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## The characteristics of un-apprehended firesetters living in the UK community

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The prevalence and characteristics of un-apprehended, self-reported deliberate firesetters living in the community were examined. Ten percent of Thanet households in Kent, UK ( $n = 5568$ ) were randomly invited to participate in an online study investigating deliberate firesetting. Participants answered demographic questions, questions relating to any deliberate fires ignited and five questionnaires: *The Fire Setting* and *Fire Proclivity Scales* [Gannon & Barrowcliffe (2012). Firesetting in the general population: The development and validation of the Fire Setting and Fire Proclivity Scales. *Legal and Criminological Psychology*, 17(1), 105–122], *The BIDR* [version 6; Paulhus (1984). Two-component models of socially desirable responding. *Journal of Personality and Social Psychology*, 46, 598–609; Paulhus (1988). *Assessing self-deception and impression management in self reports: The balanced inventory of desirable responding*. Unpublished manual, University of British Columbia, Vancouver, Canada], *The Identification with Fire Scale* [Gannon, Ó Ciardha, & Barnoux (2011). The identification with fire questionnaire. Unpublished manuscript. CORE-FP, School of Psychology, University of Kent, UK] and *The Fire Attitude Scale* [Muckley (1997). Firesetting: Addressing offending behaviour. A resource and training manual. Redcar and Cleveland Psychological Service]. A question relating to deliberate firesetting was answered by 157 participants. Eighteen (11.5%) participants were classified as deliberate firesetters. Firesetters and non-firesetters were similar, but significantly more firesetters self-reported a history of self-harm, having a family member who ignited a deliberate fire, and a father with a psychiatric illness. Interestingly, significantly more non-firesetters reported experimenting with fire before the age of 10 compared to the firesetters. Firesetters also scored significantly higher compared to the non-firesetters on The Fire Setting Scale, The Fire Proclivity Scale, The Identification with Fire Scale and The Fire Attitude Scale. This new information shows promise in identifying community individuals who may require education or preventative work.

**Keywords:** Arson; firesetter; deliberate firesetting; fire interest; un-apprehended

Setting a deliberate fire can have devastating consequences. In England 68,900 deliberate fires were ignited between April 2012 and March 2013 which resulted in 68 fatalities (Department for Communities and Local Government [DCLG], 2013). Furthermore, the estimated cost of deliberate firesetting was £1.7 billion in 2008

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(DCLG, 2011). Unfortunately, however, deliberate firesetting in the form of *arson* has the poorest detection rate in England and Wales relative to other crimes (Smith, Taylor, & Elkin, 2013). For example, in 2013, of 19,306 arson offences reported, only 2316 (or 12%) resulted in official police detection (Smith et al., 2013). Thus, the vast majority of arson perpetrators remain un-apprehended.

*Arson* is a restrictive legal term used to refer to the unlawful and intentional destruction of property using fire (Kolko, 2002; Williams, 2005). The term *firesetting* is broader and encompasses all types of deliberate fires which may or may not have been legally recorded (Gannon & Pina, 2010). For the purposes of this paper, the term *arson* will be used only with reference to the specific crime and *firesetting* will be used collectively to refer to all deliberate firesetting.

A comprehensive understanding of those who deliberately set fires is integral to managing and controlling firesetting effectively (Doley, 2003). However, to date, the majority of empirical literature is severely skewed towards investigating the characteristics of apprehended populations. Research shows that apprehended firesetters share common characteristics. For example, apprehended firesetters tend to be male (Bradford, 1982; Muller, 2008; Pettit, 1987; Räsänen, Hakko, & Väisänen, 1995; Rautahaimo, 1989), Caucasian (Gannon, 2010; Koson & Dvoskin, 1982), characterised by poor developmental experiences such as victimisation or abuse during childhood (Gannon, 2010; Noblett & Nelson, 2001; Saunders & Awad, 1991), separation from parents (Macht & Mack, 1968; Saunders & Awad, 1991; Tennent, McQuaid, Loughnane, & Hands, 1971) and poor education (Harmon, Rosner, & Wiederlight, 1985; Lewis & Yarnell, 1951; Rautahaimo, 1989). In addition apprehended firesetters are often reported to hold mental health issues (Räsänen et al., 1995; Tyler & Gannon, 2012), low IQ (Bradford, 1982; Harmon et al., 1985; Lewis & Yarnell, 1951; Rautahaimo, 1989), and substance abuse problems (Jayaraman & Frazer, 2006). Research also shows that apprehended firesetters report igniting their fires close to home (Bradford, 1982; Rautahaimo, 1989; Wachi et al., 2007).

Apprehended firesetters appear to hold a wide range of motivations underpinning their deliberate firesetting. Research indicates that revenge is the most highly prevalent motive associated with deliberate firesetting (Gannon, Ó Ciardha, Doley, & Alleyne, 2012; Koson & Dvoskin, 1982; Lewis & Yarnell, 1951; O'Sullivan & Kelleher, 1987; Rix, 1994; Swaffer & Hollin, 1995). Other motivators associated with deliberate firesetting are: vandalism and excitement (Gannon & Pina, 2010; Icove & Estep, 1987; Inciardi, 1970), peer pressure (Molnar, Keitner, & Harwood, 1984; Swaffer & Hollin, 1995), crime concealment (Dennet, 1980), self-protection (Tyler et al., 2014), political motivation (e.g. terrorist attacks and riots; Prins, 1994), communication (Geller, 1992), and self-injury and suicide (Jayaraman & Frazer, 2006; McKerracher & Dacre, 1966; Noblett & Nelson, 2001; O'Sullivan & Kelleher, 1987; Swaffer & Hollin, 1995).

Only a relatively small amount of research has been conducted with un-apprehended firesetters. The first studies utilised data from the US National Epidemiologic Survey on Alcohol and Related Conditions (NESARC; Blanco et al., 2010; Vaughn et al., 2010). Within this survey – which was conducted face to face – participants who responded positively to the question ‘in your entire life, did you ever start a fire on purpose to destroy someone else’s property or just to see it burn?’ were classified as firesetters. Using this definition, the prevalence rate of deliberate firesetters living in the US community was estimated to be 1–1.13% (Blanco et al., 2010; Vaughn et al., 2010) with the majority of firesetting being reported during adolescence

(i.e.  $\leq 15$  years; Blanco et al., 2010). NESARC data was obtained from a nationally representative sample.

NESARC firesetters ( $n = 407$ ) were compared to non-firesetters ( $n = 41,552$ ) on key socio-demographic factors. Specific risk factors for firesetting included: being male, US born, receiving a high annual income ( $> \$70,000$ ), and never having married (Blanco et al., 2010; Vaughn et al., 2010). DSM-IV diagnoses of anti-social personality disorder, drug dependence, bipolar disorder and pathological gambling were strongly associated with firesetting following statistical adjustments for socio-demographic factors (Blanco et al., 2010). Furthermore, firesetters were more likely to report engaging in anti-social behaviours (e.g. destroying property) relative to non-firesetters even when they did not have an ASPD diagnosis.

Within the NESARC research, the single question relating to firesetting is extremely vague and could have resulted in some respondents identifying childhood experimentation with fire as meeting the criteria for starting a fire 'on purpose to destroy someone else's property or just to see it burn' (Dickens, Sugarman, & Gannon, 2012). Furthermore, since interviews were conducted face to face, respondents may have been reluctant to answer questions truthfully for fear of reprisals (Dickens et al., 2012; Gannon & Barrowcliffe, 2012). It is also unclear from the NESARC data what types of fires were set, how severe the fires were, or whether the respondent was ever formally apprehended for their actions. Furthermore, variables highly related to apprehended firesetting (e.g. fire interest; Gannon et al., 2013) were not measured.

Recently, Gannon and Barrowcliffe (2012) set out to rectify some of the limitations of the NESARC research through assessing the prevalence and characteristics of unapprehended UK firesetters. They met with University and community individuals ( $n = 168$ ; 109 female) face to face yet attempted to reduce social desirability through ensuring participants placed their responses in an unlabelled envelope to protect anonymity. The study instructions explicitly requested participants to think about the *types* of fire that they had set and requested that certain types of fires (i.e. fires set before the age of 10 years,<sup>1</sup> ignited accidentally, or as part of organised events such as bonfires) should not be reported. Participants who had ignited a fire which matched the criteria were also requested to report detailed information about the fires that they had set (e.g. motives) and to complete measures designed specifically for the purpose of the study. All participants completed the rest of the questionnaire which included The Fire Setting Scale, comprising of two subscales measuring fire interest and anti-social behaviour and The Fire Proclivity Scale comprising of six hypothetical firesetting scenarios designed to measure firesetting proneness or proclivity. Using this measure, participants were asked to imagine themselves perpetrating each of the firesetting scenarios and then to rate their likelihood of *fire fascination*, *behavioural propensity* to act similarly, *arousal*, and *general anti-socialism* in relation to each scenario.

The prevalence rate of deliberate firesetters using this methodology was 11% ( $n = 18$ ); with the majority of respondents (89%,  $n = 16$ ) indicating that they had lit their fire(s) during adolescence due to boredom, peer pressure, to express feelings, or for excitement. None of the firesetters reported ever having been apprehended for their fires. A comparison of firesetters and non-firesetters on socio-demographic and historical variables elicited few notable differences. However, firesetters were significantly more likely to report having been diagnosed with behavioural problems or a conviction for a vandalism-related offence(s). On the newly developed Fire Setting Scale, firesetters – relative to non-firesetters – self-reported significantly higher levels of anti-social

behaviour but not fire interest. On the Fire Proclivity Scale, firesetters – relative to non-firesetters – self-reported significantly higher levels of *fire fascination*, *behavioural propensity*, and *arousal*. Of these factors, only the behavioural propensity subscale of the Fire Proclivity Scale entered the final discriminant function analysis equation successfully classifying firesetters at a rate of 91% overall.

The key limitation of this UK research is that participants were predominantly University students with females overrepresented; limiting the conclusions that could be drawn regarding the characteristics of un-apprehended firesetters. Furthermore, Gannon and Barrowcliffe (2012) did not include any measures examining identification with fire, or attitudes towards fire.

The aim of this study was to rectify existing knowledge gaps regarding the characteristics of un-apprehended firesetters. Previous research has concentrated almost exclusively upon the prevalence of un-apprehended firesetters with little consideration of the characteristics of this population. In the only paper that has focused on characteristics, the population was predominantly female and University based. In this paper we report on the characteristics of a sample of un-apprehended deliberate firesetters randomly selected from a high firesetting prevalence community within Kent, UK. We explore the predictive ability of basic demographics and use a combination of measures examining fire interest and identification, anti-social behaviour, and firesetting proclivity with the aim of predicting and discriminating between deliberate firesetters and non-firesetters.

## Method

### *Design*

To ensure an adequate sample size of un-apprehended firesetters, we examined data collected from UK Kent Fire and Rescue Services (Incident Response System, 2012) and chose a district within the county (i.e. Thanet) that was both geographically convenient to travel to and held the third highest prevalence of deliberate fires in Kent (1615 fires between April 2009–March 2012). Following this, ten percent of households ( $n = 5568$ ) were randomly selected by the first author using the website Dougal.co.uk and invited to partake in an online survey examining firesetting. To maintain even distribution, we ensured that survey invitation letters were delivered – by hand – to 10% of households within each of the 23 Wards officially documented within the district of Thanet.

### *Participants*

Two hundred and fifty six individuals accessed the online questionnaire survey. Of these, 158 answered the question relating to deliberate firesetting. One participant was excluded as they self-reported a conviction for arson. Twenty-four individuals left parts of the survey incomplete resulting in only 133 individuals who fully completed the survey (i.e. a 2.82% partial and 2.39% complete response rate respectively). Of the participants who answered the deliberate firesetting question, 78 reported themselves as male and 79 female; the majority identified themselves as White British ( $n = 153$ , 97.45%).<sup>2</sup> The majority of participants indicated that their highest level of education was GCSE or A Levels ( $n = 71$ ; 45.22%), and just under half of the participants indicated that they held a degree or higher degree ( $n = 63$ ; 40.13%) indicating

Table 1. Comparison of demographics and historical characteristics of self-reported firesetters and non-firesetters.

Variable	Firesetters <i>M</i> <i>SD</i>	Non-firesetters <i>M</i> <i>SD</i>
<i>Demographics</i>		
Siblings (number)	2.61 (.85)	2.81 (1.35)
	<i>Percentage yes (n)</i>	<i>Percentage yes (n)</i>
Formal qualifications	100 (18)	93.5 (130)
History of enuresis	5.6 (1)	1.4 (2)
Psychiatric illness diagnosis	22.2 (4)	18.5 (25)
Physical disability diagnosis	5.6 (1)	5.2 (7)
Expulsion from school	0 (0)	2.2 (3)
History of suicide	22.2 (4)	7.2 (10)
History of self-harm	27.8 (5)*	4.3 (6)
Criminal convictions	1.83 (.38)	1.92 (.27)
<i>Family background</i>		
Lack of money (i.e. sometimes not enough money for food)	38.9 (7)	20.9 (29)
Witnessed domestic violence	27.8 (5)	15.8 (22)
Mother diagnosed with a psychiatric illness	11.8 (2)	11.7 (15)
Father diagnosed with a psychiatric illness	21.4 (3)*	4.8 (6)
A family member also ignited a deliberate fire	38.9 (7)*	3.6 (5)

Note:  $\chi^2$  with 95% confidence.

\* $p \leq .05$ .

a preponderance towards highly educated participants. Key demographic details are outlined in Table 1. Participants did not receive any remuneration for their participation.

### *The measures*

Participants were requested to complete an online questionnaire and broadened from Gannon and Barrowcliffe (2012) which comprised a *demographic and historical background* section (e.g. questions relating to gender, number of siblings, family background, psychiatric history and education level) and a *firesetting disclosure* section. Within the firesetting disclosure section, similarly to Gannon and Barrowcliffe's (2012) protocol, participants were asked to indicate whether they had ever deliberately set a fire or fires to *annoy other people, to relieve boredom, to create excitement, for insurance purposes due to peer pressure or to get rid of evidence*. Participants were requested to exclude fires that they had set before the age of 10 years, fires started accidentally, or fires started for organised events such as bonfires. Participants who answered affirmatively to this item were then requested to disclose specific information relating to the offence via a series of forced choice questions examining: number of deliberate fires set, age at first and last firesetting incident, formal apprehension or therapy relating to their firesetting, factors precipitating the firesetting (i.e. intoxication, planning), modus operandi (i.e. use of accelerants, ignition points, distance of fire from home), motives and targets for the deliberate firesetting, and response to the firesetting (i.e. attempts to extinguish the fire). Participants were also asked to

indicate – to the best of their knowledge – whether anyone in their family had ever deliberately set a fire.

The final part of the questionnaire comprised five measures: *The Fire Setting Scale*, *The Fire Proclivity Scale*, *The BIDR* (version 6; Paulhus, 1984, 1988), *The Identification with Fire Scale* (Gannon, Ó Ciardha, & Barnoux, 2011) and *The Fire Attitude Scale* (Muckley, 1997).

*The Fire Setting Scale (FSS)*. The 20 item Fire Setting Scale (FSS) was specifically developed by Gannon and Barrowcliffe (2012) from empirical literature reviews examining the factors associated with apprehended adolescent and adult firesetters. The FSS has two subscales each containing 10 items measuring *anti-social behaviour* (e.g. *I like to engage in acts that are exciting* and *I am a rule breaker*) and *Fire Interest* (e.g. *I am attracted to fire* and *I get excited thinking about fire*). The items are rated using a 7-point Likert scale (1 = *not at all like me*, 7 = *very strongly like me*). Gannon and Barrowcliffe (2012) reported that the Fire Setting Scale had good internal consistency (overall  $\alpha = .86$ , anti-social behaviour  $\alpha = .80$ , Fire Interest  $\alpha = .85$ ) in their UK community sample. In the present study, we found internal consistency ranging from acceptable to excellent (overall  $\alpha = .90$ , anti-social behaviour  $\alpha = .72$ , Fire Interest  $\alpha = .92$ ). See [Appendix 1](#) for the full version of the FSS.

*The Fire Proclivity Scale (FPS)*. The Fire Proclivity Scale (FPS) was specifically developed by Gannon and Barrowcliffe (2012) to provide an indication of an individual's propensity to engage in firesetting using a combination of Bohner et al.'s (1998) Rape Proclivity Scale and the firesetting research literature. Participants read six hypothetical vignettes describing firesetting situations of varying degrees of severity, are asked to imagine themselves as the firesetting protagonist, and then are requested to respond to four questions using a 5-point Likert scale assessing: (1) *fascination* with the fire described in the scenario (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 in the scenario (1 *would not enjoy [watching it] at all* to 5 *would greatly enjoy [watching] it*), and (4) general anti-socialism (1 *would not enjoy [watching others' reaction] at all* to 5 *would greatly enjoy [watching others' reaction]*). Gannon and Barrowcliffe (2012) reported that the overall FPS had good internal consistency ( $\alpha = .82$ ). In addition the subscales were reported as holding internal consistency that ranged from acceptable to good (i.e. fire fascination  $\alpha = .82$ , behavioural propensity  $\alpha = .68$ , fire arousal  $\alpha = .83$ , and general anti-socialism  $\alpha = .78$ ). In the present study, there were similar levels of internal consistency (overall  $\alpha = .93$ , fire fascination  $\alpha = .86$ , behavioural propensity  $\alpha = .66$ , fire arousal  $\alpha = .81$ , and general anti-socialism  $\alpha = .76$ ). See [Appendix 2](#) for the full version of the FPS.

*The Identification with Fire Scale*. The Identification with Fire Scale was developed by Gannon et al. (2011) to measure a participant's level of identification with fire (e.g. *fire is almost part of my personality*). It contains 10 items rated on a 5-point Likert scale (1 = *strong disagreement*, 5 = *strong agreement*). The psychometric properties of the FAS have not been formally reported. In the present study, however, we found acceptable internal consistency ( $\alpha = .71$ ).

*The Fire Attitude Scale*. The Fire Attitude Scale (FAS; Muckley, 1997) is a 20 item measure rated on a 5-point Likert scale (1 = *strong disagreement*, 5 = *strong agreement*) and was originally designed for use within Fire and Rescue Services. The FAS items assess attitudes and beliefs about firesetting (e.g. *the best thing about fire is watching*

it spread). To date, the psychometric properties of the FAS have not been formally reported. In the present study, however, we found acceptable internal consistency ( $\alpha = .64$ ).

*Balanced Inventory of Desirable Responding.* Paulhus' Balanced Inventory of Desirable Responding (BIDR) (1984, 1988) is a 40 item scale rated on a 5-point Likert scale (1 = *not true*, 5 = *very true*). In this study, we examined the Impression Management (IM) scale; 20 items relating to intentional self-misrepresentation (e.g. *I never swear*). The BIDR IM scale has established psychometric properties and good internal consistency ( $\alpha$  ranging from .75 to .86; Paulhus, 1988). In the present study, we found similar levels of internal consistency  $\alpha = .83$ .

### **Procedure**

The study was ethically approved by the University's Research Ethics Committee (Ref 20122520). The lead author randomly selected households through postcode information and hand-delivered a letter to each selected household inviting participation in an online firesetting questionnaire. Online participants provided informed consent and were assured of anonymity. Participants were requested to refrain from disclosing identifiable information about either themselves, or the fires that they had set to ensure that the researcher was not obliged to inform the authorities regarding undisclosed arson offences. A written debrief appeared on screen after questionnaire completion. The debrief reiterated that the information provided would remain confidential and participants would not be personally identified. In addition participants were thanked for their participation and provided with contact numbers for organisations which could help should they wish to talk about any potential issues raised by the research.

### **Results**

#### ***Firesetting prevalence and features***

Eighteen participants (11.5%) reported having set a deliberate fire in the community. All of these firesetters reported themselves to be White British and as holding qualifications (i.e. GCSE or above). Just under two thirds of self-reported firesetters identified themselves as male ( $n = 11$ ; 61.1%). Firesetters reported igniting their deliberate fires between the ages of 10–51 years of age. Firesetting began between the ages of 10–35 years (median age 11.5 years) and the most recent fire was ignited between the ages of 11–51 years (median age 15 years). Only two firesetters (11.11%) reported that they ignited their first deliberate fire as adults and a total of seven firesetters (38.89%) ignited their most recent fire in adulthood.

Firesetters stated that they ignited either one fire (16.7%,  $n = 3$ ), two fires (22.2%,  $n = 4$ ), three fires (16.7%,  $n = 3$ ), or four or more fires (44.4%,  $n = 8$ ). None of the firesetters reported being apprehended for their fires nor had they ever received therapy for firesetting. However, three firesetters reported a general criminal conviction (e.g. vandalism, possession of drugs, shoplifting). The majority of firesetters reported being single at the time of their fire(s) ( $n = 8$ , 72.7%) and igniting fires within walking distance (i.e. less than a mile away) from their home ( $n = 7$ , 63.6%). No firesetter reported having been influenced by alcohol or drugs whilst setting their fire(s). The majority of firesetters reported igniting their fire



with other people ( $n = 12$ , 92.3%). See Table 2 for further offence characteristics. Overall, participants reported having set fire(s) due to curiosity and experimentation ( $n = 9$ , 81.8%). None of the firesetters indicated that revenge was a motive although three firesetters (27.3%) stated they experienced a love of fire. See Table 3 for a detailed breakdown of motivations.

Although the majority of firesetters ( $n = 5$ , 63.6%) attempted to extinguish their fires, two firesetters stated that the fire brigade had extinguished their fires (18.2%). Firesetters indicated that increased confidence to stand up to peers ( $n = 2$ , 18.8%) and increased awareness of the dangers of fire ( $n = 2$ , 18.8%) would have prevented them igniting fires.

Table 2. Deliberate firesetting offence characteristics.

Offence characteristics	Percentage yes ( $n$ )
<i>Ignition point and target</i>	
One ignition point	81.8 (9)
Multiple ignition points	18.2 (2)
Ignited countryside (e.g. grass/shrubbery)	33.3 (6)
Ignited empty/derelect garage/shed/beach hut	27.8 (5)
Ignited a rubbish bin outside	5.6 (1)
Ignited clothes	5.6 (1)
Ignited an unoccupied car	5.6 (1)
Ignited flammable liquid/items	16.7 (3)
Ignited evidence relating to another crime	5.6 (1)
<i>Fires ignited alone or with accomplices</i>	
Ignited fire alone	7.7 (1)
Ignited fire with 1 other person	38.5 (5)
Ignited fire with 2 other people	15.4 (2)
Ignited fire with 3+ people	38.5 (5)

Note: Figures may not add up to 100% due to missing data.

Table 3. The motivations behind deliberate firesetting.

Motivation	Percentage yes ( $n$ )
Curiosity or experimenting with fire	81.8 (9)
To create fun/excitement or alleviate boredom	54.5 (6)
Love fire	27.3 (3)
Problems at home or school	18.2 (2)
Dared or pranked	18.2 (2)
Vandalism	9.1 (1)
Covering a crime/destroying documents or evidence	9.1 (1)
For financial gain	9.1 (1)

Note: Motivations do not add up to the number of firesetters due to multiple motives.

**Comparison of firesetter and non-firesetter characteristics**

*Demographic and historical variables.* Univariate comparisons of firesetters and non-firesetters were conducted on basic demographics and historical variables (Table 1). Firesetters could not be significantly differentiated from non-firesetters on number of siblings, formal qualifications, history of enuresis, psychiatric illness, physical disability, expulsion from school, history of suicide attempts, criminal convictions, family finances, witnessing domestic violence in childhood, or mother being diagnosed with a psychiatric illness. However, relative to non-firesetters the firesetters were more likely to report that they had self-harmed,  $X^2(1, n = 157) = 10.10, p < .01, \varphi = .29$ , had a father who had been diagnosed with a psychiatric illness,  $X^2(1, n = 140) = 3.38, p < .05, \varphi = .20$ , and a family member who had ignited a deliberate fire  $X^2(1, n = 149) = 23.81, p < .01, \varphi = .44$ . Interestingly, significantly more non-firesetters ( $n = 32, 23.0\%$ ), reported experimenting with fire prior to the age of 10 years relative to firesetters,  $X^2(1, n = 157) = 3.88, p < .03, \varphi = -.18$ .

*Questionnaire measures.* Overall, the Fire Setting Scale and the Fire Proclivity Scale were negatively correlated with the IM subscale of the BIDR, ( $r = -.36; p < .01$  and  $r = -.27; p < .01$  respectively). Similarly, the Identification with Fire Scale and The Fire Attitude Scale were also negatively correlated with the IM subscale of the BIDR ( $r = -.18; p < .05$  and  $r = -.33; p < .01$  respectively). However, when these correlations were computed for firesetters and non-firesetters separately, the Fire Setting Scale was negatively correlated with the IM ( $r = -.31, p < .01$ ) and the Fire Attitude Scale ( $r = -.30, p < .01$ ) for the non-firesetters only. Nevertheless, firesetters scored significantly higher on the BIDR IM compared to the non-firesetters,  $t(131) = -3.02, p = .003$ .

Mean scores for firesetters and non-firesetters on the Fire Setting Scale, the Fire Proclivity Scale, the Identification with Fire Scale, Fire Attitude Scale and the BIDR IM were calculated (Table 4). Two separate one-way between-groups

Table 4. The scores and reliability of the scales and subscales for self-reported deliberate firesetters and non-firesetters.

Scale	Cronbach alpha	Firesetters		Non-firesetters		Scale range
		M	SD	M	SD	
Fire setting scale	0.90	63.27	(25.86)*	39.19	(14.99)	20–140
Behavioural items	0.72	27.00	(7.92)***	17.77	(6.19)	10–70
Fire interest items	0.93	36.27	(19.09)*	21.43	(11.19)	10–70
Fire proclivity scale	0.93	55.18	(19.42)*	34.51	(10.61)	24–120
Fire fascination	0.86	15.55	(6.52)*	9.32	(3.95)	6–30
Behavioural propensity	0.66	13.09	(4.93)*	8.51	(2.42)	6–30
Fire arousal	0.81	15.64	(6.34)*	9.24	(3.38)	6–30
Anti-sociality	0.76	10.91	(4.13)*	7.43	(2.03)	6–30
Identification with fire scale	0.71	19.18	(6.85)*	13.85	(3.44)	10–50
Fire attitude scale	0.64	52.55	(8.15)***	42.60	(6.28)	20–100
BIDR						
Impression management	0.83	54.55	(11.60)	65.61	(11.61)*	20–100

\* $p < .05$ .

\*\*\* $p < .001$  (independent  $t$ -tests).

multivariate analysis of variance (MANOVA) were conducted to establish any differences between firesetters and non-firesetters on the subscales of the Fire Setting Scale and Fire Proclivity Scale.<sup>3</sup> Assumption testing for the Fire Setting Scale showed no serious violations of normality, linearity, outliers, multicollinearity, or homogeneity of variance-covariance. Firesetters scored significantly higher than non-firesetters on the total Firesetting Scale  $F(2,137) = 12.53, p < .01$ ; Wilks'  $\Lambda = .84$ ;  $\eta_p^2 = .16$  and its subscales; the behavioural subscale,  $F(1,138) = 21.54, p < .01$ ;  $\eta_p^2 = .14$  and the fire interest subscale  $F(1,138) = 15.68, p < .01$ ;  $\eta_p^2 = .10$ .

The MANOVA examining the combined subscale indices of the Fire Proclivity Scale also revealed that firesetters scored significantly higher than non-firesetters,  $F(4, 133) = 9.16, p < .01$ ; Pillais = .78;  $\eta_p^2 = .22$ . Firesetters scored significantly higher than non-firesetters on all subscales of fire fascination,  $F(1,136) = 22.34, p < .01$ ;  $\eta_p^2 = .14$ , behavioural propensity  $F(1,136) = 29.50, p < .01$ ;  $\eta_p^2 = .18$ , arousal index  $F(1,136) = 30.48, p < .01$ ;  $\eta_p^2 = .18$  and the anti-social index  $F(1,136) = 24.29, p < .01$ ;  $\eta_p^2 = .15$ .

An independent samples *t*-test revealed that firesetters scored significantly higher than non-firesetters on the Identification with Fire Scale,  $t(10.45) = 2.55, p < .05$  (two-tailed). The magnitude of the difference in the means (mean difference = 5.33, 95% CI: 0.71, 9.96) was small to moderate ( $\eta_p^2 = .05$ ).

Firesetters also scored significantly higher compared to non-firesetters on the Fire Attitude Scale,  $t(135) = 4.92, p < .01$  (two-tailed). The magnitude of the difference in the means was 9.95 (95% CI: 5.95, 13.95) indicating a large effect ( $\eta_p^2 = .15$ ).

### ***Classifying firesetters and non-firesetters***

A logistic regression was conducted to assess the impact of the eight variables which significantly differentiated firesetters and non-firesetters in predicting firesetting group status. The eight predictor variables were history of self-harm, having a father diagnosed with a psychiatric illness, experimentation with fire under 10 years of age, history of family

Table 5. Logistic regression predicting the likelihood of being a firesetter.

	$\beta$	S.E.	Wald	<i>df</i>	<i>p</i>	Odds ratio	95% C.I. for odds ratio	
							Lower	Upper
Self-harmed	-0.45	2.73	0.03	1	0.87	0.64	0.00	135.11
Father had a psychiatric illness	3.25	1.59	4.17	1	0.04	25.83	1.14	586.71
Experimented with fire	-19.09	6640.83	0.00	1	0.99	0.00	0.00	
Family history of deliberate firesetting	4.49	2.41	4.58	1	0.03	88.78	1.46	5409.54
Fire setting scale	-0.06	0.06	1.11	1	0.29	0.94	0.84	1.05
Fire proclivity scale	-0.05	0.07	0.5	1	0.48	1.05	0.92	1.21
Identification with fire scale	-0.16	0.15	1.13	1	0.29	0.85	0.63	1.15
Fire attitude scale	-0.21	0.13	2.38	1	0.12	0.81	0.63	1.06
Constant	29.06	6640.84	0.00	1	0.99	4.19E+12		

firesetting, the Fire Setting Scale<sup>total score</sup>, the Fire Proclivity Scale<sup>total score</sup>,<sup>4</sup> the Identification with Fire Scale and the Fire Attitude Scale. The full model was significant  $X^2(8, n = 117) = 38.29, p < .01$ , and therefore able to distinguish between self-reported firesetters and non-firesetters. The model as a whole explained between 27.9% (Cox and Snell R Square) and 71.1% (Nagelkerke R squared) of the variance in firesetting status, and overall correctly classified 98.3% of cases. As shown in Table 5 two independent variables – having a family member with a history of deliberate firesetting and having a father diagnosed with a psychiatric illness – were statistically significant contributors to the model (odds ratios of 88.75 and 25.83 respectively). Thus, participants who had a family member with a history of deliberate firesetting were more than 88 times more likely to be a firesetter.

## Discussion

An area in Kent was identified as having a high incidence of deliberate fires and provided an opportunity to assess the characteristics of un-apprehended deliberate firesetters living in the community. A random sample of households revealed an 11.5% prevalence rate of deliberate firesetting (i.e. 18 un-apprehended community firesetters). This prevalence rate is substantially higher than the NESARC prevalence rate of 1% to 1.13% in the USA (Blanco et al., 2010; Vaughn et al., 2010) yet similar to the 11% prevalence rate reported by Gannon and Barrowcliffe (2012) in their research conducted with Kent University students who were predominantly female. It is likely that the difference in prevalence rate reported in the current study relative to the NESARC study relates to differing assurances of anonymity. Our study, similarly to that of Gannon and Barrowcliffe (2012), assured participants that their responses would not be incriminating. However, the researchers associated with the NESARC study did not make such assurances. Failing to provide assurances of anonymity is likely to seriously reduce participant's likelihood of reporting firesetting behaviour. Perhaps more surprising is the fact that our study targeted a particularly fire prone area in Kent, and yet our prevalence rates were still similar to that reported by Gannon and Barrowcliffe (2012). It is unclear why this was the case. However, our sample were relatively well educated suggesting that a firesetting prevalence rate of 11% may be generally accurate for members of the educated Kent, UK community. Furthermore, our study and that of Gannon and Barrowcliffe (2012) both pinpointed the majority of firesetting activity to have occurred during adolescence. These findings suggest that many adults have set deliberate fires during adolescence and supports work suggesting that adolescent firesetting is a relatively common (Mackay, Boak, Adlaf, Henderson, & Marton, 2009) yet undetected criminal activity.

In terms of basic demographics, firesetters and non-firesetters were similar on a number of variables (e.g. formal education). Firesetters and non-firesetters also exhibited similar historical characteristics (e.g. psychiatric diagnosis, previous convictions). However, significantly more firesetters – relative to non-firesetters – reported having: engaged in self-harming behaviour, a father diagnosed with a psychiatric illness, and a family member who had also ignited a deliberate fire. These findings support research that has been conducted with apprehended firesetters showing the relationship between male and female firesetting and self-harm (Coid, 1999, Miller & Fritzon, 2007; Noblett & Nelson, 2001).

To date there is a lack of research assessing the relationship between firesetting and family psychiatric illness. Furthermore, our finding that firesetters tended to self-report having a family member who has set a fire appears to support theoretical models of firesetting which suggest that social learning is important in promoting the sequence of firesetting behaviour (see Gannon et al., 2012; Jackson, Glass, & Hope, 1987). What is less clear, however, is why more *non-firesetters* reported experimenting with fire prior to reaching 10 years of age. In line with Gannon et al.'s (2012) theory of firesetting it is possible that firesetters hold restricted experiences in manipulating fire as children which feeds into their motivation to misuse fire later on. Clearly, it would be beneficial for future research to be conducted with larger samples to truly assess the effects of family background and childhood experiences with fire on firesetting behaviour.

Other comparisons can also be made between our findings with un-apprehended firesetters and the literature on apprehended firesetters. For example, professionals have suggested that apprehended firesetters tend to ignite their fires close to home (Bradford, 1982; Rautaheimo, 1989). Similarly, in our present study the majority of un-apprehended deliberate firesetters living in the general community also indicated that they ignited fires close to home (e.g. within one mile). In addition the research associated with apprehended firesetters highlights that the majority of firesetters tend to be male (Bradford, 1982; Muller, 2008; Pettiway, 1987; Räsänen et al., 1995; Rautaheimo, 1989) and although our current data converges well, there is a notable percentage (38.9%) of female firesetters. It is unclear why there is a high percentage of un-apprehended female firesetters, perhaps females felt more comfortable disclosing their firesetting behaviour due to the stringent assurances of anonymity. It is unclear why those who participated chose to do so and previous research has suggested that relative to males, females are more likely to participate in research (Sax, Gilmartin, Lee, & Hagedorn, 2008) and particularly research with a lack of remuneration (Sax, Gilmartin, & Bryant, 2003). Nevertheless the participation rate of males and females was similar and therefore perhaps a reasonable explanation for the higher than usual rate of female firesetters is that females are more willing to answer personal and potentially incriminating questions and were perhaps additionally reassured by the guarantee of anonymity.

There are some noticeable differences between un-apprehended and apprehended firesetters. Both juvenile and adult apprehended firesetters have been noted to be unskilled and have low IQ (Bradford, 1982; Harmon et al., 1985; Lewis & Yarnell, 1951; Rautaheimo, 1989). In contrast all of the un-apprehended firesetters in the current study were educated and reported holding formal qualifications. Perhaps those apprehended for their firesetting are the least successful at covering their tracks, which could be indicative of low intelligence and/or poor problem solving skills. Numerous researchers have highlighted findings to suggest that apprehended firesetters hold poor problem solving skills (Jackson et al., 1987; Tyler et al., 2014) which could, in part, explain this difference.

The research literature examining apprehended firesetters also indicates that they tend to have issues with alcohol (Bourget & Bradford, 1989; Rautaheimo, 1989). In the current study, however, none of the un-apprehended firesetters indicated that alcohol or drugs played a role in the deliberate firesetting. A key possibility is that alcohol and drug issues are likely to be over represented in the apprehended firesetting population. For example, relative to the un-apprehended firesetters the apprehended firesetters

under the influence of alcohol or drugs may lack the cognitive capacity to cover their tracks and evade detection. In light of this stark contrast between apprehended and un-apprehended firesetters it would be beneficial to further research the influence of drugs and alcohol.

The predominant motivations behind deliberate firesetting in the current un-apprehended population were curiosity and experimentation ( $n = 9$ , 81.8%). However, in previous research Gannon and Barrowcliffe (2012) found only one community firesetter (5.6%) who claimed to ignite a fire as a result of curiosity. Both in the current research ( $n = 6$ , 54.5%) and the original research ( $n = 8$ , 44.4%, Gannon & Barrowcliffe, 2012) a high proportion of firesetters claimed they ignited fire(s) to create fun or alleviate boredom ( $n = 6$ , 54.5%). The literature associated with apprehended firesetters highlights revenge as the predominant motive behind deliberate firesetting (Lewis & Yarnell, 1951; O'Sullivan & Kelleher, 1987; Swaffer & Hollin, 1995). However none of the community firesetters in this research or in Gannon and Barrowcliffe's (2012) original research acknowledged revenge as a motive. This further highlights the need for additional research examining the area of un-apprehended firesetters.

In our study, each of the factors which differed significantly between firesetters and non-firesetters were entered into a Logistic Regression to assess if they were able to predict firesetting status. The static variables included were a history of self-harm, having a father diagnosed with a psychiatric illness, experimentation with fire under the age of 10 and history of firesetting in the family. The dynamic variables entered were; the Fire Setting Scale, the Fire Proclivity Scale, the Identification with Fire Scale and the Fire Attitude Scale. Only two of the static variables in the model – having a family member who has also ignited a deliberate fire and having a father diagnosed with a psychiatric illness – successfully distinguished between firesetters and non-firesetters. However a limitation is that the time point of each of these two variables was not specified. It would therefore be beneficial to cross validate this research using more specific questions with a larger number of participants.

It is acknowledged that the current study is not nationally representative and there are limitations associated with relying on self-reports. It is possible that the traits and characteristics of people who voluntarily disclose personal information differ from those who do not comment on their behaviour. There are also issues associated with fear of reprisals. Despite the participants being assured of anonymity and confidentiality it is possible that some members of the public were reluctant to disclose potentially incriminating information 'online'. In addition although a representative sample of the Thanet population were invited to participate in the research, the low participation rate is a research limitation. It is unclear why the participation rate is low however the participants do appear to be representative of the local population. For example the general Thanet population are predominantly White British (90.4%; ONS, 2011) and similarly 97.45% of the participants indicated they were White British. The gender division of the participants (49.68% male, 50.32% female) was also similar to the gender split of the general Thanet population between the ages of 20 to 70 years (48.00% male, 52.00% female).

It is interesting that two of the un-apprehended deliberate firesetters (18.8%) believed that if they had been more aware of the dangers associated with fire they would not have ignited their fires. Therefore, for these firesetters, education programmes which focus on fire safety would help to reduce the incidences and severity of deliberate fires.

Only a small number of firesetters are apprehended and prosecuted (Rider, 1980). Despite this, the vast majority of research is centred around firesetters who are the least successful and are therefore by no means representative of all firesetters. The literature relating to both juvenile and adult undetected firesetters is sparse, thus one hypothesis is unable to encompass all firesetters. It is advisable and advantageous to develop a comprehensive understanding of the firesetters who manage to evade detection. To our knowledge no other scale exists requesting participants to imagine themselves as the fire protagonist. Physically carrying out behaviours and imagining those behaviours is believed to result in the same brain activation (see Jeannerod & Frak, 1999). Therefore asking un-apprehended firesetters to imagine themselves in firesetting scenarios maybe a powerful form of self-reflection.

Additional research will aid a wider understanding of community individuals who have a proneness to engage in illegal firesetting activity. By understanding different types of deliberate firesetters, professionals could predict, discriminate and direct appropriate education and treatment programmes to prevent those at risk of this type of behaviour. Deliberate firesetting is a dangerous and complex offence with devastating consequences. By developing and directing resources effectively we can help to reduce the number of deliberate fires and the devastating consequences of fire.

### Disclosure statement

No potential conflict of interest was reported by the authors.

### Notes

1. This paper considers acts of deliberate firesetting where the perpetrator possessed the capability to understand their actions. In the UK children under 10 cannot receive a criminal conviction (Gov.UK, 2015) and therefore the law assumes that such children are too young to understand that they are doing wrong.
2. Non-firesetters were not asked their age. Current age of the firesetter group ranged from 22 to 72 years old (median age 45 years).
3. MANCOVA analysis was also conducted but the effect of adding the BIDR IM scores as a covariate did not significantly alter the results.
4. Logistic Regression using the subscales of the FSS and FPS was also conducted, but we found that none of the individual subscales were significant contributors to the model in their own right.

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## Appendix 1. Items from the fire setting scale

The following items were presented using a 7 point Likert Scale (1 = not at all like me, 7 = very strongly like me).

### Fire Interest items

- I like to watch and feel fire
- I get excited thinking about fire
- I like watching fire
- I like watching fire being extinguished
- I like to feel the heat from fire
- I am fascinated by fire
- I have a strong interest in fire
- I am attracted to fire
- Fire equipment paraphernalia interests me
- I find fire intriguing

### Anti-social Behaviour items

- At school I would often truant
- I like to engage in acts that are dangerous
- I have a behavioural problem
- I have intended to cause harm with my behaviour
- I am a rule breaker
- I like to engage in acts that are exciting
- I like to wind people up
- I care what other people think of me
- I like to engage in acts to annoy other people
- I have physically threatened another person

## Appendix 2. Fire proclivity scale vignettes

The following items were introduced with the next six questions involve reading a short story and answering four questions relating to the story.

Billie is a 15-year-old who had spent the weekend being bored. Billie decided to go to the local wreck to see if anyone wanted to hang out. There were already a few people there just hanging around and chatting. One of them lit a cigarette. The sight of the flame shooting out of the lighter gave Billie an idea. Billie decided to set a rubbish bin alight. Billie lit a piece of rubbish and dropped it into the bin. The rest of the rubbish burned and the bin began to melt whilst Billie and the group carried on chatting and hanging out.

Tony felt constrained by life, conforming to the rules and regulations of society but in the country Tony felt free and relaxed. Nature appealed to Tony because it is free and natural. One quiet Sunday evening Tony decided to light a twig on fire. Tony watched as the flames were also free to flicker and move as they pleased. From the burning twig, Tony then lit a pile of dried leaves and watched and listened as the leaves crackled in the flames.

Hillary had finished sorting through the paperwork and had accumulated a large pile of old papers. Hillary took the old papers to the bottom of the garden and put them in a pile. Hillary then lit the corners of a few of the papers at the bottom of the pile. Hillary stood back and watched as the flames slowly crept up the side of the stack of papers. Hillary watched as the flames danced about freely in the breeze engulfing the whole stack of papers until eventually the old pile of papers were reduced to a pile of ashes.

Jo and the other locals would often dare each other to play pranks on the adults in the street. The neighbourhood was fairly posh and most people lived in large gated properties with big gardens. Some people had electric gates whilst others had picket fences but most people had letter and newspaper boxes attached to either their fence or gate. One day whilst Jo was delivering papers it was agreed that when the paper was put into the newspaper box it would be

set alight. So Jo lit the corner of the paper and put it into the newspaper box and then carried on with the rest of the paper round.

Terry had always had an interest in fire and became excited when thinking about fire. Often when alone either at work or at home Terry would light matches. Terry watched as the intensity and the colour of the flame changed as more of the match began to burn. As the flame began to die out but before totally extinguished Terry lit another match from the original flame. Terry was fascinated by the falling trail of ash left behind by the burning match and by the intensity of the heat from one little flame.

Sammy and the others in the group were very mischievous. They spent most of their weekends creating some sort of graffiti on the local bus station walls. One weekend they decided to reduce the problem of old bus tickets littering the floor by setting fire to them. This then progressed to lighting the corners of posters hanging on the walls and watching them crinkle up and fall off the walls creating little piles of ashes.