*, 2008; Gannon *et al.*,  
39  
40 2013; MacKay *et al.*, 2009; Martin *et al.*, 2004; Rice and Harris, 1996) and research showing  
41  
42 influences on fire learning (Thomas, MacKay, and Salsbury, 2012). However, there are some  
43  
44 notable differences; for example, whilst un-apprehended individuals appear to have increased  
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46 levels of antisocial behaviour compared to non-firesetting individuals, unlike apprehended  
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48 samples, this behaviour appears to have gone undetected as indicated by the low number of  
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50 participants with previous convictions. Further, despite being more likely than non-firesetting  
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52 individuals to use substances, un-apprehended firesetting participants predominantly report  
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3 not being intoxicated at the time of the firesetting which is in contrast to findings with  
4  
5 apprehended samples (e.g., Ritchie and Huff, 1999; Rix, 1994).  
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8 In terms of motivations, the most frequently reported motives for firesetting by un-  
9  
10 apprehended individuals were to create excitement, alleviate boredom, or to satisfy curiosity;  
11  
12 none of the participants who self-reported firesetting in this current study (nor previous UK  
13  
14 un-apprehended firesetting studies) cited revenge as a motive. In contrast, research with  
15  
16 apprehended firesetting individuals suggests revenge is one of the most common motivations  
17  
18 firesetting whereas boredom is less common (Rix, 1994). It therefore appears un-  
19  
20 apprehended individuals are less likely to ignite fires for emotionally driven reasons but  
21  
22 instead ignite fires for immediate gratification. This may also explain why perpetrators of un-  
23  
24 apprehended fires are likely to have smaller targets and therefore are less likely to come to  
25  
26 the attention of the authorities.  
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31 Taken together, the findings from the current study highlight the importance of  
32  
33 primary prevention initiatives for reducing the incidence of un-apprehended deliberate  
34  
35 firesetting. More specifically, they emphasise the importance of initiatives for both parents  
36  
37 and young people to reduce risk factors of parental supervision, access to fire paraphernalia,  
38  
39 curiosity and interest in fire, and modelling of problematic fire use. Fire safety education  
40  
41 represents an existing strategy that may hold value for preventing un-apprehended firesetting.  
42  
43 However, further research is needed to understand the full range of risk and protective factors  
44  
45 for un-apprehended firesetting. Understanding both factors that are associated with firesetting  
46  
47 and those that protect individuals from engaging in this behaviour will provide useful targets  
48  
49 for prevention and early intervention initiatives.  
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54 A notable strength of the current study is that it utilised an anonymous online survey  
55  
56 to capture self-reported firesetting, overcoming limitations associated with previous research  
57  
58 using face-to-face methods (e.g., Blanco *et al.*, 2010; Vaughn *et al.*, 2010). It also sought to  
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2  
3 overcome limitations with recall bias associated with previous research, by restricting  
4  
5 participation to those age 18 to 23 years. That said, limitations of the research include its  
6  
7 reliance on self-report measures to capture firesetting behaviour, the use of a crowdsourcing  
8  
9 platform to recruit participants, and the reliance on single item questions to assess certain  
10  
11 psychological characteristics (e.g., boredom, assertiveness, and antisocial associates). First,  
12  
13 the firesetting disclosure question exclusively focused on self-reported fires that were for  
14  
15 antisocial or fire interest purposes, potentially excluding individuals who set fires for other  
16  
17 reasons (e.g., to communicate feelings of distress). Second, whilst crowdsourcing platforms  
18  
19 are considered to provide more geographically and demographically diverse samples than  
20  
21 university samples, they have also been criticised for not necessarily producing samples that  
22  
23 are representative of the general population (i.e., high rates of Caucasian, highly educated,  
24  
25 and student respondents; Peer, Brandimart, Samat, and Acquisti, 2017). However, research  
26  
27 suggests crowdsourcing platforms are useful for obtaining high quality data, particularly for  
28  
29 clinically relevant psychopathology, whilst also providing anonymity (Shapiro, Chandler, and  
30  
31 Mueller, 2013). Finally, the use of single items to assess some psychological characteristics  
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33 may have meant that differences between the two groups that may have been detected by  
34  
35 more sensitive measures were missed. Future research would benefit from addressing the  
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37 limitations associated with the current study to further our understanding of un-apprehended  
38  
39 firesetting.  
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47 Whilst the current study extends previous research on un-apprehended firesetting,  
48  
49 variables selected for inclusion in the study were based on the apprehended firesetting  
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51 literature. Although there are some clear similarities between apprehended and un-  
52  
53 apprehended firesetting individuals, there are also some notable differences. Given un-  
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55 apprehended firesetting individuals appear to be emerging adults who are engaged in a range  
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57 of antisocial behaviours, future research may benefit from examining whether psychological  
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3 characteristics that are more broadly associated with antisocial behaviour in adolescents and  
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5 emerging adults are also associated with firesetting. The more we can learn about un-  
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7 apprehended firesetting the better we can detect, intervene, and ultimately prevent this  
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10 behaviour and the serious consequences it has.  
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Table I. Firesetting and non-firesetting participants background and demographic characteristics.

Variable	Firesetting	Non-firesetting
	( <i>n</i> = 60)	( <i>n</i> = 180)
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )
<b>Demographics</b>		
Age	20.1 (1.5)	19.9 (1.4)
Siblings (number)	2.5 (1.1)	2.3 (.9)
	<b>Percentage yes (<i>n</i>)</b>	<b>Percentage yes (<i>n</i>)</b>
Males	71.7 (43)	42.2 (76)
Females	28.3 (17)	57.8 (104)
White British	75.0 (45)	74.4 (134)
White Other	5.0 (3)	8.4 (15)
Black African	1.7 (1)	1.7 (3)
Mixed ethnic background	8.3 (5)	3.9 (7)
Indian	1.7 (1)	5.0 (9)
Pakistani	3.3 (2)	0
Chinese	1.7 (1)	3.9 (7)
Other ethnic background	3.3 (2)	2.8 (5)
Formal qualifications 5 GCSE A* to C	90.0 (54)	89.4 (161)
Formal qualifications 3 A Levels A* to C	55.0 (33)	65.0 (117)
History of enuresis	11.7 (7)	8.3 (15)
Psychiatric illness diagnosis	18.3 (11)	20.0 (36)
Physical disability diagnosis	0 (0)	1.61 (2)
Behavioural problem diagnosis	3.3 (2)	2.8 (5)
As a teenager had easy access to fire paraphernalia	95.0 (57)**	74.4 (134)
Suspension from school	10.0 (6)	6.7 (12)
Expulsion from school	3.3 (2)	2.8 (5)
Deliberately skipped class more than once a week	28.3 (17)**	11.1 (20)
History of suicide	13.3 (8)	7.2 (13)
History of self-harm	35.0 (21)	31.1 (56)
Exerted power over a partner	10.0 (6)	2.8 (5)
Underage drinking	70.0 (42)	57.8 (104)
Smoking	63.3 (38)	51.7 (93)
Experimented with fire before the age of 10	50.0 (30)**	28.3 (51)
<b>Self-reported criminal behaviour</b>		
Taken drugs e.g., Dope/Cannabis	70.0 (42)***	43.9 (79)
Taken drugs e.g., Cocaine, Ecstasy or Heroin	35.0 (21)**	17.2 (31)

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3	Taken any drugs	68.3 (41)***	43.9 (79)
4	Assault	18.3 (11)***	3.9 (7)
5	Sexual assault	0	0
6	Robbery	11.7 (7)*	3.3 (6)
7	Shop theft	38.3 (23)***	16.7 (30)
8	Vandalism	21.7 (13)**	7.2 (13)
9	Burglary	1.7 (1)	0
10	Fraud	6.7 (4)	2.2 (4)
11	Car theft	0	0
12	Threatened someone with a weapon	0	0
13	Reported receiving a criminal conviction	5.0 (3)	0.1 (1)
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21	<b>Family Background</b>		
22	Lack of money (i.e., sometimes not enough money for food)	20.0 (12)	16.7 (30)
23	Witnessed domestic violence	28.3 (17)**	10.0 (18)
24	Mother diagnosed with a psychiatric illness	21.7 (13)	20.0 (36)
25	Father diagnosed with a psychiatric illness	20.0 (12)	9.4 (17)
26	Mother smoked	21.7 (13)	22.2 (40)
27	Father smoked	28.3 (17)	25.0 (45)
28	As a child had easy access to fire paraphernalia	46.7 (28)	37.8 (68)
29	A family member also ignited a deliberate fire	32.6 (15)***	7.0 (11)
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$\chi^2$  with 95% confidence \* $p < .05$ , \*\*  $p < .01$ , \*\*\* $p < .001$ .

Table II. Deliberate firesetting offence characteristics.

<b>Offence Characteristics</b>	<b>Percentage yes (n)</b>
<b>Number of deliberate fires ignited</b>	
One	45.0 (27)
Two	16.7 (10)
Three	8.3 (5)
Four or more	30.0 (18)
<b>Ignition point and target</b>	
One ignition point	63.3 (38)
Multiple ignition points	36.7 (22)
Paper, books or newspapers	25.0 (15)
Ignited countryside (e.g., grass/ shrubbery)	23.3 (14)
Ignited a bin outside	15.0 (9)
Ignited a toilet roll dispenser	13.3 (8)
Ignited clothing	10.0 (6)
Ignited a bin inside	8.3 (5)
Ignited an animal which was alive	3.3 (2)
Mattress or bedding	1.7 (1)
Ignited fire within a mile of home	63.3 (38)
Copied a fire seen in the media	16.7 (10)
<b>Fires ignited alone or with accomplices</b>	
Ignited fire alone	35.0 (21)
Ignited fire with 1 other person	23.3 (14)
Ignited fire with 2 other people	16.7 (10)
Ignited fire with 3+ people	25.0 (15)
<b>State of mind</b>	
Believed they were in control of the fire	93.3 (56)
Sober at time of ignition	85.0 (51)
Planned the fire	31.7 (19)
Under the influence of drugs at time of ignition	3.3 (2)

**Motivations\***

Curiosity and experimentation with fire	80.0 (48)
To create fun/excitement or alleviate boredom	78.3 (47)
A love of fire	30.0 (18)
Dare or prank	8.3 (5)
Stress or frustration	8.3 (5)
Protection	5.0 (3)
Reason not specified	5.0 (3)
Problems at home or school	3.3 (2)
Vandalism	3.3 (2)
To cover up another crime/ destroy evidence	1.7 (1)
Revenge	0
Insurance payout or financial gain	0

**Extinguishing the fire**

Took part in extinguishing the fire	81.7 (49)
Left the fire to burn itself out	18.3 (11)
The Fire Service extinguished the fire	0

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\*Note: Some firesetters ( $n = 46$ , 76.7%) indicated multiple motivations.



Table III: Personality measures for firesetting and non-firesetting participants

Items/Scale	Firesetting		Non-Firesetting	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Anger	10.29	4.78	8.75	4.25
Emotional loneliness	8.25	3.02	8.26	3.34
Assertiveness	4.22	1.61	3.79	1.60
Impulsivity	4.57***	1.42	3.72	1.54
Boredom proneness	5.02	1.41	4.72	1.43
Supervision as a teenager	3.50	1.48	4.02	1.23
Criminal associates	3.13***	2.0	2.17	1.48
<b>FSS</b>	71.60***	(19.44)	57.03	(17.76)
Behavioural items	31.03***	(10.34)	24.89	(8.78)
Fire Interest items	40.57***	(13.52)	32.14	(13.46)
<b>FPS</b>	57.67***	(13.34)	49.09	(12.97)
Fire Fascination	17.68***	(4.82)	15.08	(4.62)
Behavioural Propensity	13.17***	(3.64)	10.73	(3.24)
Fire Arousal	16.48***	(4.25)	13.97	(4.48)
Antisociality	10.33*	(3.38)	9.31	(2.79)
<b>PBI</b>				
Maternal Care	26.37	(7.62)	27.79	(7.65)
Maternal Over protectiveness	14.57	(7.93)	13.19	(7.39)
Paternal Care	21.96	(10.12)	23.66	(8.47)
Paternal Over protectiveness	9.75	(7.19)	10.61	(7.16)
Parental Care	48.20	(15.09)	51.41	(14.40)
Parental Over protectiveness	24.53	(11.60)	23.80	(12.16)
<b>BIDR - IM</b>	53.88	(11.58)	58.06	(10.25)
<b>Attachment style based on Likert responding</b>				
Secure	4.22	(1.91)	4.05	(1.75)
Fearful	4.22	(1.90)	4.52	(1.81)
Preoccupied	3.65	(1.89)	4.03	(1.77)

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3	Dismissing	4.00	(1.94)	3.77	(1.85)
4					
5	<b>Attachment style based on categorical responding</b>				
6					
7		<b>Percentage</b>	<b>(n)</b>	<b>Percentage</b>	<b>(n)</b>
8					
9	Secure	36.7	(22)	31.1	(56)
10	Fearful	18.3	(11)	21.1	(38)
11	Preoccupied	25.0	(15)	35.0	(63)
12	Dismissing	20.0	(12)	12.8	(23)
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15	<i>*p ≤ .05, **p &lt; .01, ***p ≤ .001</i>				

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Table IV. Logistic Regressions predicting firesetting status based on parental supervision and behavioural issues, anti-social behaviours and fire related interests, attitudes and propensities

	$\beta$	S.E.	Wald	df	<i>p</i>	Odds Ratio	95% C.I. For Odds Ratio	
							Lower	Upper
<b>Parental supervision and behavioural issues</b>								
BIDR-IM	-0.2	.02	1.30	1	.26	.98	.95	1.01
Witnessing domestic violence	.96	.49	3.83	1	.05	2.60	2.09	13.52
Experimented with fire before age 10	1.00	.38	7.02	1	.01	2.72	1.00	6.77
Family history of deliberate firesetting	1.67	.48	12.35	1	<.001	5.32	1.30	5.70
Constant	-.98	1.02	.93	1	.33	.38		
<b>Anti-social behaviours</b>								
BIDR-IM	.01	.02	.38	1	.54	1.01	.98	1.05
Criminal friends	.13	.10	1.73	1	.19	1.14	.94	1.40
Impulsivity	.31	.12	6.46	1	.01	1.37	1.07	1.74
Teenage access to fire paraphernalia	1.71	.64	7.22	1	.01	5.55	1.59	19.36
Skipped class more than once per week	.61	.44	1.88	1	.17	1.84	.77	4.39
Taken any drugs	.31	.36	.70	1	.40	1.36	.67	2.77
Participated in criminal behaviour	.86	.38	5.10	1	.02	2.37	1.12	5.03
Constant	-5.44	1.47	13.77	1	<.001	.004		
<b>Fire related interests, attitudes, and propensities</b>								
BIDR-IM	-.01	.02	.24	1	.63	.99	.96	1.02
Fire Setting Scale	.03	.01	7.34	1	.01	1.03	1.01	1.06
Fire Proclivity Scale	.02	.02	1.79	1	.18	1.02	.99	1.05
Constant	-4.32	.75	33.34	1	<.001	.01		