Subtypes of firesetters

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ABSTRACT

Background *Prior research has classified firesetters by motive. The multi-trajectory theory of adult firesetting (M-TTAF) takes a more aetiological perspective, differentiating between five hypothesised trajectories towards firesetting: antisocial cognition, grievance, fire interest, emotionally expressive/need for recognition and multifaceted trajectories.*
Aim *The objective of this study was to validate the five routes to firesetting as proposed in the M-TTAF.*
Methods *All 389 adult firesetters referred for forensic mental health assessment to one central clinic in the Netherlands between 1950 and 2012 were rated on variables linked to the M-TTAF. Cluster analysis was then applied.*
Results *A reliable cluster solution emerged revealing five subtypes of firesetters – labelled instrumental, reward, multi-problem, disturbed relationship and disordered. Significant differences were observed regarding both offender and offence characteristics.*
Discussion *Our five-cluster solution with five subtypes of firesetters partially validates the proposed M-TTAF trajectories and suggests that for offenders with and without mental disorder, this classification may be useful. If further validated with larger and more diverse samples, the M-TTAF could provide guidance on staging evidence-based treatment. Copyright © 2015 John Wiley & Sons, Ltd.*

Introduction

Ninety-two lives were lost in over 36,000 fires registered in the Netherlands in 2013; 85% of those outdoors and almost 20% of those indoors were started deliberately (Statistics Netherlands, 2014). In Great Britain, fire and rescue services attended over 88,000 'primary' fires (i.e. in buildings or vehicles, with casualties or attended by more than five appliances) in 2013–2014, of which 25% were

caused deliberately (Department for Communities and Local Government, 2015). Under Article 157 of the Dutch penal code, arson is defined as intentional fire setting that endangers persons or goods. Although elements of the legal definition are similar across the world – intentionality and physical damage by fire – (Gannon and Pina, 2010; Burton et al., 2012; Federal Bureau of Investigation, 2012), as there are differences between jurisdictions, we will use the term 'firesetting' throughout.

Previous research on characteristics of firesetters

Most firesetters are male (Gannon and Pina, 2010; Ducat et al., 2013a, 2013b; Fritzon et al., 2014), young (Gannon, 2010; Dickens and Sugarman, 2012), white, single and unemployed (Dickens et al., 2007; Blanco et al., 2010; Vaughn et al., 2010; Dalhuisen and Koenraadt, 2012; Dickens and Sugarman, 2012). Other commonly described characteristics include below average intelligence (Davis and Lauber, 1999; Dickens et al., 2007), alcohol misuse (Repo et al., 1997; Labree et al., 2010), a problematic family, often characterised by absent and/or abusive parents (Regehr and Glancy, 1991; Stewart, 1993; Rix, 1994; Jayaraman and Frazer, 2006; Gannon and Pina, 2010), and behavioural problems in childhood (Ducat et al., 2013a). Personality disorders, alcohol use disorders, affective and/or psychotic disorders are common (Lindberg et al., 2005; Enayati et al., 2008; Blanco et al., 2010; Vaughn et al., 2010; Hoertel et al., 2011; Burton et al., 2012; Ducat et al., 2013a). In addition, firesetters are often poor communicators with social difficulties (Gannon and Pina, 2010; Dickens and Sugarman, 2012; Fritzon et al., 2014), so treatment is typically to improve coping and problem-solving skills.

Classifications of firesetters

Considerable research effort has been expended on categorising the offence and the offenders into subtypes (e.g. Lewis and Yarnell, 1951; Inciardi, 1970; Prins et al., 1985; Harris and Rice, 1996; Geller, 2008). First attempts to do so relied on motive, with anger/revenge, crime concealment, financial, pyromania/excitement and wanton/vandalism firesetters presented as important subtypes (Lewis and Yarnell, 1951; Inciardi, 1970; Prins et al., 1985; Icove and Estepp, 1987). One limitation of this approach is that it generates a large number of subgroups – from 6 (Inciardi, 1970; Dennett, 1980) to 15 (Rix, 1994), but a more important problem is that it is often difficult to find one clear-cut, single motive (Geller, 2008; Horley and Bowlby, 2011). Firesetting is a complex behaviour influenced by interrelating biological, psychological and social factors (Koson and Dvoskin, 1982; Smith and Short, 1995). Alternative approaches have been to characterise by details of the offence – for example, its location (Kocsis and Irwin, 1997), or the offender – recidivist/one-off (Dickens et al., 2009), mental

disorder (Geller, 2008) or offending limited to firesetting versus versatile offenders (Barnett et al., 1999; Lindberg et al., 2005; Ducat et al., 2013a; Ducat et al., 2015). Empirically driven multifactorial approaches have also been deployed, in which the interdependence of certain characteristics was taken into account. In one (Canter and Fritzon, 1998), firesetters were differentiated by the object targeted and their motives, yielding a two-by-two model: firesetters who act out of instrumental (external) or expressive (internal) motives and target either objects (external) or persons (internal). This four-pattern matrix, known as the action system model (Fritzon et al., 2001), has been partly validated by links between it and other characteristics; instrumental firesetting directed at objects is, for example, mainly committed by young offenders while that targeting persons mainly follows a failed relationship. Del Bove and Mackay (2011) offered another approach, clustering 240 firesetters aged 4–17 according to both fire-specific characteristics (e.g. numbers of fires and nature of target) and general individual (e.g. social skills) and environmental features. They found three clusters: conventional limited, home instability moderate and multi-risk persistent. An empirical study of serial firesetters showed four patterns by motive/drive: thrill, anger, wanton and sexual (Kocsis and Cooksey, 2002). Such differentiation between groups may be seen as the first stage in developing a theory and/or coherent strategy for managing firesetters safely (Blackburn, 1993; Canter and Almond, 2002), but classifications alone do not give insight into the personal meaning of the fires for the firesetter (Horley and Bowlby, 2011).

The multi-trajectory theory of adult firesetting

Although previous research has, therefore, come a long way in identifying firesetter subtypes, these studies mostly fail to take criminogenic and psychopathological factors into account (Horley and Bowlby, 2011). Using a theory-knitting approach (Kalmar and Sternberg, 1988) incorporating main elements of the various theories, Gannon et al. (2012) constructed a comprehensive theoretical model of pathways into firesetting. This allows for variables relevant to onset, maintenance and desistance of men and women, mentally disordered and non-mentally disordered firesetters. This multi-trajectory theory of adult firesetting (M-TTAF) has two levels. The first provides interactional explanations of firesetting drawing on research, existing theoretical explanations and clinical experience. Aetiological variables include developmental context and psychological vulnerabilities (e.g. offence-supportive attitudes, emotional dysregulation and communication problems), which may become risk factors if triggered, for instance, by negative life events. Mental health and self-esteem act as moderators 'Reinforcers', such as financial gain or sensory stimulation, are maintenance factors.

The second tier of the M-TTAF describes five prototypical trajectories that, according to Gannon et al. (2012), can be used in clinical practice (see also Ó Ciardha and Gannon, 2012, and the Supporting Information). The first

trajectory is labelled antisocial cognition. These firesetters usually start their criminal career early and are often diagnosed with conduct or antisocial personality disorder. The firesetting is typically instrumental, such as for financial gain. Critical risk factors are antisocial cognition and general criminal scripts, but others, such as poor self-control, may be important. The second trajectory is of grievance. Again, firesetting is instrumental but here, to acquire revenge/retaliation, often temporarily improving self-esteem and self-efficacy. Self-regulation, aggression, anger and hostility and communication problems with development of scripts involving fire appear to underpin this route. Fire interest is the third trajectory – indicating fascination with fire, often with impulsivity. Again, fire may be a means of coping with adverse situations and emotions. The fourth trajectory is termed emotionally expressive/need for recognition; communication problems constitute the primary risk factor, with emotional dysregulation prominent, so these people easily feel overwhelmed by circumstances and then use fire as a cry for help. They may also try to gain positive attention as the hero/rescuer. Finally, the multifaceted trajectory captures those with multiple developmental adversities. Antisocial cognitions and a criminal history are common and the firesetting instrumental, repetitive and without consideration for others. Interest in fire is a key risk factor; emotional dysregulation and poor communication skills are likely.

Aim

Our aim was to test the validity of the five subtypes of firesetters according to *The Multi-Trajectory Theory of Adult Firesetting* using a large sample of Dutch firesetters.

Method

The sample

The sample included all 389 firesetters admitted for pre-trial forensic mental health assessment in the main forensic observational hospital in the Netherlands between 1950 and 2012 for whom data were available. In the Netherlands, a decision to refer for pre-trial assessment is based on a purpose-designed instrument covering characteristics of the offence and the offender (Van Kordelaar, 2002). Such pre-trial assessments are common for alleged arsonists (Van Kordelaar, 2002); 55% of a random sample of 100 convicted arsonists in the Netherlands had completed one (Dalhuisen and Koenraadt, 2014). In general, around 10% of all pre-trial forensic mental health evaluations in the Netherlands concern arson cases (Canton, 2004; Van Kordelaar, 2008). Suspects were assessed and observed over 7 weeks, after which a multidisciplinary report was produced.

Data sources

Data were retrieved from these forensic reports. Sections used were as follows: (1) social background, recorded by forensic social workers and including data from patients' relatives; (2) details of behaviour on the ward and during group activities; (3) the medical examination; (4) full psychological assessment; (5) the psychiatric report; (6) synthesis of information on criminal accountability; and (7) advice to the judiciary on the risk and management (i.e. treatment) of recidivism (Koenraadt et al., 2007). Reports often included some police data. Missing information was unusual.

Measures

Data were coded using a standardised item list partly based on the HKT-30, a Dutch risk of reoffending assessment tool (Ministerie van Justitie, 2003). This draws on several national and international instruments and consists of 30 items (11 historical, 13 clinical and dynamic and 6 indicators of future risk), each scored on a 5-point scale. A study of the predictive validity of the HKT-30, based on several research samples, converting effect sizes into areas under the curve, the median area under the curve value was moderate (0.72, interquartile range 0.65–0.73) (Singh et al., 2011). Interrater reliability is excellent (Hildebrand et al., 2005). The clinical items of the HKT-30 used in our study were substance use, impulsiveness, empathy, hostility, social skills, self-efficacy, acculturation problems, responsibility for the offence and coping skills.

Firesetting-specific items were added, including an item on nature of the offence (instrumental/expressive and person/object oriented, drawn from Canter and Fritzon, 1998) and on specific recidivism (pure/non-pure firesetters, based on Barnett et al., 1999; Lindberg et al., 2005; Ducat et al., 2013a, 2015).

Procedure

All 633 available forensic pre-trial assessment reports of all firesetters observed in the Pieter Baan Centre were retrieved. Additional reports for the same offence by the same offender (10) or prior reports of offenders with multiple assessments concerning firesetting (16) were excluded to avoid duplication. Students were trained to assist the first author in coding the items, but all files were checked and evaluated by the first author to ensure consistency.

Cluster variables

Cluster analysis has proved useful in uncovering subtypes of violent offending (Stefurak and Calhoun, 2007; Liem and Reichelmann, 2014), including firesetting (Harris and Rice, 1996; Del Bove and Mackay, 2011). Cluster

variables were chosen theoretically, based on elements of the first tier of the M-TTAF and existing literature on firesetter characteristics (Gannon et al., 2012). The first variable corresponds to the developmental context of the M-TTAF, also relating to caregiver environment, the latter being operationalised as 'being victim of childhood abuse' (0 = *never* and 1 = *witness and/or victim at least once*). The element of psychological vulnerability was operationalised with four variables from the HKT-30, recoded from a 5- to a 3-point scale (0 = *no/minor risk/problems*, 1 = *moderate risk/problems* and 2 = *high risk/problems*). Offence-supportive cognition was represented by the cluster variable 'empathy', one cognitive component believed to underlie this vulnerability (Gannon et al., 2012). The cluster variables 'impulsivity' and 'coping skills' correspond to self/emotional-regulation issues and 'social skills' to communication problems. According to the M-TTAF, psychological vulnerabilities can turn into critical risk factors through interaction with proximal triggers. One moderator of this interaction is mental health. We included psychosis because of the established link between firesetting and psychotic disorders (Enayati et al., 2008; Anwar et al., 2011; Burton et al., 2012) and operationalised it by coding for time of offence: 0 = *no psychosis*, 1 = *past psychosis only* and 2 = *psychosis present*. In the Supporting Information, we show how all variables, including cluster variables, were represented in the second tier of the M-TTAF.

Data analysis

A two-step cluster analysis was performed, using SPSS version 20.0 (IBM Corporation, Armonk, NY, USA) to test the fit of the firesetters into the five M-TTAF subtypes. Cluster analysis is a general term for several statistical procedures that may be used to create groups or clusters empirically in such a way that the similarity of cases within each cluster is maximised, while the similarity between them is minimised (Norušis, 2011). A two-step procedure overcomes the problem of commensurability, enabling both continuous and categorical variables on different scales, and is preferable in large datasets. Further, it automatically determines the optimal number of clusters, using the auto-cluster option (Bacher et al., 2004). Atypical values are solved using the noise-handling algorithm; in our sample, there was a value of 10 for the fraction of noise.

To interpret the cluster solution, firstly, similarities within and differences between clusters were considered by examining the clustering variables; secondly, univariate Pearson's chi-square or Fisher's exact tests, as appropriate, were conducted to test for cluster differences in offender and/or offence-related variables in the second tier of the M-TTAF. We calculated the adjusted standardised residuals to identify the nature of the dependence (Agresti, 2007). Unlike the standardised residual, the adjusted standardised residual takes into account the overall sample size. Under the null hypothesis of independence, each adjusted

residual has a standard normal distribution, so residuals with an absolute value of about 2 or higher (±1.96) – corresponding to a smaller or larger number of cases than expected by chance – indicate that the variables are dependent (Agresti, 2007; Field, 2009).

Results

Sample characteristics

Firesetters had a mean age of 29 (standard deviation 10.06). Most were Dutch (359, 92%), male (354, 91%), single (300, 78%), unemployed (254, 67%) and had an average or above average intelligence (232, 61%), based on various validated measures of IQ, including the Wechsler Adult Intelligence Scale, Raven's matrices and/or a Dutch instrument, the Groninger Intelligence Test, completed during the observational hospital stay. The alleged index firesetting almost always resulted in property damage (379, 98%), but many also harmed people (272, 70.5%), a few fatally (27, 7.0%). Self-reported motivation for most offences was commonly anger or revenge (157, 43%). Offences were generally committed alone (322, 84%) and unplanned (231, 67%). People in this sample were pre-trial at the time of inclusion and, thus, had not been found guilty of any offence, but, among the 90 cases for whom outcome was known, 88 (98%) were found guilty. For simplicity, everyone included in the sample will be referred to as a firesetter.

Cluster solution

The automatically determined two-cluster solution had a fair cluster quality (average silhouette 0.3), a ratio of 2.18 and included 289 cases, but a fixed five-cluster solution had a similar cluster quality (average silhouette 0.3) with a better ratio (1.96) and more cases (313). Table 1 shows the descriptive statistics and chi-square values of the five-cluster solution.

Cluster 1 contained 49 firesetters. One-third of them either witnessed or had been a victim of caregiver abuse in childhood. Firesetters in cluster 1 had the best scores on empathy, coping and social skills; they also had low impulsivity scores. They had not been psychotic at the time of the offence. Cluster 2 was made up of 47 firesetters who had all experienced caregiver abuse in childhood. In comparison with people in other clusters, they more often scored moderately on the empathy and social skills scales but, like cluster 1 members, low on impulsivity and problems with coping. Cluster 3 was the second largest, holding 76 individuals, all with scores indicating impaired empathy, and most with high scores on coping skill deficits, social skill problems and impulsivity; childhood abuse by caregivers was also common. Cluster 4 held 49 people, all, as in cluster 2, abused in childhood. They obtained high impulsivity and low coping skills scores, but their

Table 1: Two-step cluster solution with fixed cluster number

	Cluster 1 (n=49)	Cluster 2 (n=47)	Cluster 3 (n=76)	Cluster 4 (n=49)	Cluster 5 (n=92)	Outliers cluster (n=76)	χ^2
Developmental context							
Victim of caregiver abuse	32.7[a]	100.0[b]	78.9[b]	100.0[b]	58.7[a]	46.1[a]	96.48**
Psychological vulnerabilities/critical risk factors							
Empathy							302.12**
No risk/problems	32.7[b]	—[a]	—[a]	12.2	—[a]	43.4[b]	
Moderate risk/problems	65.3[b]	91.5[b]	23.7	87.8[b]	43.5	35.5[a]	
High risk/problems	2.0[a]	8.5[a]	100.0[b]	—[a]	56.5[b]	21.1[a]	
Impulsivity							261.21**
No risk/problems	—[a]	2.1	—[a]	8.2	—[a]	27.6[b]	
Moderate risk/problems	95.9[b]	70.2[b]	23.7	6.1[a]	—[a]	30.3	
High risk/problems	4.1[a]	27.7[a]	76.3[b]	85.7[b]	100.0[b]	42.1[a]	
Coping skills							256.76**
No risk/problems	65.3[b]	51.1[b]	9.2[a]	24.5	—[a]	30.3	
Moderate risk/problems	34.7	42.6	—[a]	6.1[a]	72.8[b]	46.1	
High risk/problems	—[a]	6.4[a]	90.8[b]	69.4[b]	27.2[a]	23.7[a]	
Social skills							230.34**
No risk/problems	59.2[b]	—[a]	—[a]	20.4	—[a]	42.1[b]	
Moderate risk/problems	16.3[a]	100.0[b]	21.1[a]	24.5	38.0	23.7[a]	
High risk/problems	24.5[a]	—[a]	78.9[b]	55.1	62.0[b]	34.2[a]	
Moderators							
Psychotic disorder at the time of the offence							FE**
No psychotic disorder	100.0[b]	91.5	97.4[b]	98.0[b]	59.8[a]	69.7[a]	
Psychotic disorder in the past	—[a]	2.1	2.6	2.0	—[a]	10.5[b]	
Psychotic disorder present	—[a]	6.4	—[a]	—[a]	40.2[b]	19.7	

Note: FE = Fisher's exact.
[a]The value of the adjusted standardised residual was less than −1.96.
[b]The value of the adjusted standardised residual was greater than 1.96.
*p < 0.05.
**p < 0.001 (two-sided).

empathy and social skills ratings were average. The fifth and largest cluster, with 92 individuals, had high impulsivity and high rate of psychosis. They were all at least moderately poor in their coping skills, social skills and empathy. Over half had experienced childhood abuse.

Differences in offender and offence characteristics between clusters

Tables 2 and 3 show the comparisons between personal and offence characteristics of members of the various clusters. Table 4 gives a visual summary of differences based on adjusted standardised residuals.

Individuals in cluster 1 were typically first offenders and accused of multiple fires. Behavioural problems were common but not usually apparent before the age of 12, and personality disorders were rare. Firesetters in this cluster had low hostility and usually an adequate social network. Emotional and physical neglect in childhood were uncommon. The main motives were revenge/retribution (24%), profit (13%), vandalism/boredom (7%) or crime concealment (7%). The financial gain motive was most likely to appear in this cluster. Members rarely had suicidal thoughts at the time of the offence.

Firesetters in cluster 2 differed from the others in having the highest proportion of individuals without a judicial history, less often showing high hostility and being most likely to have experienced emotional neglect as a child. Revenge/retribution (24%), profit (13%) and need for recognition (10%) were the main motives. Offence planning was common.

The third cluster included the highest proportion of women. People in this cluster had higher general recidivism scores and the highest hostility. Adequate support from family, friends and others was rare; one-third had experienced physical neglect as a child. Their main firesetting motives were revenge/retribution (22%) and cry for help (9%). Half of them had also been accused of other offences, but multiple fires were exceptional.

Individuals in the fourth cluster also had high general recidivism scores but were more likely to be pure firesetters who had typically been accused of multiple fires without other offences in the indictment, without planning. They were likely to have been behaviourally disturbed from age 12. Childhood emotional neglect and physical abuse were common. Revenge/retribution (33%) was the main firesetting motive, then cry for help (13%).

Cluster 5 firesetters were characterised by being most likely to have eight or more previous incarcerations, higher hostility and inadequate social support. This group had not experienced emotional neglect or physical abuse as children. They sustained a diagnosis of one or more personality disorders. Revenge/retribution (17%) and cry for help (14%) were their main motives, while a financial motive was rare (1%). They typically had suicidal thoughts at the time of the offence but rarely harmed others with their fires.

Table 2: Differences in offender characteristics described in the second tier of the M-TTAF

	Cluster 1 (n=49) M (SD)	Cluster 2 (n=47) M (SD)	Cluster 3 (n=76) M (SD)	Cluster 4 (n=49) M (SD)	Cluster 5 (n=92) M (SD)	F
Age	28.53 (11.6)	27.34 (9.5)	27.53 (9.2)	29.61 (9.4)	30.12 (10.6)	1.02
Age first conviction	20.52 (7.4)	22.55 (17.0)	19.46 (5.8)	20.36 (5.3)	20.38 (6.1)	.67
	%	%	%	%	%	χ^2
Gender						FE¥
Male	98.0	91.5	84.2[a]	93.9	91.3	
Female	2.0	8.5	15.8[b]	6.1	8.7	
Judicial history						24.04¥
No judicial history	38.8	40.4[b]	19.7[a]	22.4	27.2	
No incarceration	10.2	4.3	5.3	12.2	10.9	
1–2 incarcerations	32.7	29.8	36.8	26.5	27.2	
3–7 incarcerations	14.3	12.8	19.7	26.5[b]	13.0	
8> incarcerations	4.1[a]	12.8	18.4	12.2	21.7[b]	
First offender (firesetting)	81.6[b]	80.9	63.2	61.2	67.4	9.50¥
Pure firesetting	—	7.7	10.3	21.9[b]	8.5	FE¥
Behavioural problems >12	72.9[a]	86.4	90.5	95.8[b]	84.3	12.27*
Hostility						72.39**
No hostility	38.8[b]	24.4	9.3[a]	12.5	18.0	
Moderate hostility	57.1[b]	60.0[b]	25.3[a]	45.8	24.7[a]	
High hostility	4.1[a]	15.6[a]	65.3[b]	41.7	57.3[b]	
Social network						41.78**
No network	24.5[a]	36.2	56.0	55.1	53.9	
Network of moderate quality	34.7	46.8	37.3	36.7	38.2	
Adequate network	40.8[b]	17.0	6.7[a]	8.2	7.9[a]	
Friends	68.3	63.4	49.2	50.0	53.5	5.26
Emotional neglect as a child	44.7[a]	93.6[b]	77.3	87.5[b]	60.4[a]	40.56**
Physical neglect as a child	6.3[a]	20.0	32.4[b]	22.9	20.0	12.16*
Sexual abuse as a child	6.4	15.9	17.9	14.9	9.2	4.92
Physical abuse as a child	31.3	47.7	43.8	65.3[b]	31.4[a]	17.82*
Personality disorder in the past						21.23*
No personality disorder	65.2[b]	44.4	36.1	38.6	37.8	
Traits of a personality disorder	30.4	40.0	43.1	52.3	35.4	
Personality disorder	4.3[a]	15.6	20.8	9.1	26.8[b]	

Note: Some variables had missing values resulting in a smaller sample size.
FE = Fisher's exact; M-TTAF = multi-trajectory theory of adult firesetting; SD = standard deviation; M = mean.
[a]The value of the adjusted standardised residual was less than −1.96.
[b]The value of the adjusted standardised residual was greater than 1.96.
*$p < 0.05$.
**$p < 0.001$.
¥$p < 0.10$ (two-sided).

Table 3: Differences in offence characteristics described in the second tier of the M-TTAF

	Cluster 1 (n=49) %	Cluster 2 (n=47) %	Cluster 3 (n=76) %	Cluster 4 (n=49) %	Cluster 5 (n=92) %	χ^2
Only firesetting in accusation	55.1	66.0	51.3	65.3	60.9	4.04
Suicidal thoughts	4.8	6.7	14.9	15.6	16.3	5.46
Offence planned	40.4	43.2	30.2	19.6[a]	32.9	7.12
Multiple fires in accusation	38.8	34.0	28.9	38.8	37.0	2.00
Dangerousness (personal damage)						8.92
No damage to persons	36.2	31.9	28.0	28.6	32.6	
Threat of bodily damage	53.2	53.2	57.3	61.2	62.0	
Physical injury	6.4	6.4	4.0	6.1	1.1	
Fatal injury	4.3	8.5	10.7	4.1	4.3	
Motives						39.69
Profit	13.3[b]	13.2[b]	4.5	—	1.1[a]	
Revenge/retribution	24.4	23.7	22.4	33.3[b]	17.2	
Vandalism/boredom	6.7	—	3.0	4.2	5.7	
Fire interest/thrill	2.2	2.6	1.5	2.1	2.3	
Cry for help	2.2	5.3	9.0	12.5	13.8	
Suicide/self-harm	4.4	—	1.5	2.1	3.4	
Need for recognition	4.4	10.5[b]	4.5	2.1	1.1	
Crime concealment	6.7	5.3	4.5	2.1	2.3	
Other	35.6	52.6	49.3	41.7	52.9	

Note: Some variables had missing values resulting in a smaller sample size.
M-TTAF = multi-trajectory theory of adult firesetting.
[a]The value of the adjusted standardised residual was less than −1.96.
[b]The value of the adjusted standardised residual was greater than 1.96.

Discussion

Our study partially validated the M-TTAF using cluster analysis. As far as we know, this is the first independent validation. Recent studies on firesetting have used the M-TTAF either as an explanatory model (Doley et al., 2013) or as a classification tool (Hagenauw et al., 2014), but still this model would benefit from a more theoretical basis.

Empirical validation of five subtypes

Our first cluster is best characterised as 'non-pure firesetters' with low specific re-cidivism and a range of motives, including revenge and profit. Firesetters in this cluster had the most favourable characteristics, both criminologically and

Table 4: Summary of differences between the clusters on clustering variables, offender and offence characteristics based on adjusted standardised residuals

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Clustering variables					
Victim of caregiver abuse	No	Yes	Yes	Yes	No
Empathy	No problems and moderate problems	Moderate problems	High problems	Moderate problems	High problems
Impulsivity	Moderate problems	Moderate problems	High problems	High problems	High problems
Coping skills	No problems	No problems	High problems	High problems	Moderate problems
Social skills	No problems	Moderate problems	High problems	—	High problems
Psychotic disorder at the time of the offence	No	—	No	No	Yes
Offender characteristics					
Gender	—	—	Female	—	—
Judicial history (general recidivism)	Less often >8 incarcerations	More often no judicial history	Less often no judicial history	More often 3–7 incarcerations	More often >8 incarcerations
First offender (specific recidivism)	Yes	—	—	—	—
Pure firesetting	—	—	—	Yes	—
Hostility	No problems and moderate problems	Moderate problems	High problems	—	High problems
Social network	Adequate	—	Less often adequate	—	Less often adequate
Emotional neglect as a child	No	Yes	—	Yes	No
Physical neglect as a child	No	—	Yes	—	No
Physical abuse as a child	—	—	—	Yes	No
Behavioural problems >12	No	—	—	Yes	—
Personality disorder in the past	No	—	—	—	Yes
Offence characteristics					
Offence planned	—	—	—	Less often	—
Motives	Profit	Profit Need for recognition	—	Revenge/retribution	Less often profit

psychologically. Given the instrumental motives, such as financial or crime concealment, we labelled this cluster the instrumental subtype. It most resembles the M-TTAF antisocial cognition trajectory. In our cluster 1, however, unlike the M-TTAF type, people had less extensive criminal careers and no serious antisocial characteristics, such as poor empathy or high hostility.

Our second cluster includes individuals with moderate scores on many personal characteristics such as empathy, impulsivity, social skills, hostility or behavioural problems who had all experienced caregiver abuse; they were more often motivated by an apparent need for recognition. The developmental context appears to be an important contributor to the firesetting, perhaps fulfilling needs that have not been met in childhood, as postulated by Jackson et al. (1987). The fire interest-motivated fires were mostly found in this cluster, suggesting some overlap with the fire interest subtype suggested by Gannon et al. (2012). The combination of expressed need for recognition and financial gain led us to label this cluster as the reward subtype.

Members of the third cluster showed even more developmental problems and also psychological vulnerabilities, so we named this the multi-problem subtype. This cluster had the largest proportion of women. The dangerousness of fires in this cluster was high, often with potential for physically harming others. These perpetrators had often reported seeking revenge/retribution or crying for help, the latter equating to the 'expressive motives' described by Canter and Fritzon (1998). Overall, however, our third cluster most resembles the M-TTAF multifaceted trajectory, although it differs in gender distribution and multiplicity of fires.

Revenge or retribution was an even more prevalent in cluster 4, also characterised by interpersonal problems; revenge by firesetting appeared to be their way of communicating; members were impulsive, had severe social skills deficits and had no friends. They had commonly been victims of childhood caregiver physical abuse and emotional neglect, so we called this the disturbed relationship subtype. Its revenge qualities, though, may be seen as similar to the motive-based subtype in prior studies (Lewis and Yarnell, 1951; Inciardi, 1970; Prins et al., 1985; Icove and Estepp, 1987) and the grievance trajectory of the M-TTAF (Gannon et al., 2012), although relationship disturbance and hostility did not seem as high as in the latter.

The fifth cluster – the disordered subtype – contained a high proportion of cry-for-help-motivated and psychotic firesetters. Personality disorders were common, as were impulsivity, hostility, impaired empathy, poor problem-solving and social skills and social network, even though their childhood had been less troubled than in clusters 2–4. Mental disorders have previously been found among firesetters (Blanco et al., 2010; Burton et al., 2012; Ducat et al., 2013a) and used in previous classifications (Geller, 2008). This subtype also has similarities to the emotional expressive component described by Gannon et al. (2012).

Limitations

The nature of our sample – referees for a full mental health assessment – meant that bias towards a high prevalence of mental disorders was inevitable. The M-TTAF was developed for all firesetters, so partial validation of the tool would probably be the best to be expected. In addition, indications for and methods of forensic mental health assessments differ between countries (Dressing and Salize, 2006; Nedopil, 2009), potentially limiting the generalisability of our findings. The fact that we were reliant on records data may also have impacted on our findings, because fire interest and offence-supportive attitudes (important elements of the M-TTAF) as well as other cognitive and affective components (Jackson et al., 1987) were not measured. Future empirical research should take these elements into account.

Implications

Differentiation of firesetters is crucial for a better understanding of them and their specific treatment needs. We found five subtypes of firesetters in a mental health service sample and these correspond reasonably well to some of the types already described in the literature, albeit across different studies. We labelled the clusters instrumental, reward, multi-problem, disturbed relationship and disordered subtypes, and it can be seen that these bear resemblance to M-TTAF subtypes, although with a few differences. Thus, it can be said that we have partially validated that model for use in the mental health field. It would be important now to build on this work with larger and more diverse samples. If further validation is forthcoming, then this model could provide useful guidance on prioritising aspects of treatment, particularly among those with multiple and more complex problems.

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