RISK FACTORS FOR ARSON RECIDIVISM IN ADULT OFFENDERS

by

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A thesis submitted to the University of Birmingham for the degree of

Doctorate in Forensic Psychology Practice (ForenPsyD)

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September 2015

ABSTRACT

This thesis explores risk factors for recidivistic arson in adult offenders. Chapter one provides an introduction to the characteristics of adult firesetters and theoretical approaches to understanding their behaviour. Chapter two provides a critique of the Fire Setting Scale (FSS) in terms of its psychometric properties and concludes that the FSS shows promise as a psychometric measure of fire interest and antisociality associated with firesetting in the general population. Chapter three contains a systematic review of the evidence base relating to risk factors for recidivistic arson in adult offenders. Standardised effect sizes are calculated and the data synthesised to identify risk factors with varying strengths of empirical support. The 15 studies reviewed varied in quality, contained few female subjects, and often studied psychiatric rather than wider criminal justice populations. The empirical research presented in Chapter four consists of a retrospective case-control study comparing a large sample of recidivist and first-time arsonists on a range of variables. Separate analyses for female and male subjects revealed differences in risk factors. Logistic regression was used to build predictive models of arson recidivism which were then operationalised into gender-specific risk prediction tools. Theoretical and clinical implications of the thesis are discussed in Chapter five, and a preliminary model of arson recidivism is proposed.

ACKNOWLEDGEMENTS

I would like to express my gratitude to my academic supervisors Dr Darren Bishopp and Dr Louise Dixon for their encouragement, guidance and support over the past three years. Thanks also to colleagues in the National Offender Management Service and Ministry of Justice who provided advice, access to data, and support of other kinds.

Finally, to CP, thank you for your patience, encouragement, and belief in me when the end seemed a long way off. I love you.

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CHAPTER ONE:

INTRODUCTION TO THE THESIS

Context

Fire services in Great Britain attended 212,500 fires in the financial year 2013-2014, with 322 fatalities recorded (Department for Communities and Local Government, 2015). A quarter (21,900) of the most serious or 'primary' fires recorded (88,500) were deliberately started, with 70 fatalities and 1,300 non-fatal casualties caused as a result of deliberately started fires. Of these deliberately started fires, 9,100 were in buildings, almost half of which were in dwellings (where 39 of the 70 deaths occurred).

United States fire departments recorded an estimated 282,600 intentional fires per year during the period 2007-2011, with an average of 240 civilian fatalities, 1,360 injuries and US$1.3 billion of property damage every year (Campbell, 2014). Meanwhile, 20% of those arsons logged by the FBI's Uniform Crime Reporting (UCR) programme in 2011 were resolved by arrest or exceptional means, with the number of these clearances attributed to under-18-year-olds at 33% (Federal Bureau of Investigation, 2011), suggesting that the majority of detected arsonists are adults.

Definitions

As one group of researchers neatly explain, "firesetting is a behavior, arson is a crime, and pyromania is a psychiatric diagnosis." (Burton, McNiel, & Binder, 2012, p. 355). The Criminal Damage Act 1971 defines arson as occurring when a person without lawful excuse destroys or damages any property by fire. Within this thesis, *arson* will be used to

describe the specific legal offence defined above (or as defined in the jurisdiction under discussion), *firesetting* will be used to describe the behaviour of deliberately setting fires which are not legally sanctioned (excluding for example controlled bonfires), and *pyromania* to describe the psychiatric disorder. The focus of the thesis, except where explicitly stated, is on adults.

Pyromania

The diagnostic criteria for pyromania are defined by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5; American Psychiatric Association, 2013), as repeated intentional firesetting with no clear motive but accompanied by an interest in or fascination with fire. This firesetting must be pre-empted by emotional arousal, lead to relief or pleasure, not result from impaired judgement, and not be associated with personality disorder, conduct disorder or delusional/psychotic disorders. Pyromania is located within the DSM-5 chapter on disruptive, impulse-control and conduct disorders.

The exclusion of those who set fires when intoxicated (under the impaired judgement criteria) makes diagnosis of pyromania exceptionally rare, with one study in Finland finding that only 3 of 90 arson recidivists referred for pre-trial psychiatric evaluation met the diagnostic criteria. A further nine participants would have met diagnostic criteria had acute alcohol intoxication not been present (Lindberg, Holi, Tani, & Virkkunen, 2005). Gannon and Pina (2010) reviewed a number of studies which reported on rates of pyromania and found that researchers identified either no pyromaniacs at all in their firesetter samples, or rates of 3% - 10%, and this despite the fact that many of the populations studied could be expected to have much higher likelihood of diagnosis than groups of firesetters in the criminal justice system or wider community. The concept of

pyromania is now often seen as outdated and overly restrictive in its definition (Ducat, McEwan, & Ogloff, 2013), and it does appear that the diagnostic criteria for pyromania are simply too restrictive to be of much clinical or research utility.

Firesetter characteristics

A large scale US epidemiological study found that those who report a history of firesetting also report high levels of other antisocial behaviour and crime, including use of violence across a range of contexts, and are more likely to have alcohol- or marijuana-use disorder (Vaughn et al., 2010). This study also found that firesetters were twice as likely to have a family (parents or siblings) history of antisocial behaviour.

A comprehensive review of the characteristics of adult firesetters (Gannon & Pina, 2010) summarised the available evidence and concluded that firesetters are generally criminally versatile and more similar to property than violent offenders. They are usually white, young, male and socially disadvantaged, from abusive and impoverished backgrounds, lack self-esteem, communication and assertiveness skills, are impulsive, and likely to have a range of mental disorders (Gannon & Pina, 2010). Until recently the only substantial reviews of research into firesetting were written from a psychiatric standpoint, or focused only on firesetting among young people rather than adults (Gannon & Pina, 2010).

In further research since this review, detected firesetters have again been found to be mostly versatile offenders and to have higher levels of psychopathology and more behavioural problems as a child than other types of offender, but not to be any more likely to suffer from a psychotic disorder (Ducat, McEwan, et al., 2013). This study also found that presence of antisocial personality disorder helped to distinguish between firesetters and offender controls. Somewhat higher levels of psychopathology were also identified in

a sample of UK imprisoned firesetters, with borderline personality traits being identified as the strongest discriminator between firesetters and offender controls (Ó Ciardha, Alleyne, et al., 2015). This study contradicted earlier research in finding that firesetters did not show higher levels of delusional disorders or antisocial personality disorder than controls. Imprisoned firesetters have also been found to have higher levels of anger-related cognition, higher levels of identification with and interest in fire, lower self-esteem and a more external locus of control than prisoners serving sentences for non-firesetting offences (Gannon et al., 2013). Firesetters have also been found to have higher mortality rates than community controls for death by both natural and unnatural causes, with alcohol abuse and suicidality featuring prominently (Thomson, Tiihonen, Miettunen, Virkkunen, & Lindberg, 2015).

Psychological approaches to understanding firesetting

Although by no means the first published attempt to offer some psychological insight into the human relationship with fire, Freud's (1932) paper is perhaps the best known. Freud drew on Greek mythology and philosophical approaches to propose that fire for the primitive man was a symbol of the libido, for, "the form and motion of the flame suggest the phallus in action." (p. 407). Freud proposed that the desire to acquire power over fire relates to a sexualised desire to extinguish flames through a stream of urine from the phallus. Freud's approach has had a longstanding impact with much effort since expended looking for associations between firesetting and enuresis (Slavkin, 2001, 2004; Yarnell, 1940), and firesetting and sexual gratification (see e.g. Prins, Tennent, & Trick, 1985; Quinsey, Chaplin, & Upfold, 1989; Sapsford, Banks, & Smith, 1978). Until recently such theories have not always been data-driven and it has been argued that assumptions implicit

in much empirical research into firesetting behaviour have not been tested in the context of any underlying theoretical model (Doley et al., 2011).

One of the earliest attempts to split or categorise firesetters into typologies on the basis of their motivation was provided by Lewis and Yarnell (1951), although it has been noted that these authors did not explore the psychological implications of the system they proposed (Gannon & Pina, 2010). Inciardi (1970) analysed the offence motivations of the 138 arson offenders paroled from New York State prisons in 1961-1966 and grouped them into six motivational typologies: revenge, excitement, institutionalized, insurance-claim, vandalism, and covering up another crime. The revenge firesetter was identified as by far the most common typology, as well as the most dangerous, accounting for 58% of the sample, followed by those who offended for excitement (18%). The remaining typologies each accounted for no more than 10% of cases.

Typical of many such motive-based classification systems which subsequently emerged in the literature, a classification of 11 motives for arson was proposed by Prins and colleagues (1985), which in fact included two categories relating to the age of the perpetrator as opposed to their motivation. Significantly, these authors did identify that there was often no definitive single motivation for arson offences. Rix (1994) built on the classification systems already discussed, using a sample of 153 adults referred for psychiatric assessment. Arsonists in this study were allocated to one of 15 different motives. Revenge was the most commonly identified motive in each of these studies, although neither system was backed by convincing empirical support and they covered such a wide range of motivations as to be more descriptive than ampliative. A further study of 243 male arsonists in a maximum security Canadian psychiatric hospital (Harris

& Rice, 1996) proposed four subtypes of firesetter: psychotic, underassertive, multi-firesetter, and criminal. This study laid greater claim to empirical foundations having employed correlational and cluster-analysis as a means of identifying their subtypes. Similarly, cluster analysis was used to explore the behaviour, motivations and symptomology of 59 Australian arson offenders who were acquitted on account of mental illness (Green, Lowry, Pathé, & McVie, 2014). The analysis led to the identification of three clusters, which were labelled angry-antisocial, spree firesetters, and persecuted-suicidal, and were described as consistent with the subtypes proposed by Harris and Rice (1996). Gannon and Pina (2010) conducted a thorough review of classification-type systems and highlight a key weakness in the approach, which is the tendency to suggest that firesetting is motivated by a single factor for each individual.

Taking an alternative approach to the issue, Canter and Fritzon (1998) classified 175 arson cases on the basis of crime scene actions, identifying each as either expressive or instrumental, and targeted at either person or object. These resultant four types of offence were found to correspond reasonably well with four sets of offender characteristics, leading to suggestions that treatment programmes could be tailored appropriately, as could criminal investigations. This Action Systems Model was further developed using a larger crime scene sample (Fritzon, Canter, & Wilton, 2001) and later replicated using an English prison therapeutic community sample (Almond, Duggan, Shine, & Canter, 2005), while it has also been used to identify some differences between offence actions and offender characteristics between Britain and Australia (Fritzon, Doley, & Hollows, 2013). Efforts meanwhile to profile Australian serial arsonists by investigating associations between offence and offender characteristics led to the identification of a cluster of behaviours common to most serial arsons, as well as four discrete behavioural patterns, which were

termed thrill, anger, wanton, and sexual, and bore some similarities with the Action Systems Model (Kocsis & Cooksey, 2002). It has been suggested that this type of approach is of more use to crime investigators than clinicians (Gannon & Pina, 2010), but it nonetheless allows for a more complex clinical analysis of offender motivations than previous classification systems.

One of the most influential models for understanding recidivistic firesetting used a functional analysis paradigm to bring together a range of factors implicated in the behaviour, including those of a developmental nature (Jackson, Glass, & Hope, 1987). Jackson and colleagues argued that recidivist arsonists generally experience psychosocial disadvantage, dissatisfaction with life and the self, and are ineffective at social interaction. These key antecedent events, in combination with some significant previous emotive experience with fire and a triggering stimulus from which the arsonist feels powerless or out of control, lead to the firesetting behaviour which is then reinforced both positively and negatively by the fire itself and by the responses of caregivers and the authorities. This was further developed into the Only Viable Option theory based on the idea that, at the time of setting their fire, many arsonists view doing this as the only possible solution to the emotional state, problem or circumstances in which they find themselves (Jackson, 1994).

Fineman's (1995) dynamic-behaviour model similarly emphasised the role of psychosocial disadvantage and social ineffectiveness alongside reinforcement contingencies. He proposed assessment instruments to assist in the detailed analysis of individual offenders' thoughts, feelings and behaviours which accompany their firesetting.

Building on the strengths and addressing many of the weaknesses of the plethora of classification and theoretical approaches to date, Gannon, Ó Ciardha, Doley, and Alleyne

(2012) integrated these pre-existing models and theories to develop the Multi-Trajectory Theory of Adult Firesetting (M-TTAF), described as a comprehensive etiological approach. The M-TTAF sets out a **developmental context** (caregiver environment, learning, cultural forces and biology/temperament), which contributes to a range of **psychological vulnerabilities** (inappropriate fire interest/scripts, offence-supportive attitudes, self/emotional regulations issues, communication issues), which in turn interact with **proximal factors and triggers** (life events, contextual factors, internal affect/cognition, biology, culture) and **moderators** (mental health, self-esteem) to become **critical risk factors** which lead to firesetting behaviour (Gannon, Ó Ciardha, et al., 2012).

Importantly the M-TTAF is intended to account for the offending of both male and female firesetters and to include those offenders with mental disorder. In doing so it conceptualises mental health (the specific issue of command hallucinations notwithstanding) and self-esteem primarily as moderators of other psychological vulnerabilities as opposed to motivators in themselves (Gannon, Ó Ciardha, et al., 2012). This is helpful in widening the scope of applicability of the theory, although it has been argued that psychoses more broadly, rather than just command hallucinations, are more than just a moderating factor for a subset of mentally disordered firesetters (Green et al., 2014).

In order to assist clinicians to apply the M-TTAF, Gannon, Ó Ciardha and colleagues (2012) propose five provisional trajectories towards firesetting behaviour and use the concept of firesetting scripts as a means to gaining further insight into the cognitions underlying firesetting behaviour. Butler and Gannon (2015) have since elaborated on this approach, proposing a link with the concept of firesetting expertise, and inviting empirical

research to investigate and test their proposals. The M-TTAF has undoubtedly provided a significant step forward in the psychological understanding of firesetting behaviour and has also led to the development of so called micro-theories such as the firesetting offence chain for mentally disordered offenders (FOC-MD; Tyler et al., 2014) and the descriptive model of adult male firesetting (DMAF; Barnoux, Gannon, & Ó Ciardha, 2015) which seek to provide further detail on how firesetters commit their offences (in terms of cognitions, emotions, behaviours and environmental considerations) and thereby aid the development of future theories and treatment interventions (Barnoux et al., 2015).

Risk assessment of arsonists

As has been demonstrated, only limited research exists into the factors which underpin deliberate firesetting and theoretical approaches are thus far underdeveloped when compared to other types of serious offending behaviour such as violent and sexual offending. There is consequently very little specific guidance on how to assess risk of recidivism in this type of offender (Gannon & Pina, 2010), to a large degree because of the lack of high quality rigorous research to identify factors that can be said to predict such risk.

Classification approaches (e.g. Canter & Fritzon, 1998) have been of limited help to clinicians seeking to formulate and understand the motivations of firesetters, while functional analysis paradigms (Jackson et al., 1987) have been of greater utility. The tiered approach of the M-TTAF (Gannon, Ó Ciardha, et al., 2012) and more recent attempts to construct actuarial prediction tools (Edwards & Grace, 2014) also show promise. However, empirical knowledge relating to firesetting has not generally been translated into risk assessment tools specific to this group of offenders. Work to identify treatment needs

of specific groups of firesetters (Gannon et al., 2013) and the development of conceptual approaches to the most dominant motivations, such as revenge (Barnoux & Gannon, 2014), could help in the development of dynamic risk assessment tools. Actuarial assessment will be aided by more rigorous and large-scale research into static factors which predict recidivism.

Aims of the thesis

The overarching aims of this thesis are to contribute to the understanding of both static and dynamic risk factors for arson recidivism and to aid forensic clinicians in the process of assessing risk of recidivism in arson offenders. It also seeks to explore the utility of extant models or tools for predicting arson recidivism and to develop alternatives.

This initial chapter has provided background to the topic, clarified definitions, briefly explored some characteristics of arsonists in general, and provided an introduction to the pre-eminent theoretical approaches in the literature. Chapter two provides a critical review of a psychometric measure, the Fire Setting Scale (FSS; Gannon & Barrowcliffe, 2012). The FSS was designed primarily for use with undetected firesetters in the community, but is proposed here to be of potential use in measuring clinical need in firesetters in secure facilities. The development of the tool is outlined and its scientific properties are evaluated. Chapter three consists of a systematic review of risk factors for arson recidivism in adult offenders, the first such review conducted on this topic. The review identifies relevant research, which is described and evaluated in terms of its quality. Standardised effect sizes are calculated and the data synthesised to identify risk factors with varying strengths of empirical support. Building on this work, a large-scale empirical research study is presented in Chapter four. This retrospective investigation of risk factors for

recidivism importantly includes a substantial number of female arsonists, allowing for separate analysis to be conducted by gender. Risk factors are explored within domains of criminal history, offence characteristics/motivations, childhood/developmental variables, adult adjustment, mental health, and cognitive skills. Risk prediction models and tools are constructed and discussed. This research using a large England and Wales criminal justice sample was particularly warranted in light of findings that characteristics of arson offences differ quite considerably between Britain and Australia (Fritzon et al., 2013).

Finally, in Chapter five, the key findings of the thesis as a whole are discussed and placed in context, and the implications for both future research and forensic practice are considered.

CHAPTER TWO:

A PSYCHOMETRIC CRITIQUE OF THE FIRE SETTING SCALE:

INTRODUCTION

This review examines a psychometric assessment developed by Gannon and Barrowcliffe (2012) entitled the Fire Setting Scale (FSS). The tool is evaluated and critiqued in terms of its scientific properties, utility with community, forensic and clinical populations, research uses, and potential use in prediction of recidivism risk. Comparison is made with other psychometric tools designed for similar purposes.

Firesetting

There is a distinct lack of empirical knowledge about risk factors for firesetting, and a dearth of validated psychometric tools to assist with measurement of such factors (see Doley, Fineman, Fritzon, Dolan, & McEwan, 2011; Gannon & Pina, 2010 for reviews). A large epidemiological study in the US identified a prevalence rate of firesetters of 1.0% (Vaughn et al., 2010) to 1.13% (Blanco et al., 2010) in the community, although the question and methods used to elicit these figures have been open to criticism and suggestions that they are likely to have underestimated the true prevalence (Barrowcliffe & Gannon, 2015; Dickens & Sugarman, 2012; Gannon & Barrowcliffe, 2012). Firesetters in this sample self-reported much more extensive histories of antisocial behaviour (Blanco et al., 2010; Vaughn et al., 2010).

Evidence points to several key factors being predictive of repeated firesetting: a more extensive criminal history (Ducat, McEwan, & Ogloff, 2015; Rice & Harris, 1991), younger age (Dickens et al., 2009; Edwards & Grace, 2014; Rice & Harris, 1991, 1996),

being single or unmarried (Dickens et al., 2009; Rice & Harris, 1991, 1996), and presence of personality disorder (Barnett, Richter, & Renneberg, 1999; Barnett, Richter, Sigmund, & Spitzer, 1997; Dickens et al., 2009; Ducat et al., 2015; Rice & Harris, 1991). Feelings of tension and excitement associated with fire setting acts have also been identified as more common in recidivist firesetters (Dickens et al., 2009; Rice & Harris, 1991).

Antisocial personality disorder appears to be the personality disorder most commonly associated with deliberate firesetting (Blanco et al., 2010; Ducat, Ogloff, & McEwan, 2013; Lindberg et al., 2005), with 51.5% of undetected community firesetters meeting the diagnostic criteria, as against just 3.2% of controls (Blanco et al., 2010). Family reports of childhood interest in fire have been found to correlate most highly ($r = .49$) with belonging to a firesetter rather than other offender type group as an adult within a maximum security psychiatric institution (Rice & Harris, 1991). Imprisoned male firesetters have also been found to have greater levels of identification with and interest in fire, particularly serious fires, when compared with matched non-firesetting imprisoned controls (Gannon et al., 2013).

This evidence for both antisociality and fire interest or excitement-based factors being predictive of firesetting is given further support by a study which found both fire interest and antisocial behaviour to be predictive of repeat firesetting in 192 male children and adolescents aged 6 to 17 years (MacKay et al., 2006).

There are very few published psychometric measures designed specifically for the assessment of attitudes or interests associated with firesetting in adults, the vast majority being focused on juveniles and adolescents (see MacKay, Feldberg, Ward, & Marton, 2012 for a list of the major assessment tools for youths). The notable exceptions, being

designed for adults, are the Firesetting Assessment Schedule and Fire Interest Rating Scale (FSAS and FIRS; Murphy & Clare, 1996) and the Fire Attitude Scale (FAS; Muckley, 1997). The focus of this critique is on measures with applicability to adult populations, and which could be of use in assisting with the assessment of firesetting recidivism.

Murphy and Clare (1996) developed their two psychometric tools for use in a comparison of two groups of adults with mild learning disabilities, 10 of whom were firesetters and 10 of whom were not. The FSAS is only suitable for use with firesetters, as it consists of statements which ask about events, thoughts and feelings prior to firesetting incidents (16 items), and about the consequences for the firesetter of having set fires (16 items), each to be rated "usually", "sometimes", or "never". The FSAS is therefore perhaps of most use in understanding motivations of individual or groups of firesetters, but of less direct utility in predicting severity of future risk.

The FIRS could be used with firesetters and non-firesetters, and consists of 14 brief descriptions of fire-related scenarios, with participants rating how they would feel in each situation on a 7 point scale from "most upsetting/absolutely horrible" through to "very exciting, lovely, very nice". Whilst higher FIRS scores were reported for those firesetters for whom boredom and need for stimulation and excitement were central to their firesetting, the FIRS scores were not of use in discriminating between the firesetter and non-firesetter groups (Murphy & Clare, 1996), perhaps due partly to the very small sample size and to the transparency of the questions which could lead to socially desirable responding.

A study of 14 intellectually disabled arsonists found improvements in scores on the FIRS and FAS measures after a treatment intervention (Taylor, Thorne, Robertson, & Avery,

2002), but the sample size was very small and neither this nor the original study in which they were published (Murphy & Clare, 1996) present comprehensive data on their reliability. The psychometric properties of these tools have only very recently been subject to more rigorous testing and analysis (Ó Ciardha, Barnoux, et al., 2015).

The FAS (Muckley, 1997) is a 20-item scale apparently designed for use with adults and children. Items cover elements of fire interest, fire safety awareness and fire-related antisocial behaviour, and are rated for agreement on 5-point Likert items. Data on the reliability and validity of the scale are not provided.

Two of the above tools (the FIRS and FAS) have recently been combined with an unpublished scale, the Identification with Fire Questionnaire (IFQ), leading to the development of a five factor model for assessing firesetters' fire interests and attitudes (Ó Ciardha, Barnoux, et al., 2015). The factors of identification with fire, serious fire interest, perceived lack of fire safety, and seeing firesetting as normal, all discriminated between firesetters and non-firesetters in a prison sample, while multiple firesetters were discriminated from single firesetters by only one of the factors, identification with fire. Receiver operating characteristic analysis did not suggest sufficient accuracy for scores on any of the factors or scales to be used to predict risk of firesetting recidivism[1]. However, it is suggested that scores on specific factors could be of value in understanding individual pathways to offending and in identifying appropriate treatment targets (Ó Ciardha, Barnoux, et al., 2015).

[1] An area under the curve (AUC) of at least .71, corresponding to a large effect size (Rice & Harris, 2005), would be advisable before considering such use.

There is insufficient published data available on the aforementioned tools for them to form the basis of the current critique. The Fire Setting Scale (FSS; Gannon & Barrowcliffe, 2012) is the tool with the best, albeit still currently limited, research base to warrant detailed further exploration. It was chosen as the focus of the present review on this basis and because of its clear focus on the key factors of antisociality and fire interest. Alongside their development of the FSS, Gannon and Barrowcliffe (2012) also developed the Fire Proclivity Scale (FPS), in an attempt to measure *propensity* for firesetting behaviour. The FPS consists of six hypothetical firesetting vignettes, with participants asked to rate their own level of fascination with the fire, their likelihood of doing the same, level of enjoyment of the fire, and level of enjoyment at other people's reactions to the fire (deemed *general antisocialism*). Overall internal reliability of the FPS was good ($\alpha = .82$), although the Behavioural Propensity ($\alpha = .68$) and Antisociality subscales ($\alpha = .78$) were less internally consistent. Test-retest reliability was excellent ($r_{tt} = .88$), while the antisociality subscale was less reliable, although still acceptable, by this measure ($r_{tt} = .73$). Firesetters and non-firesetters differed significantly on their scores on the FPS and its subscales, with the exception of the Antisociality subscale. The Behavioural Propensity subscale from the FPS was able to predict firesetter group membership at 61% above chance, and non-firesetter group membership at 10% above chance (Gannon & Barrowcliffe, 2012). The complexity of the FPS, and need for greater levels of abstract thinking, may limit its use with lower functioning clients. However, findings suggest that attempting to assess proclivity for firesetting behaviour may provide a valuable addition to, or possibly replacement for, exclusively attitudinal measures in prediction of risk.

OVERVIEW OF THE TOOL

Purpose of the Fire Setting Scale

The Fire Setting Scale (FSS; Gannon & Barrowcliffe, 2012) was developed to examine the characteristics of adult undetected deliberate firesetters. A key aim of the authors was to be able to classify members of an undetected UK community sample as firesetters or non-firesetters by measuring the level of the two main facets which have been shown to be associated with detected firesetting in adults (Gannon & Barrowcliffe, 2012). The scale was designed primarily for use with those in the community and is proposed to be of potential use in identifying undetected firesetters who may benefit from community intervention work. The authors also propose that the FSS may be of use in measuring clinical need in firesetters in secure facilities, but it is important to acknowledge that the scale is still very much in its infancy and has not yet been tested with such a population.

The FSS is a 20-item self-report questionnaire, with each item rated on a seven-point Likert item on the basis of the extent to which the participant believes the statement is *"like"* them. It was designed to measure two constructs and therefore comprises two scales, the first measuring a general interest in fire, termed *"fire interest"* and the second *"antisocial behavioural problems relating to firesetting"* termed *"antisocial behaviour"* (p. 6), which the authors propose to be, "…the two main pathways or routes to firesetting…" (p. 2) either singly or in combination for each individual firesetter.

The 20 items comprising the FSS are as follows:

Fire interest items
I have a strong interest in fire
I find fire intriguing
I like watching fire

Fire equipment/paraphernalia interests me
I like watching fire being extinguished
I am fascinated by fire
I am attracted to fire
I like to feel the heat from fire
I like to watch and feel fire
I get excited thinking about fire

Antisocial behaviour items
I have physically threatened another person
I like to engage in acts that are dangerous
At school I would often truant
I like to engage in acts that are exciting
I am a rule breaker
I don't care what other people think of me
I have a behavioural problem
I like to do things to annoy other people
I like to wind people up
I have intended to cause harm with my behaviour

(Gannon & Barrowcliffe, 2012)

There is no published manual for the FSS. However the test materials and procedures for administration and scoring are publicly available (see Gannon & Barrowcliffe, 2012), which includes a description of the development and validation of the tool along with basic instructions for administration.

The Scientific Development of the Tool

The FSS was initially developed via a self-report study using an opportunistic sample consisting mostly of UK university students whose ages ranged between 18 and 70 (M = 32.1, SD = 16.5) years. The FSS was administered to 158 (109 female, 49 male) participants at Time 1. It was then re-administered to 150 of these participants again around two weeks later at Time 2 (Gannon & Barrowcliffe, 2012). Responses at Time 1 were used to examine the key psychometric properties of the tool, while comparisons with responses at Time 2 were used to examine test-retest reliability. As well as providing

demographic data, the participants also completed a firesetting disclosure section, providing information relating to the number of deliberate fires they had started from age 10 onwards, their age at the time, and their reasons for doing so. An impression management scale was also administered.

The utility of the FSS was further explored using a more representative community sample in Kent, UK. In this self-report study, ten percent (n = 5,568) of households in the Thanet region were asked to take part in an online survey (Barrowcliffe & Gannon, 2015). After the exclusion of one person who had an arson conviction, the responses of 157 (79 female, 78 male) participants who also answered a question on deliberate firesetting were sufficiently complete to be analysed. The non-firesetters were not asked their age, but firesetters' ages ranged between 22 and 72 years (median = 45 years).

There is not yet any other published use of the FSS in the academic literature and so the following discussion of test properties is based on information and data presented in the two studies referred to above.

TEST CONSTRUCTION AND SCIENTIFIC PROPERTIES

The 20 items of the FSS were generated by the authors (Gannon & Barrowcliffe, 2012) based on previously published literature reviews of factors relevant to detected adult and adolescent firesetters. Unfortunately no further information is provided on the construction of the scale. Therefore, it seems unlikely that factor analysis or item analysis were employed in its construction, despite the healthy participant to variable ratio. The lack of such data analysis in the construction of the FSS is problematic, and despite its face validity, this arguably limits the extent to which the two subscales reported by the authors can be said to represent psychometrically meaningful variables or factors.

The rationale for use of Likert response rather than dichotomous test items is not provided, although it appears a sensible choice, particularly given the transparent nature of many of the items (see below). Likert scales are generally most appropriate for measuring attitudes (Kline, 2000), and use of this method for the FSS, rather than forcing dichotomous responses, may introduce necessary sensitivity to the test which would otherwise be lost.

The FSS is an ordinal level scale. There cannot be said to be a real and meaningful zero from which scores are measured, so it cannot be described as providing ratio level data. It has also been argued that the size of the intervals in data drawn from Likert scales are not meaningfully quantifiable and can therefore be of use only to indicate the ordinal position of data. However, it is widely accepted that parametric statistical analysis can be used with Likert type data (Norman, 2010). The FSS loosely relies on a Classical Test Theory (CTT) approach, assuming a general linear model, rather than venturing into Item Response Theory (IRT) approaches (see e.g. Furr & Bacharach, 2008). A cumulative model such as IRT may be more beneficial when more is known about the subject area in question, but the use of CTT appears appropriate to the FSS.

Unfortunately, the instructions for administration of the FSS do not specify the order in which the 20 items should be administered, beyond stating that they should be randomised and not presented in separate groupings relating to the Fire Interest and Antisocial Behaviour subscales (Gannon & Barrowcliffe, 2012). Initial randomisation is appropriate to determine order of presentation, but given the importance of standardisation and consistency in administration for replicating and comparing results, it would be preferable that the items are always administered in the same order, unless separate analysis had already demonstrated that such variation did not impact on the responses of individuals.

RELIABILITY

Internal Reliability

Internal reliability refers to the internal consistency of a test, the extent to which the items of the test correlate with each other, or the extent to which the test is measuring one concept (Kline, 2000). Given the nature of psychological variables, it must be borne in mind that excessively high or 'perfect' internal reliability may lower test validity, as it could be an indication that a test is excessively narrow and specific, doing little more than asking the same question in lots of different ways (Kline, 2000), sometimes referred to as bloated specifics (Cattell, 1973).

Measures of reliability should be obtained using samples which are large enough to produce meaningful results, and representative of the population with whom the test is intended to be used (Kline, 2000). The validation study for the FSS (Gannon & Barrowcliffe, 2012) tested the scale on 158 participants taken from a general community population (albeit weighted towards university students), going some way to meeting both of these requirements.

Cronbach's alpha coefficients are reported from the administration of the FSS with 158 participants at Time 1 for the FSS Total Score ($\alpha = .86$), as well as the two subscales Fire Interest ($\alpha = .85$), and Antisocial Behaviour ($\alpha = .80$). The subsequent use of the tool with a more representative community sample of 157 participants reported internal consistency for the FSS Total Score ($\alpha = .90$), Fire Interest subscale ($\alpha = .92$), and Antisocial Behaviour ($\alpha = .72$) (Barrowcliffe & Gannon, 2015).

The very high Cronbach's alpha of .92 may indicate some level of item redundancy in the Fire Interest subscale, with consequent reduction in validity as outlined above. It is however reasonable to conclude that the FSS generally demonstrates a good level of internal consistency, both in terms of its total score and its constituent subscales.

Test-Retest Reliability

Test-retest reliability of a psychometric measure is defined as the correlation between the scores obtained by the same group of participants when tested using the same measure at two different times. For a measure to be of any practical or theoretical use, test-retest reliability must be high, meaning a correlation of at least .8 (Kline, 2000). Kline recommends at least a three month period between testing events in order to obtain a reliable estimate of test-retest reliability, and use of at least 100 participants. The validation study for the FSS (Gannon & Barrowcliffe, 2012) therefore used sufficient participants, but at an average of two weeks, arguably did not allow sufficient time between test and re-test to provide a reliable estimate of rest-retest reliability as the questions may still have been fresh in the minds of respondents.

Test-retest reliabilities (correlation coefficients) for the FSS are reported in the validation study for the FSS Total Score (r_{tt} = .86), as well as the two subscales Fire Interest (r_{tt} = .83), and Antisocial Behaviour (r_{tt} = .84). Whilst the non-optimum period between testing events is a limitation, these correlations do exceed the minimum cut-off to be considered high and therefore provide tentative evidence that the FSS can be considered reliable over time.

VALIDITY

"A test is said to be valid if it measures what it claims to measure." (Kline, 2000, p. 17). The FSS is evaluated below in terms of the major types of test validity.

Face Validity

"A test is said to be face valid if it *appears* [emphasis added] to be measuring what it claims to measure" (Kline, 2000, p. 18), but as Kline goes on to assert, aside from ability tests, face validity is unrelated to true validity, and if too obvious can even be a hindrance to honest and open reporting from those being tested.

As it has been demonstrated that an interest in fire and a history of antisocial behaviour are both related to risk of firesetting, then the FSS can be said to demonstrate a high level of face validity. However, it is therefore also highly transparent and would face a risk of distorted responding, particularly if administered to forensic or clinical populations and not completed anonymously.

Fire Interest subscale items include statements such as, "I have a strong interest in fire," and, "I get excited thinking about fire," while items on the Antisocial Behaviour subscale include, "I have physically threatened another person," and, "I have a behavioural problem." The items are face valid, in that they are appropriate to the two factors being measured, but as argued above, face validity may not actually be desirable in a psychometric tool of this type.

Concurrent Validity

Concurrent validity is the extent to which a test correlates with other tests designed to measure the same variable or construct (Kline, 2000). The lack of pre-existing measures designed to measure the fire interest and antisocial factors associated with adult firesetters limits the ability of the FSS to demonstrate such validity. It is argued that concurrent validity is only worthy of serious consideration if at least one criterion test of accepted validity already exists (Kline, 2000). As this is manifestly not the case, it is perhaps understandable that no attempt to establish concurrent validity was reported by the authors of the FSS (Gannon & Barrowcliffe, 2012). The Antisocial Behaviour subscale of the FSS could in future be tested for concurrent validity against pre-existing measures of this concept, as validated tools do exist, for example the relevant subscales of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2; Butcher et al., 1989) and the Millon Clinical Multiaxial Inventory-III (MCMI-III; Millon, Millon, Davis, & Grossman, 2009). Other tests focused on fire setting, albeit with their own problems in terms of validity and reliability, have already been discussed and could also be used in future to assist with establishing the level of concurrent validity of the FSS.

Predictive Validity

"A test may be said to have predictive validity if it will predict some criterion or other" (Kline, 2000, p. 21). The FSS seeks to predict membership of the group of people who have or have not deliberately set a fire. Participants were asked to confidentially self-report whether they had or had not deliberately set a fire (excluding those which were legally sanctioned or accidental) since the age of 10-years. Of the 158 participants in the validation study, 11.4% (n = 18) reported having set at least one fire, while 88.6% (n =

140) did not. FSS Total Score was found to be significantly higher in the firesetter vs. non-firesetter group ($p = .004$). More of this difference was accounted for by the Antisocial Behaviour subscale ($p = .001$), whereas the Fire Interest subscale did not quite reach significance in terms of the difference in scores between the groups ($p = .07$) (Gannon & Barrowcliffe, 2012).

Discriminant function analysis was performed to identify which of the subscales of the FSS and the Fire Proclivity Scale (FPS), which was developed in tandem, could distinguish firesetters from non-firesetters. Only the Behavioural Propensity subscale from the FPS entered the final equation, indicating that the FSS subscales had a limited ability to predict classification of firesetters and non-firesetters, and suggesting that measures which more narrowly assess behavioural propensity to set fires may be of more use in this regard.

In the subsequent investigation of the tool, FSS Total Score was found to be significantly higher in the firesetter vs. non-firesetter group ($p < .01$), as were scores on the Antisocial Behaviour subscale ($p < .01$), and the Fire Interest subscale ($p < .01$). On this occasion logistic regression was used to predict group membership. FSS Total Score was entered as one of eight predictor variables, but did not make a statistically significant contribution to the model (Barrowcliffe & Gannon, 2015).

Content Validity

Content validity for the FSS is very difficult to measure, claim, or achieve because so little is known about the theoretical and empirical underpinning of risk for firesetting (see Tyler & Gannon, 2012 for a review). The field is not at a sufficiently advanced stage for it to be possible to say whether or not the FSS provides coverage of all relevant items within the

concepts of fire interest and antisocial behaviour, which could contribute to risk for firesetting. Examining each of the subscales separately, it may be easier to establish content validity for the Antisocial Behaviour subscale of the FSS, given the greater agreement on what this concept includes. It is possible that the 10 items of this subscale may not achieve measurement of the full range of behaviours normally associated with an antisocial personality.

There is no reported use of additional subject matter experts (see e.g. Lawshe, 1975) beyond the authors of the FSS in order to enhance content validity. As noted previously, the FSS is certainly face valid, but this does not necessarily lead to the conclusion that it also has content validity. Given the difficulties in measuring content validity for the FSS, attention should instead be placed on the extent to which it achieves appropriate construct validity.

Construct Validity

"The construct validity of a test represents the extent to which the test measures the theoretical construct it is intended to measure" (Shaughnessy & Zechmeister, 1994, p. 140).

In the absence of a criterion test against which to test concurrent validity, and the difficulties establishing content validity, the construct validity of the FSS takes on greater importance.

There has been criticism of the tendency to see criterion-related (i.e. concurrent and predictive) validity as evidence for the presence of construct validity (McGrath, 2005), on the basis that a tool could be a good predictor of a certain outcome, or score on another

scale, without necessarily being a good representation of the construct it claims to measure. McGrath goes on to challenge the orthodoxy of using the same psychometric tests for accurately representing constructs and for predicting outcomes. It could be that tools which focus too highly on construct validity may sacrifice some predictive validity and vice versa.

Kline (2000) argues that construct validity be measured by testing a number of hypotheses based on the construct itself. He asserts that construct validity in fact incorporates all of the types of validity discussed here and points out that the measurement of construct validity relies on the construct itself being clearly defined.

Investigators must also be wary here of what Meehl (1990) terms the *crud factor*, which asserts that within the social sciences everything is more or less correlated with everything else. Observed correlations, even when reaching statistical significance, may therefore be inflated by the crud factor and care should therefore be taken in drawing conclusions about so-called *real* constructs.

No formal study of the construct validity of the FSS is reported by the authors, but elements of the validation study (Gannon & Barrowcliffe, 2012) can be taken as contributing towards a view that there is some support for the construct validity of elements of the FSS. Self-reported firesetters scored significantly higher than non-firesetters on the FSS Total Score and Antisocial Behaviour subscale (see Predictive Validity above), but not on the Fire Interest subscale. This raises the possibility that the latter may not be effectively measuring the construct of fire interest which has been found in earlier studies to be associated with firesetting behaviour. However. in the subsequent community study, self-reported firesetters did score significantly higher than non-

firesetters on the Fire Interest subscale, as well as on the FSS Total Score and the Antisocial Behaviour subscale (Barrowcliffe & Gannon, 2015).

Given the stated aim of the FSS is to assess the antisocial and fire interest factors associated with firesetting, it can be argued that in this case the construct being measured has been defined in terms of its ability to predict an outcome (undetected firesetting), and therefore McGrath's (2005) distinction between outcome prediction and construct representation cannot readily be drawn. A future development of the FSS, or similar tool, may benefit from drawing clearer distinctions between constructs and outcomes, thereby allowing more distinct analysis of its representational merits. Applying McGrath's distinction, it then follows that efforts could be extended separately to the development of tests which represent specific constructs related to firesetting, and to tools which seek only to predict likelihood of future firesetting behaviour.

DISTORTED RESPONDING

In order to monitor for distorted response patterns, Gannon and Barrowcliffe (2012) administered the 20-item Impression Management scale of the Balanced Inventory of Desirable Responding (BIDR; see e.g. Paulhus, 1998), on which higher scores indicate higher levels of socially desirable responding. No significant difference was found overall between firesetter and non-firesetter groups on this impression management measure, and when examining the sample as a whole, BIDR scores were unrelated to FSS scores. Interestingly however, when the firesetter and non-firesetter groups were examined separately, BIDR scores were found to be significantly negatively related to scores on the FSS, for the firesetter group only. In the later community study, the self-reported firesetters scored higher on the BIDR than non-firesetters, while BIDR scores were

negatively correlated with FSS scores. When looking at firesetters and non-firesetters separately, BIDR scores were only negatively correlated with FSS scores in the non-firesetter group (Barrowcliffe & Gannon, 2015). These conflicting results indicate a need for further investigation into the role of socially desirable responding on the FSS, and how this may differ based on the sample demographics.

NORMATIVE DATA

The mean scores (with standard deviations) for self-reported firesetters and non-firesetters in both of the reported adult community samples provide useful points of reference against which other populations could be compared. Further research would be necessary to establish normative scores in forensic and clinical populations, and particularly among detected firesetters, in order for individual scores to be used as a possible way of identifying need for or progress in treatment.

CONCLUSION

It is concluded that the FSS shows promise as a psychometric assessment to measure fire interest and antisocial behaviour problems associated with firesetting in the general population, although it cannot at this stage be considered to be validated and standardised for use in forensic, clinical or legal settings. Future validation across regional and cultural boundaries and with a wider cross-section of both offender and non-offender populations could allow for the development of reliable normative data and bring the FSS closer to a position where it could justifiably be used to assist in clinical and forensic risk assessment, rather than only in research. The ability of the FSS to predict future firesetting in both forensic and non-forensic populations could also be investigated longitudinally, potentially enabling its use as a predictor of risk, and as a measure of clinical change in offenders. It

may be that more detailed composite scales formed by the amalgamation of other existing measures, such as the previously discussed five factor model (Ó Ciardha, Barnoux, et al., 2015), overtake the FSS in clinical utility, but further evidence of their reliability and validity would be required.

Evidence for the role of socially desirable responding patterns indicates that clinicians and researchers should seek to measure distorted response patterns and consider ways of moderating or revising FSS scores for those participants who show a high socially desirable response bias.

There is scope in future, following further validation, for psychometric measures such as the FSS or alternative composite scales to feature as one part of decision making processes within emerging Structured Professional Judgement approaches to risk assessment of firesetters.

CHAPTER THREE:

A SYSTEMATIC REVIEW OF RISK FACTORS FOR ARSON RECIDIVISM IN ADULT OFFENDERS

ABSTRACT

Background - The human and financial costs of arson offending are high, with 64 deaths in 77,500 deliberately started fires in one year in England alone. The research literature to date has tended to focus on juvenile and adolescent firesetters. This systematic review aimed to identify risk factors for arson recidivism in adult offenders. No previous systematic reviews on this topic could be identified in the literature.

Method - Searches were conducted using PsycINFO, Web of Science, PsycARTICLES, and MEDLINE, among others, covering the years 1970 - 2015. Additionally searches were conducted using an internet search engine, reference lists were scanned, and experts contacted for additional data. Specific inclusion and exclusion criteria were applied using a PICOS framework. Data were extracted from studies meeting inclusion criteria and the studies evaluated using a quality assessment tool designed for the purpose. Studies are described and standardised effect sizes presented to allow comparisons to be made. Data are synthesised and potential risk factors identified and ranked according to the strength of the supporting evidence.

Results - Of a total of 278 potential hits, 67 were duplicates, and 60 studies were obtained in full. Of these, 15 studies met the inclusion criteria. The majority employed an observational cohort study design, with the remainder employing case-control methods. Two studies contained prospective elements with the remainder being purely retrospective

in nature. Scores (possible range 0 – 30) on the quality assessment tool ranged from 9 to 26, with one study deemed low quality (0 – 14), nine studies medium quality (15 – 19) and five high quality (20 – 30). The five factors identified as most reliably linked to arson recidivism were young age at first firesetting incident or conviction, number of previous arson offences, being single/never married, young age at time of index offence or subsequent assessment, and presence of personality disorder.

Conclusions - Findings remain tentative due to the methodological limitations of the studies reviewed. Studies contained few female subjects, covered six international jurisdictions and often studied psychiatric rather than wider criminal justice populations. Future research should seek to be as methodologically robust as possible, to include female participants and to explore the relevance of the 'international' factors highlighted to representative samples within specific jurisdictions.

BACKGROUND

The Department for Communities and Local Government (2014) report that in the financial year 2013-2014 the fire services in England attended 170,000 fire incidents, of which 46% (77,500) were classified as deliberately started. There were 275 fire fatalities, including 64 people who died in deliberately set fires. Fires in England that year also led to 3,600 non-fatal injuries which required hospital treatment. Whilst it is encouraging that these figures are part of a steadily declining trend, with more than three times the number of deliberate fires being attended annually in the early 2000s (Department for Communities and Local Government, 2014), and fire-related deaths down a third from their peak in the early 1980s (Department for Communities and Local Government, 2015), the human and financial costs of deliberate firesetting remain high.

Recidivism rates

Despite widely held beliefs to the contrary, the evidence suggests that the majority of arsonists do not in fact go on to commit further offences of arson, although reported recidivism rates vary markedly between studies (see Brett (2004) for a review).

In one of the more robust and recent studies, 6.2% (77) of 1246 arsonists in New Zealand were reconvicted for another arson offence over a 10-year follow-up (Edwards & Grace, 2014). Similarly, 5.3% (56) of 1052 Australian firesetters were charged with a further firesetting offence over an average 7-year follow-up (Ducat et al., 2015). These figures are fairly consistent with findings from earlier large criminal justice samples, for example the 4% rate observed by Soothill and Pope (1973) over a 20-year follow-up in England and Wales, and the 10.7% in the later replication of this study (Soothill, Ackerley, & Francis, 2004). There is some indication that higher rates of arson reconviction may be found in

forensic psychiatric samples, although such studies are less conclusive as they tend to feature far fewer participants. For example, in one of the most widely reported studies, 16% (33) of 208 male patients admitted to a Canadian secure hospital for firesetting failed by setting a further fire over an average 7.8 year follow-up (Rice & Harris, 1996).

A major limitation of any research into risk factors for recidivism is the low detection and conviction rate for offending, an issue which appears particularly relevant to arson offending. As noted above, the fire services in England attended 77,500 deliberately started fires in the financial year 2013-2014. This led to the police recording 18,579 arson offences that year (Office for National Statistics, 2014). While national conviction data for arson is not currently published (it is grouped with criminal damage offences), historical evidence shows that only 8% of the approximately 60,000 arson crimes recorded by police in 2001-2002 led to conviction (Arson Control Forum, 2003), compared to a detection rate of 23% that year for all recorded crimes. Detection rates in North America may be even lower, with it being reported that only 3% of arson offences lead to conviction (Geller, 1992, cited in Quinsey, Harris, Rice, & Cormier, 2006b).

Generally only those convicted of a further offence are counted as recidivists within research studies, but it is likely that many of those included within study populations do in fact commit further offences which remain undetected. This problem is compounded by the fact that many studies confuse or conflate recidivism of various types, meaning that their use for evaluating the likelihood of recidivism specifically by way of committing further arson offences is limited or non-existent.

Limitations on government resources available for the treatment and management of offenders have become more pronounced in an era of reduced public sector spending, with

the National Offender Management Service (NOMS) having been required to reduce its annual spend by an unprecedented 24% or £898m in the period 2011 – 2015 (National Offender Management Service, 2014). Within this context the case for allocating resources towards those offenders posing the highest risk remains compelling, yet little is known about how to predict the risk of future firesetting.

Much is known about the factors which increase risk of recidivism in general, with a growing consensus also in relation to factors predicting recidivism for violent offences (Quinsey, Harris, Rice, & Cormier, 2006c) but not for predictors of arson recidivism. General predictors of recidivism are well accounted for within actuarial risk prediction measures such as the Offender Group Reconviction Scale 3 (OGRS3; Howard, Francis, Soothill, & Humphreys, 2009) which is widely used within the prison and probation services in England and Wales. Such generic scales are of use in predicting general reoffending, but of less use with those offenders who commit violent and sexual offences, or arson. Scales have been developed for use with the first two of these specific groups, for example the Violence Risk Appraisal Guide (VRAG; Quinsey, Harris, Rice, & Cormier, 2006a) and the OASys Violence Predictor (OVP; Howard & Dixon, 2012) for violent offenders, and Risk Matrix 2000 (RM2000; Thornton, 2007) and Static 99 (Hanson & Thornton, 2000) among others for sexual offenders. However, no such tool has been developed or is in use for the prediction of arson recidivism within England and Wales. Recent research in New Zealand has led to the initial development of such an actuarial prediction model based purely on static factors (Edwards & Grace, 2014), although it is too early to say whether this is applicable to other jurisdictions.

The lack of research identifying factors known to predict firesetting recidivism, and lack of specific guidance for assessing this risk, was highlighted by Brett (2004) and has been reinforced by the findings of reviews over recent years (see e.g. Gannon & Pina, 2010; Doley et al., 2011). The extensive psychiatric literature on firesetters has been suggested as a reason for distorted beliefs about the perceived dangerousness of their group and their likelihood of committing further arson offences, regardless of actual recidivism rates (Quinsey et al., 2006b). The early literature was often strongly rooted in psychoanalytical approaches inferring sexual and/or urinatory motivations (see e.g. Freud, 1932; Yarnell, 1940) which added to the mystique and fear surrounding arsonists and continued to influence the search for potential risk factors for many decades, for example in research investigating the so-called Ego Triad of enuresis, firesetting and cruelty to animals (Slavkin, 2001, 2004).

Firesetting carried out by children, and particularly by adolescents, has been the subject of far more research and academic discussion than has that by adults. A systematic review to identify risk factors for firesetting recidivism in children and adolescents (Kennedy, Vale, Khan, & McAnaney, 2006) identified previous firesetting behaviour as the biggest predictor of recidivism. The other factors found to be predictive were fire interest, social skills deficits, covert antisocial behaviour, being male rather than female, being an older child/adolescent, and having a history of family/parental problems. The review noted that findings in relation to IQ/academic achievement and anger/hostility were mixed, with these factors not emerging as clear risk factors (Kennedy et al., 2006).

A non-systematic review of the literature into risk factors for recidivistic arson in adults (Doley et al., 2011), identified some possible risk factors under the headings of ‘criminal

history', 'mental illness and sociodemographic factors', 'possible offence-specific factors', 'offence-related behaviours and offence features', 'offence-related emotional states', and 'offence-related cognition'. A lack of clarity regarding criteria for inclusion in this review may have somewhat hindered its ability to draw many firm conclusions, as did the lack of available research, but there is clear value in identifying salient features of recidivists. The review concluded that fire interest, undetected firesetting, substance abuse, and young age are the most likely risk factors for firesetting recidivism (Doley et al., 2011). These authors specifically recommend as a result of their review that more retrospective research be carried out with firesetters in purely forensic settings, in addition to the ideal of long-term prospective reconviction studies.

Brett (2004) conducted an earlier review on this topic, focusing particularly on observed rates of firesetting recidivism rather than on the factors which may predict this offending. It was noted that research up to that point had tended to study firesetters based on where they were detained, as opposed to any underlying process of differentiation or classification. Studied populations were found to be drawn from forensic psychiatric settings, the criminal justice system, or general and psychiatric hospitals. Methodological problems and difficulties in generalising from each of these types of study were identified (Brett, 2004), and it appears that research conducted with samples drawn from the criminal justice system was most useful for drawing conclusions that could be applied to all firesetters.

It has been shown that the factors which predict firesetting recidivism are somewhat different from those which predict nonviolent recidivism and very different to the predictors of violent recidivism (Rice & Harris, 1996). There is now good evidence to

suggest that arson should be seen as a category of offending distinct from both violent and non-violent offending, and that different factors predict recidivism for arson than predict other types of offending (Edwards & Grace, 2014). For this reason it is important to examine in more detail the factors that have been shown specifically to predict future arson offences as opposed to wider definitions of recidivism.

Objectives

Preliminary searches were performed using the Cochrane Database of Systematic Reviews (CDSR), the University of York's Centre for Reviews and Dissemination (CRD) and the Campbell Collaboration database on 9th February 2014 to identify whether any systematic reviews of similar or identical focus had been conducted in recent years. These searches identified no such systematic reviews. Additional preliminary scoping using PsycARTICLES, PsycINFO, and Ovid MEDLINE identified the existence of one published non-systematic review of risk factors for recidivistic arson in adult offenders (Doley et al., 2011), an earlier partially systematic review focusing primarily on rates of recidivism rather than risk factors (Brett, 2004), and one systematic review on the topic which focused exclusively on child and adolescent offenders (Kennedy et al., 2006). Therefore, the current review is deemed both necessary and timely.

The current review aims to systematically investigate the nature, consistency and strength of empirically derived risk factors for arson recidivism in adult offenders.

METHOD

Sources of Literature

To identify studies for consideration and inclusion in the current review, the following electronic databases were searched in February 2014 and updated on 25th August 2015, with studies extracted in the order presented: PsycINFO, Web of Science, PsycARTICLES, MEDLINE, Applied Social Sciences Index and Abstracts (ASSIA), global Dissertations and Theses Database (Proquest), and finally the National Criminal Justice Reference Service (NCJRS) Abstracts Database.

The following additional measures were also taken to increase the scope of the review and reduce the impact of publication bias: a search was performed using the Google search engine to identify, for example, conference proceedings; reference lists of included studies, of a non-systematic review into the same topic (Doley et al., 2011), and of related discussion pieces (e.g. Gannon & Pina, 2010), were searched to identify additional relevant studies; and a number of established experts within the field of study were contacted by email to ask if they could provide details of any additional or unpublished research of relevance. Eleven out of 14 experts contacted responded to this request, although the exercise did not yield any additional studies or data. A list of experts contacted can be found at Appendix 1 and a sample email text at Appendix 2.

All identified studies published since 1970 were considered in scope for this review, that being the date after which the first generally cited empirical studies appear (see e.g. Soothill & Pope, 1973; Tennent, McQuaid, Loughnane, & Hands, 1971). Given societal and criminal justice system changes over time, any studies published earlier were deemed very unlikely to provide additional information to influence this review.

Search Strategy

The databases listed above were searched using the keywords and synonyms shown in Table 1 below:

Table 1: Search terms

Keyword	Synonyms				
Arson	Arson*	Fire sett*	Fire-sett*	Firesett*	Pyromani*
Risk	Risk*	Predict*	Protect*	Sociocultural factor*	Socio-cultural factor*
Recidivism	Recidiv*	Reoffend*	Re-offend*	Re offend*	

A decision was made not to use 'adult' as a search term, nor to exclude papers including 'juvenile' or 'adolescent' at the initial search stage, in order to increase the chances of identifying any studies with mixed adult/child samples. Keywords were searched individually before being combined so that all articles containing all three keywords, or any synonym thereof, were identified.

All terms were mapped to subject headings where possible and also searched separately without mapping to subject headings, for maximum scope and inclusion. An example of the search syntax is included at Appendix 3.

Inclusion Criteria

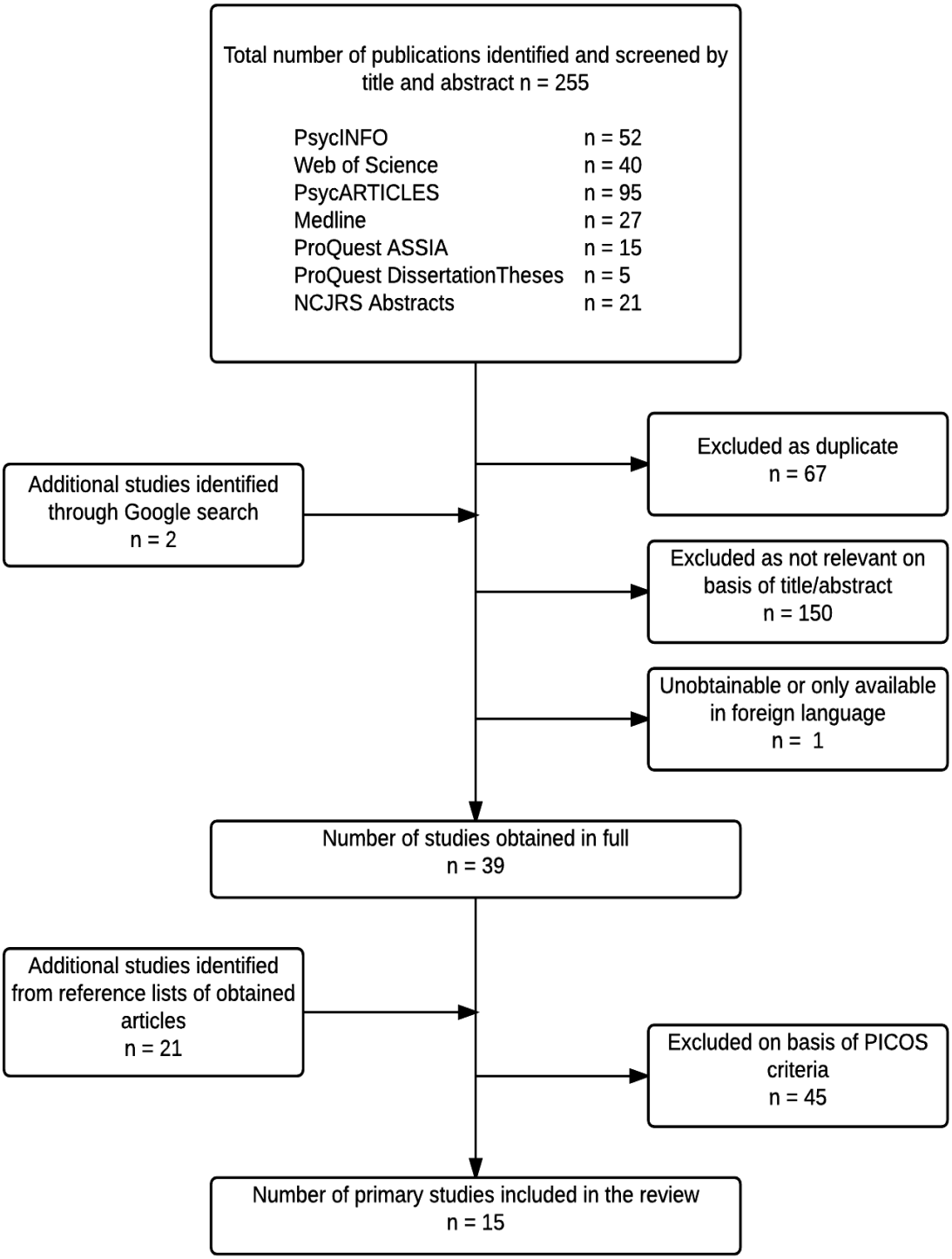
Studies emerging from the search process were first screened on the basis of title and abstract to remove duplicates and exclude any obviously unrelated to the subject of this

review. Remaining studies were then assessed against the inclusion criteria at Figure 1 on the basis of their abstracts and, if required, the full contents of the papers. The study selection process is depicted at Figure 2.

Figure 1: PICOS inclusion and exclusion criteria

	Inclusion Criteria	**Exclusion Criteria**
Population	Adults (18 years and over) at time of offending. Arson offenders (current or previous conviction(s) for arson). Any gender, nationality and ethnicity.	Sample only includes people aged 17 years and younger. Study does not include offenders with arson convictions. Non-offenders.
Interventions / Comparators	Risk factor(s) / factor(s) predicting arson recidivism.	No examination of risk factors / factors predicting arson recidivism.
Outcomes	Arson/firesetting recidivism/reoffending (including self-report and/or any official measure).	
Study Design	Cohort studies (prospective or retrospective); Case-control studies. Some use of inferential statistics to determine relevance of risk factors.	Reviews; commentaries; editorials; discussion/opinion pieces; case studies; case series. No use of inferential statistics to determine relevance of risk factors. Data reported in a purely descriptive manner.
Additional Criteria	Written in English. Year of publication 1970 – 2015.	

Figure 2: Flowchart depicting study selection process



Quality Assessment

After applying the inclusion and exclusion criteria each of the included studies was assessed in terms of its quality. This assessment was conducted by the author using an appraisal tool designed prior to the review (see Figure 3) by adapting publicly available checklists for evaluating the quality of cohort and other quantitative studies (Critical Appraisal Skills Programme, 2013; Effective Public Health Practice Project, 2003). The 15 criteria on the quality tool covered key issues of sampling, design, measurement, accounting for biases/confounding factors, appropriateness of statistical analyses and clarity of reporting. Scores for each of the 15 criteria were assigned as follows: criterion fully met = 2, criterion partially met = 1, criterion not met/unclear = 0. The maximum possible score on the quality assessment tool was 30, and study quality labels were assigned to studies based on quality score ranges shown below:

- Score 20-30: High quality. 80% (12 out of 15) or more of criteria were at least partially met, and at least 47% (7 out of 15) were fully met. Any methodological weaknesses that may be present are not likely to have impacted seriously on the results.

- Score 15-19: Moderate quality. 60% (9 out of 15) or more of criteria were at least partially met, and at least 27% (4 out of 15) were fully met. Methodological weaknesses may have impacted somewhat on the results.

- Score 0-14: Low quality. No more than 53% (8 out of 15) of criteria were partially met, and no more than 20% (3 out of 15) were fully met. Methodological weaknesses are clearly present and likely to have impacted on the results.

To ensure objectivity and consistency in quality assessment, three studies (20% of those included) were also quality assessed by another experienced forensic psychologist with relevant research expertise, who was not otherwise associated with the present review. This process initially yielded exact scoring agreement on 29 out of 45 individual criteria across the three studies, with an average difference in total quality score for each study of 2.3 points. Subsequent discussion between the two assessors resolved the inconsistencies. Final allocated quality ratings for each of the included studies are provided at Appendix 4 and discussed within the description of studies below.

Figure 3: Quality Assessment Tool

Quality Assessment Tool Screening Questions

1. **The study addresses a clearly focused issue.**
2. **The sample was recruited in a suitable way.**
3. **The sample is likely to be representative of the target population.**
4. **The study design was appropriate to answer the research question.**
5. **Comparators (potential risk factors) measured were selected appropriately.**
6. **Comparators (potential risk factors) were measured accurately to minimise bias.**
7. **Outcomes (recidivism/reoffending) were measured accurately to minimise bias.**
8. **Potential confounding factors were identified and described.**
9. **Other factors (including confounding factors/biases) are accounted for in the design/analysis.**
10. **Assessors and/or participants were blind to the research question if applicable.**
11. **Data collection tools were valid and reliable.**
12. **The follow up of participants was sufficiently complete.**
13. **The follow up of participants was sufficiently long term.**
14. **Statistical methods used were appropriate to the study design.**
15. **The results are presented in a precise and quantifiable way.**

Scores for each criterion were assigned as follows: Criterion fully met = 2, criterion partially met = 1, criterion not met/unclear = 0

RESULTS

A total of fifteen studies met the inclusion criteria and were therefore selected as forming the basis of this review. The level of variation in populations, design and analyses used in the included studies precluded the use of meta-analytic techniques for quantitative data synthesis. The findings of included studies are therefore described here, followed by a qualitative synthesis of findings. All of the studies included can be categorised as falling into one of the following two types of observational study, described here as they apply to the topic in hand:

Case-control study – Examines the presence of certain risk factors in a population with (cases) and without (controls) a certain outcome of interest (i.e. recidivist vs one-time arsonists) (Centre for Reviews and Dissemination, 2009). These studies are, by definition, retrospective.

Cohort study – Participants are followed over time to compare outcomes (e.g. commit a further arson offence or not) between those who do and do not have certain risk factors (Centre for Reviews and Dissemination, 2009). These studies can be prospective or retrospective.

Description and quality assessment of the included studies

The fifteen studies meeting the inclusion criteria are described below in chronological order based on year of publication, beginning with the most recent, along with a summary of their assessed quality. Key information on each study is also presented in Table 2.

Table 2: Summary of key information of included studies

Author, aim of study & how identified	Sample	Method	Measures	Outcomes (including effect sizes if presented)	Quality assessment score
Thomson et al. (2015) **Aims: To compare one-time and recidivist firesetters on PCL-R scores and diagnoses of personality disorder and psychoses.** **Systematic search (PsycINFO Web of Science, Medline).**	N = 135 male firesetters referred for pre-trial evaluation at Helsinki University Central Hospital in the ten year period 1989 – 1998. Mean age 32.3 (SD=11.1, range 16 - 67) years. Six offenders with an IQ of 70 or below were excluded. Final sample n = 129 males, two of whom were under the age of 18 at point of referral. 88 (68.2%) were one-time firesetters, 41 (31.8%) recidivists.	Observational case-control design. Retrospective. Recidivists compared to first-time firesetting offenders on item, factor, and total PCL-R scores, as well as on personality disorder and psychosis diagnoses. Criminally versatile vs exclusive firesetters were also compared.	The PCL-R was scored retrospectively using file information only (no interview) by a forensic psychiatrist. Diagnoses of personality disorder and psychoses taken from the original psychiatric examination. Recidivism measured only up to the point of, and entirely based on, the original psychiatric evaluation, which, "traditionally includes a paragraph summarizing the subject's previous official criminal history." (p.2).	One-time and recidivist firesetters did not differ significantly on any of the measures. Mean total PCL-R scores were 15.8 (SD = 6.8) for the one-time firesetters, compared to 16.6 (SD = 7.1) for the recidivists.	18. Moderate.

Ducat, McEwan, & Ogloff (2015) **Aims: To identify specific psychiatric and criminogenic risk factors for firesetting recidivism.** **Systematic search (PsycINFO, Web of Science, ASSIA)**	N = 1052 offenders convicted of arson or arson-related offences between 2000 and 2009 in the Australian state of Victoria. 143 (13.6% female). 62 (5.9%) under 18 years old at time of index offence. Mean age 33 (SD=14.4, range 10–83) years. Sample consisted of all arson and firesetting convictions in Victoria in this period as identified by the Sentencing Advisory Council of Victoria (SAC) (1328 offenders) minus those who could not be matched on the police database (250) and those who had since died (17).	Observational cohort study design. Retrospective. Participants were followed up for an average of 6.9 (SD = 2.6) years with data linkage procedures used to measure criminal history and further charges in the follow-up period, contact with psychiatric services, and death records. Univariate comparisons were conducted, and significant predictors used to develop an improper model of recidivistic firesetting with an AUC of 0.74. The	Data linkage to join criminal histories taken from Victoria Police Law Enforcement Assistance Program (LEAP), mental health histories from the Victorian Case Psychiatric Register (VPCR), and coronial information from the National Coronial Information Service (NCIS). Firesetting recidivism defined as having any subsequent charge for arson or arson-related offences, as conviction data was unavailable.	5.3% (n=56) subsequently charged with a firesetting offence. When compared to those offenders who did not commit further arson offences in the follow-up period, firesetting recidivists were younger at time of index offence ($p<.05$), and younger at the time of their first ever offence ($p<.01$) and first arson offence ($p<.05$). They were less likely to be pure arsonists (no history of offending other than arson) ($p<.001$), had a greater number of prior charges for any offence ($p<.001$), and were more likely to have had multiple arsons for the index offence ($p<.001$), arson plus 3 or more other offence types in their history ($p<.001$), any charges prior to the index ($p<.001$), more than two previous offences ($p<.001$), prior arson ($p<.05$), prior violent offence ($p<.01$), prior non-violent offence ($p<.001$), be highly criminally versatile ($p<.001$), be registered with mental health services ($p<.001$), to have had contact with those services as a child or adolescent ($p<.001$), and	16. Moderate.

		at-risk period was not known and therefore not accounted for in the analysis.		to have an Axis I clinical diagnosis (p<.001), a serious mental illness (p<.01), psychosis (p<.05), substance misuse history (p<.001), childhood behaviour disorder (p<.05), and a personality disorder diagnosis (p<.001). An improper model to predict firesetting recidivism incorporated the majority of these factors with an AUC of 0.74. Cut-off scores could not be identified due to the low base rate of arson recidivism.	
Edwards & Grace (2014) **Aims: to develop an actuarial model for arson recidivism, and to test whether different factors predicted arson, violent, and non-**	N = 1250 arson offenders in New Zealand (included only 4 females). Convicted of at least one arson offence between 1985-1994. All aged 14 or older at time of first (criterion) arson offence. Mean age 23.84 (SD=8.57, range 14-77) years.	Observational cohort study design. Retrospective. 10-year follow-up period taken from date of first arson court appearance (the criterion offence) occurring between 1985-1994, or 10 years from hearing date + 2/3rds of sentence for those	Criminal history and demographic variables obtained from NZ criminal database. Recidivism defined as a conviction or detainment for any offence occurring during 10-year follow-up period Stepwise survival analysis (Cox regression) used to develop predictive model on a random half	6.2% (n=77) convicted of a further arson offence in the 10-year follow-up. Violent and non-violent recidivism was much higher. Six variables were significantly correlated with arson recidivism (with correlations of .06 to .12): 1. First arson < 18 years 2. Multiple arsons for criterion offence 3. Number of prior arson offences 4. Number of prior vandalism offences 5. Number of prior violence/vandalism offences	24. High.

violent recidivism. **Systematic search (PsycINFO Web of Science, ASSIA).**	All judged criminally responsible for their arson offence at time of criterion offence court appearance.	given a custodial sentence. i.e. 10 years 'at risk'.	of the sample. P<.05 criterion for inclusion at each step. Assessed generalizability of the prediction model using a cross-validation strategy of dividing the 1250 cases into two randomised groups – a 'development' sample used to predict recidivism in a 'validation' sample.	6. Number of prior theft/violence offences Predictive model for arson recidivism (AUC .70) included 3 significant predictors (odds ratios (OR) in brackets): 1. First arson < 18 years (OR=2.51) 2. Multiple arsons for criterion offence (OR=3.27) 3. Number of prior vandalism offences (OR=1.41) Actuarial model constructed using a 10-point scale and 4 risk bands was constructed with an AUC = .67	
Dickens et al. (2009) **Aims: to identify variables which can distinguish recidivist from non-recidivist firesetters, and to investigate the role of the**	N=167 adult (over 18) arsonists in England who were referred for forensic psychiatric assessment over a 24-year period. 129 males, 38 females. Mean age at time of assessment = 29.4 (SD=11.3, range 18–77) years.	Observational case-control design. Retrospective. Examination of case notes for differences between (i) first-time and multiple (2+) firesetters; and (ii) seriousness of arson	Criminal conviction data supplied by Home Office. Other variables coded from psychiatric case notes/reports. Variables selected because previously identified in the firesetting literature. Definition of recidivism was based on evidence of repeat firesetting from clinical and	Repeat firesetters were more likely to be/have: Younger (p<.01), single(p<.01), problematic family history (p<.05) (especially violence (p<.01)), enuresis(p<.05), poor school adjustment (attended special school) (p<.01), personality disorder (p=.05), learning disability (p<.05), relationship difficulties (p=.05), earlier age of first conviction (p<.001), spent more time in prison (p<.01), more convictions for property crime	21. High

seriousness of the fire. **Systematic search (PsycINFO, Web of Science, ASSIA)**	81(49%) were repeat firesetters.	consequences vs. less-serious. [Focus only on (i) for the present review].	criminal records, not just based on convictions. Authors state they used the same definition as Rice and Harris (1991).	(p<.01), feelings of tension and excitement around the index offence (p<.05), attempted to extinguish a fire (p<.01). Repeat firesetters were less likely to be in the subgroup of participants with psychotic illnesses (p<.05), and less likely to have set a fire at a home (domestic site) (p<.05). Recidivism was not found to be related to setting serious vs less-serious fires.	
Soothill, Ackerley, & Francis (2004) **Aims: to investigate the criminal careers of arsonists and compare them to earlier cohorts of similar offenders.** **From search of reference lists.**	1980-1981 cohort (all offenders convicted of arson in England and Wales in those years) contained 5584 offenders (643 women) of whom 460 were convicted of arson endangering life. 1663 were given a custodial sentence, 3713 non-custodial, 208 medical disposal.	Observational cohort study design. Part prospective and part retrospective. Also compares results from 3 different temporal cohorts.	1980-1981 cohort followed up for 20 years using the Home Office Offenders Index. No allowance made for time 'at-risk'.	Arsonists convicted of arson endangering life were no more or less likely to be convicted of arson again. However, those convicted of endangering life were significantly more likely to be convicted of a further offence of endangering life than those convicted of an offence not endangering life (p<.0005). Further arson convictions during follow-up on basis of 1980-1981 disposal: Custodial sentence (9.1%), Non-custodial sentence (11.1%), Medical disposal (16.8%). However, no inferential statistic are reported to indicate	16. Moderate.

	Mean age 20.59 (range 10–77) years.			whether or not these differences were statistically significant. Of those imprisoned, slightly higher rate (12.5% vs 8.8%) of subsequent arson convictions in those sentenced to 5yrs+ vs. <5yrs imprisonment. Again, no inferential statistics reported on this analysis.	
Barnett, Richter, & Renneberg (1999) **Aims: to investigate if arsonists can be identified as more or less dangerous on the basis of legal categories of criminal responsibility.** **Systematic search (Medline)**	All 'not-responsible' (n=186) and 'diminished-responsibility' (n=97) (for psychiatric reasons) arsonists convicted in former West Germany between 1983 and 1985, and every third criminally responsible arsonist over the same period (n=187). Total n=470 (60 females).	Observational cohort study design. Retrospective. To investigate whether defined subgroups of arsonists with increased risk of recidivism could be identified. Arsonists in the sample also classified by whether they had any non-arson convictions ('mixed' vs. 'pure' arsonists).	Followed up until August 1994 by use of trial records. Number of arson convictions and occurrence of crimes other than arson were measured, subsequent to the index offence. Very little information provided on measures used. Terms like 'firesetting incidents' used interchangeably with 'arson convictions'.	No significant differences in arson reconviction rates between the 3 groups. When grouped into mixed vs pure arsonists: Those found partly responsible for the index offence had significantly more firesetting incidents than the 'not-responsible' pure arsonists (p=0.000) and fully responsible arsonists (p=0.001). It is often not possible to determine which comparisons are being reported due to the wording of the results section and lack of tabulated p values. It does appear clear that those who are both 'pure' arsonists and were judged	16. Moderate.

				partly (diminished) responsibility, are likely to set the most fires.	
Barnett, Richter, Sigmund, & Spitzer (1997) **Aims: To investigate whether differences exist in the level of firesetting and other criminality between groups of mentally disordered and non-mentally disordered arsonists.** **From search of reference lists.**	Same sample as (Barnett et al., 1999): All 'not-responsible' (n=186) and 'diminished-responsibility' (n=97) (for psychiatric reasons) arsonists convicted in former West Germany between 1983 and 1985, and every third criminally responsible arsonist over the same period (n=187). Total n=470 (60 females). Sample also used to identify a more 'widely defined' psychiatric firesetter group (n=228, 189 male, 39 female).	Mixed observational case-control and cohort study design. Retrospective. Compared mentally disordered firesetters with non-mentally disordered firesetters with regard to average rate of firesetting and concomitant criminality.	Followed up until August 1994 by use of trial records. Number of firesetting incidents and occurrence of crimes other than arson were measured, both prior and subsequent to the index offence. Follow-up period 9-11 years, average 10 years.	Previous firesetting: narrowly defined groups: 9% of not responsible firesetters, 13% of partly responsible firesetters, and 4% of fully responsible firesetters had previously set a fire (p=.023). Widely defined: 11% of psychiatric group and 3% of mentally healthy group had previously set a fire (p=.005). Arson reoffending: narrowly defined groups: 9% of not responsible firesetters, 10% of partly responsible firesetters, and 4% of fully responsible firesetters (p=.066). Widely defined: 11% of the mentally disordered group and 2% of the healthy group were convicted of a further arson offence (p<.0001).	20. High.

Repo & Virkkunen (1997a) **Aims: to investigate differences in recidivism and offence-specific factors between schizophrenic and non-schizophrenic firesetters and alcoholic and non-alcoholic schizophrenic firesetters.** **Systematic search (Web of Science)**	N = 304 male arsonists referred for pre-trial forensic psychiatric assessment at Helsinki University Central Hospital (1978-1991). Of these n = 44 were classified as having schizophrenia (included delusional psychosis n = 4). Mean age at assessment 31.4 (SD=10.1) years. Of the 44 patients with schizophrenia, 25 were also alcoholics. N = 260 no schizophrenia diagnosis: Mean age at assessment 33.3 (SD=11.5) years.	Observational case-control design. Retrospective. Comparisons of firesetters with and without a diagnosis of schizophrenia, and alcoholic and non-alcoholic firesetters with a diagnosis of schizophrenia.	Data gathered from medical and criminal records and structured questionnaire sent to all 'first-degree' relatives. Outcome (recidivism) measured from past criminal records. No follow-up period.	32% of firesetter without schizophrenia and 26% of firesetters with schizophrenia had previously committed at least one firesetting offence (non-significant, p = 0.568). Among those with schizophrenia there was a non-significant trend (p = 0.726) towards more recidivist fire setters (30%) alcoholic patients than among non-alcoholic patients (21%).	18. Moderate.
Repo & Virkkunen (1997b) **Aims: to compare outcomes for a**	N = 304 male arsonists over 15 years of age, referred for pre-trial forensic psychiatric assessment at Helsinki University	Observational cohort study design. Retrospective. Comparisons made by dividing	57 (44.9%) of the responders were interviewed based on Michigan Alcohol Screening Test (MAST) and 76 (59.8%) completed Karolinska	In comparison to the one-time firesetters, it is stated that the multiple firesetters: • Had obtained less social support (p=.045) • Were more deeply alcoholised (non-sig, p not reported)	17. Moderate.

group of arsonists assessed pre-trial, to identify predictors of recidivism. **From search of reference lists.**	Central Hospital (1978-1991). Followed up in 1993. Mean age 33.0 (SD=11.3) years at time of psychiatric assessment. 264 were alive and 127 responded. Mean age at time of response 39.8 (SD=10.7, range 19-69) years.	the firesetters into the following groups: one-time firesetters, multiple firesetters, violent offenders, and recidivist offenders (any other additional criminal offences). Participants who qualified for more than one group appear to have been counted in multiple groups as the total N for KSP and MAST results exceeds the reported number of participants in those assessments.	Scales of Personality (KSP). Opinion asked via questionnaire about availability of psychosocial help. Psychiatric diagnoses, WAIS IQ score, and MMPI results were taken from medical records. Outcome (recidivism) measured from lifetime (since age 15) criminal records at the end of 1993.	• Were less highly socialised (non-sig, p=.078) Differences reported as present despite lack of statistical significance. Other comparisons did not show significant differences between the one-time and multiple firesetter groups.	
Repo & Virkkunen (1997c)	N = 45 young male firesetters who were 21 years old or younger when committing their	Observational cohort study design. Retrospective.	Data gathered from medical and criminal records (all criminal offences during follow-up to 1993, by which	History of conduct disorder was only significant with respect to crimes against property. No significant difference for arson recidivism.	17. Moderate.

Aim: to investigate whether history of conduct disorder and psychiatric diagnoses differed between arsonists who had subsequently committed further offences, and those who were lifetime recidivists. **From search of reference lists.**	first firesetting offence and referred for pre-trial forensic psychiatric assessment at Helsinki University Central Hospital (1978-1991). Mean age 19.0 (SD=1.7) years at time of psychiatric assessment.	Comparison of offenders with and without a conduct disorder diagnosis. Comparison of those who were convicted of further arson offences with those convicted of other offence types.	time participants had been free from prison for 70.3 (±42.4) months. Psychiatric diagnoses were identified from the findings of psychiatric assessment. History of conduct disorder was obtained using a structure questionnaire sent to all 'first-degree' relatives.	Only descriptive statistics are presented with regard to the prevalence of other Axis I and II diagnoses between groups, so no conclusions can be drawn.	
Repo, Virkkunen, Rawlings, & Linnoila (1997b) **Aims: To investigate**	N = 304 male arsonists referred for pre-trial forensic psychiatric assessment at Helsinki University Central Hospital.	Observational cohort study design. Retrospective. Compares offenders with various	Measured history (prior to index fire) of serious suicide attempts and of non-lethal slashing. Data gathered from medical, police and criminal records and	Limited findings presented that are relevant to this review: Neither a history of suicide attempts (p=0.587) nor a history of slashing (p=0.105) were significantly more common among those who committed recidivist	21. High.

prevalence of suicidal and self-harming behaviour among arsonists and relationship between history of suicide/self-harm a range of other variables and recidivism outcomes.	Mean age 33.0 (SD=11.3) years at time of psychiatric assessment.	suicide/self-harm histories across a range of variables.	structured questionnaire sent to all 'first-degree' relatives. Personal history of self-harm taken from participants along with physical examination of scars. Recidivism measured from criminal records at 8.1 (±3.9) years. Blood glucose nadir measured using an oral glucose tolerance test.	firesetting offences, although the trend in each case was in that direction.	
Systematic search (Web of Science)					
Rice & Harris (1996) **Aims: to compare violent, nonviolent and firesetting recidivism in a group of mentally**	N = 243 men admitted to a maximum security Canadian psychiatric hospital between 1973 and 1983 for firesetting. Background data for sample presented in (Rice & Harris, 1991). Mean age at	Observational cohort study design. Part retrospective and part prospective. Examined a range of individual personal characteristics to investigate the	All variables (except outcome) coded retrospectively from patient clinical files. Background data coded 'blind' to outcome and vice versa. Outcome coded from police data and institutional records (included behaviour that	137 (66%) showed any type of recidivism: 33 (16%) by setting a fire, 118 (57%) nonviolent offence, 64 (31%) violent offence. Variables which correlated with firesetting recidivism: childhood history of firesetting, young age at first firesetting, lower highest grade reached, lower aggression score, higher number of fires set,	26. High.

disordered firesetters, and identify factors which predict each type of recidivism. **Systematic search (PsycINFO, Web of Science, ASSIA, NCJRS)**	admission 28.7 (SD=11.0) years.	multivariate prediction of future firesetting and violent and nonviolent recidivism among firesetters.	would have resulted in criminal charges if not incarcerated). Firesetting recidivism was any charge (or conduct warranting criminal charge) for firesetting, or charges of mischief in which firesetting was involved. Violent offending (excluding firesetting) outcome measured similarly, as was nonviolent recidivism (all criminal behaviour not in other two outcome measures). 208 of the 243 had the opportunity to fail up to final coding in July 1993. Average 93.6 (±87.8) months 'at risk'.	never married, no violent offence history, lower IQ, having acted alone in the firesetting offence, no concurrent criminal charges, and not having set a fire on a weekend. A multivariate prediction equation was calculated using stepwise multiple discriminant analyses, using only the above significant univariate predictors. The variables entering the equation (strongest first) were: young age at first firesetting, higher total firesetting offences, childhood history of firesetting, lower IQ, no concurrent criminal charges to the index fire, acted alone in setting the index fire, and lower aggression score. Logistic regression methods were also reported to have been used and to have yielded the same results.	
Virkkunen, Eggert, Rawlings, & Linnoila (1996)	73 violent offenders and 41 firesetters in Finland (only the firesetters are of interest to the present review) but demographic info	Observational cohort study design. Prospective. Investigated the role of psychiatric	Data gathered from medical and criminal records and structured questionnaire sent to all 'first-degree' relatives. Psychiatric diagnoses made.	Most results presented do not distinguish between violent and firesetting offenders, either in terms of index offence or in terms of type of reoffence.	15. Moderate.

Aims: To follow up groups of violent offenders and firesetters to measure recidivism and investigate the role of psychiatric diagnoses and biochemical variables. **Systematic search (Medline)**	relates to whole sample. Age 31.9 (SD=13.1) years, IQ 97.3 (SD=16.4). All were selected by the courts for forensic psychiatric evaluation.	diagnoses and biochemical variables in recidivism.	Outcome (recidivism) measured from criminal records at 53.7 (± 35.9) months after release from prison. Biochemical measures of cerebrospinal fluid (CSF) (including 5-hydroxyindoleacetic acid (5-HIAA) and homovanillic acid (HVA)), blood glucose nadir during an oral glucose tolerance test, and plasma cholesterol.	There is only one specific relevant finding reported (although not clear it refers only to firesetting reoffences): "Although findings … of low blood glucose nadir during an oral glucose tolerance test were replicated among the recidivist fire setters (data not shown), there was no difference in the mean blood glucose nadir between the overall recidivist and nonrecidivist groups." (p.528)	
Rice & Harris (1991) **Aims: to compare firesetters vs. non-firesetters and first-time vs. recidivist firesetters admitted to a maximum security**	243 male patients admitted to a Canadian maximum security psychiatric institution for firesetting. Every patient admitted due to firesetting over an 11-year period (1973-1983). Not all convicted of arson. Some on remand, some not	Observational case-control study. Retrospective. The comparison of interest is that between the 98 first-time firesetters and the 145 recidivists.	Coded retrospectively from file information – 34 independent/predictor variables organised relating to: • Offender characteristics; • Childhood and social history; And a further 19 variables relating to:	The following all differentiated multiple from one-time firesetters: • Younger age at index fire • More likely personality disordered • Lower school adjustment • More likely institutionalised as a child • More family reports of fire interest • Longer in correctional institutions • More nonfire charges	19. Moderate.

psychiatric institution. **From search of reference lists.**	guilty by reason of insanity, etc. Of the 243, 98 were first-time firesetters and 145 repeat firesetters. Mean age at admission 28.7 (SD=11.0) years.		• Characteristics of the firesetting offence (including location, method and motivation of most serious fire set). Inter-rater reliability of coding was established.	• Less likely history of interpersonal aggression • More previous fires in institutions • Younger age at first documented fire • Less likely to have victimised someone they knew • Less likely to have a delusional motive for index fire • More likely excitement or emotional release as motive for index fire Multiple discriminant analyses yielded an equation composed of age, history of suicide attempts, family reports of childhood fire interest, months in correctional institutions, marital status, and history of aggression. This allowed 68% correct classification.	
Sapsford, Banks, & Smith (1978) **Aims: To compare determinate sentenced arsonists with**	147 male arsonists (England & Wales), 138 who were given determinate prison sentences of 18 months+ and released from prison during 1970-1972, and 8 with 5years+	Observational cohort study design. Retrospective.	A "whole constellation" of variables (social, psychiatric, criminal, sentence type) were measured, with data gathered from Prison department files, parole dossiers and files from the Criminal Records	Those who had been sentenced to 5+yrs sentence were 10 times more likely than those with <5yrs sentence to have been reconvicted for arson by the end of the 5-year follow-up (20.0% vs 2.1%), but with more than 50% missing cases. At the 3-year follow-up, the difference was six times (15.2% vs	9. Low.

a group of arsonists serving life sentences, and to investigate factors which may predict different types of recidivism. **Systematic search (NCJRS)**	sentences released in 1973.	Office. Actual number of independent variables not specified. Follow up period for measuring reconviction was 3 to 5 years.	2.7%). No statistical significance figures are reported. The single biggest predictor of arson reoffending was number of previous convictions for arson. Adding total previous convictions (i.e. not just arson) improved the prediction accuracy slightly. No statistical significance figures reported. Previous history of arson was found to be significantly associated ($p<0.005$) with ever having been labelled “sexually abnormal”.

Thomson et al. (2015)

This retrospective case-control study investigated levels of psychopathy, as measured by the Hare Psychopathy Checklist – Revised (PCL-R; Hare, 1991), personality disorders, and psychoses among a consecutive sample of 135 male firesetters referred for pre-trial evaluation at the Helsinki University Central Hospital in the ten year period 1989 – 1998. Mean total PCL-R scores were 15.8 (SD = 6.8) for the one-time firesetters, compared to 16.6 (SD = 7.1) for the recidivists, showing no significant differences on this or other measures.

The study scored 18 on the quality assessment tool and was therefore rated as being of moderate quality. The aims of the study were clear and variables of interest were selected appropriately. The measurement of recidivism relied on second-hand information from the original psychiatric examination with no use of up-to-date conviction data and it appears that the PCL-R assessor was not blind to the aims of the study. However, the authors do acknowledge the limitations of the study and the statistical analyses used are appropriate and well presented.

Ducat, McEwan, and Ogloff (2015)

This study, although described by the authors as prospective, employed a retrospective cohort study methodology to investigate factors related to firesetting recidivism over an average 6.9 (SD = 2.6) years follow-up in the 1328 people convicted of arson or arson-related offences between 2000 and 2009 in the Australian state of Victoria.

When compared to those offenders who did not commit further arson offences in the follow-up period, firesetting recidivists were younger at time of index offence, and

younger at the time of their first ever offence and first arson offence. They were less likely to be pure arsonists (no history of offending other than arson), had a greater number of prior charges for any offence, and for arson, and were more likely to have had multiple arsons for the index offence, arson plus three or more other offence types in their history, any charges prior to the index, more than two previous offences, prior arson, prior violent offence, prior non-violent offence, be highly criminally versatile, be registered with mental health services, to have had contact with those services as a child or adolescent, and to have an Axis I clinical diagnosis[2], a serious mental illness, psychosis, substance misuse history, childhood behaviour disorder, and a personality disorder diagnosis.

This study scored 16 on the quality assessment tool and was therefore rated as being of moderate quality. 250 (18.8%) of the original sample could not be matched on the police database and were therefore excluded from the analysis. No analysis is reported relating to possible differences between this group of participants and those who remained within the study. Of the remaining 1052 participants, 412 (39.2%) were not convicted of arson, but of arson-related offences, which are largely specific to the geographical and legal peculiarities of Australia. The vast majority of these convictions appear to relate to the lighting of fires in the open air during times of high wild fire risk. Whilst undoubtedly dangerous, it is not at all clear that it is appropriate to group such offenders alongside those convicted of unambiguous arson offences, and no analysis is presented to explore similarities and differences between these groups.

The ratio of potential predictor variables to firesetting recidivists is rather high at around 0.5, and the authors do not apply any Bonferroni correction adjust for multiple

[2] Axis I refers to clinical disorders. Axis II refers to developmental disorders (including intellectual disabilities) and personality disorders (American Psychiatric Association, 2000).

comparisons, raising the possibility of type one (false positive) findings. The authors acknowledge that they were unable to account for incarceration time. As such the real 'at-risk' period is not known and it is impossible to determine the extent to which incarceration following the index offence biased the results. This is important given the likelihood that the most serious offenders will have spent several years in prison and that a number may have therefore had little or no opportunity to reoffend in the community during the follow-up period.

Edwards and Grace (2014)

This retrospective cohort study sought to develop an actuarial model for arson recidivism and to test whether different factors predicted arson, violent, and non-violent recidivism. All 1250 (including only 4 women) convicted of one or more arson offences in New Zealand between 1985 and 1994 were followed up for a 10-year 'at-risk' period.

Six variables (multiple arsons for criterion offence, number of prior vandalism offences, number of prior violence/vandalism offences, first arson under 18 years, number of prior arson offences, number of prior theft/violence offences) were significantly correlated with arson recidivism.

A predictive model for arson recidivism included 3 significant predictors: first arson under 18 years, multiple arsons for criterion offence, and number of prior vandalism offences. The area under the receiver operating characteristic (ROC) curve (AUC) for this model was .70 in the development sample and .68 in the validation sample, which is in the moderate to poor range.

An actuarial model was then constructed using a 10-point scale and 4 risk bands with arson recidivism rates as follows: 3% (low), 8% (medium-low), 11% (medium-high), and 22% (high). The AUC for predicting arson recidivism using the 10-point actuarial scale on the full sample was .67, which is at a level that would generally be considered poor in terms of predictive ability.

This study scored 24 on the quality assessment tool and was therefore rated as being of high quality. The aims of the study were clear and the sample inclusive and comprehensive, allowing some confidence in its wider applicability. The length and completeness of the follow-up and attempt to equalise 'at-risk' periods add to the strength of this study, and the statistical methods used and clarity of reporting are also a strength. Possible improvements could have included a clearer focus on potential confounding factors and steps taken to account for them, including information on whether assessors were blind to outcome when coding data.

Dickens et al. (2009)

This study employed a retrospective case-control design to compare first-time with multiple (two or more fires) firesetters among a sample of 167 adult arsonists (129 men, 38 women) who were referred for forensic psychiatric assessment over a 24-year period within one region of the United Kingdom. The study also compared arsonists whose fires were judged 'serious' with those whose fires were judged 'less serious'.

Repeat firesetters were significantly more likely to be younger, single, have problematic family history (particularly family history of violence), have had enuresis, poor school adjustment (attended special school), personality disorder, learning disability, relationship difficulties, earlier age of first conviction, to have spent more time in prison, and to have

more convictions for property crime. They were also more likely to have had feelings of tension and excitement around the index offence. Repeat firesetters were less likely to be in the subgroup of participants with psychotic illnesses, were significantly more likely to have attempted to extinguish a fire and less likely to have set a fire at a home (domestic site). Firesetting recidivism was not found to be related to the setting of either more or less serious fires.

This study scored 21 on the quality assessment tool and was therefore rated as being of high quality. The aims of the study were clear and potential risk factors were selected appropriately. Measuring recidivism not solely via official criminal records made this measure more sensitive. The authors also identified the limitations of the study and took some steps to account for these, although this did not include specifying whether assessors were blind to the outcome at time of coding variables.

Sampling was largely convenience driven and, as the authors acknowledge, unlikely to be representative of all arsonists. The collation of participants over a 24-year period is also problematic given the potential both for differences in recording of data over time, and the possibility that risk factors may change over time as a result of societal shifts. The retrospective nature of the study is itself a limitation but the statistical methods used were appropriate to the design and the results were presented in full and with clarity.

Soothill, Ackerley, and Francis (2004)

This study sought to replicate an earlier twenty-year cohort study on the same topic (see Soothill & Pope, 1973), although that earlier work was excluded from the present review as it did not employ any inferential statistics to analyse the data presented. Soothill and colleagues (2004) employed a part-prospective and part-retrospective cohort study design

to compare the full series of offenders convicted of arson in England and Wales at the High Court in 1951 (n = 74), and at any court in the same jurisdiction in 1963-1965 (n = 1352), 1980-1981 (n = 5584), and 2000-2001 (n = 3335). The 1980-1981 cohort was followed up for 20 years using the Home Office Offenders Index to measure recidivism and investigate the role of the original court ruling and type of disposal on future offending. Arsonists convicted of arson endangering life were found to be no more or less likely than those not endangering life to be convicted of arson again. However, those convicted of endangering life were significantly more likely to be convicted of a further offence of arson endangering life than those convicted of an offence not endangering life. Further arson convictions during follow-up on the basis of the 1980-1981 disposal were found as follows: custodial sentence (9.1%), non-custodial sentence (11.1%), and medical disposal (16.8%). However, no inferential statistics are reported to indicate whether or not these differences were statistically significant.

This study scored 17 on the quality assessment tool and was therefore rated as being of moderate quality. Rarely for studies included in this review, the sample size is both large and is representative of all convicted arsonists in England and Wales (including men and women), as opposed to only a subset (men, psychiatric, custodial etc.). The follow up of participants is also both very complete and long term, although unfortunately no allowance is made for time ‘at-risk’. Given these major advantages over many other studies, it is a shame that the data were not subjected to more rigorous analysis, and no attempt was made to identify predictors or correlates of recidivism, beyond the court outcome and disposal factors reported.

Barnett, Richter, and Renneberg (1999)

This retrospective cohort study sought to identify whether subgroups of arsonists with increased risk of recidivism could be identified by examining levels of legally determined criminal responsibility. Using the population of the former West Germany between 1983 and 1985, all convicted arsonists determined for psychiatric reasons to be 'not responsible' (n = 186) and to have 'diminished responsibility' (n = 97) were compared with every third criminally responsible arsonist (n = 187). The entire sample was also classified by whether or not they had any non-arson conviction ('mixed' versus 'pure' arsonists).

Recidivism was measured up to August 1994 and no significant difference found in the rates of further arson convictions recorded amongst the not responsible (9%), diminished responsibility (10%) and fully responsible (4%) groups.

When grouped into mixed and pure arsonists it is reported that those found partly responsible for their index offence had significantly more firesetting incidents than both the not-responsible pure arsonists and fully responsible arsonists. Unfortunately these and some other results in the study are reported in such a way as not to be fully interpretable, as the wording used does not allow the reader to determine precisely which comparisons are being reported. It does appear clear that, while neither factor raised risk for further arson on its own, those participants who were both pure arsonists and were judged to have diminished responsibility, were likely to have set the most fires. It is noted that personality disorder is likely to be the most common reasons for an offender qualifying for the diminished responsibility group, while the main reasons for being judged not responsible were psychosis, organic brain disease and intellectual disability.

This study scored 16 on the quality assessment tool and was therefore rated as being of moderate quality. The aims of the study were clear, although a strong rationale is not given either for investigating differences between legal categories and for the pure versus mixed arsonist distinction. The average length of follow-up or 'at-risk' period is not specified, so it is impossible to determine the extent to which incarceration following the index offence has biased the results. Statistical methods were appropriate, but as noted, results were not presented with sufficient clarity. The authors use the term 'firesetting incidents' interchangeably with 'arson convictions' and it is unclear whether convictions prior to the index offence were included or excluded from the analyses. This study has greater generalisability than many, being representative of all arsonists coming before the courts in West Germany. However, the use of legal categories whose definitions will vary between jurisdictions means that caution must be exercised in applying findings to other legal systems. Results were not broken down by gender and the authors pass no comment on this area.

Barnett, Richter, Sigmund, and Spitzer (1997)

This retrospective mixed case-control and cohort study sought to investigate differences in rates of firesetting and concomitant criminality between arsonists with different levels of legally determined criminal responsibility. Using the same sample as the study above (Barnett et al., 1999), a further group (n = 228) of 'widely defined' psychiatric firesetters was identified. This group consisted of 186 'not responsible' (or 'narrowly defined') mentally disordered firesetters, plus 28 (out of 97) diminished responsibility firesetters who were later detained in a forensic psychiatric hospital, and 14 (out of 187) who were found guilty and fully responsible, but were also later detained in a forensic psychiatric

hospital. The follow-up period was reported to be 9 to 11 years, with an average of 10 years.

Regardless of the definition used, those arsonists judged to have mental disorder were more likely to have set a fire in the past. Results in this paper are not always clearly presented and although it appears that some data under the heading of 'reoffending' refers specifically to firesetting reoffending, this is not explicitly stated. With this caveat, no significant difference in reoffending was found between the narrowly defined groups, but using the wider definitions, 11% of the mentally disordered group and 2% of the healthy group reoffended ($p < 0.0001$). It was concluded therefore that mentally disordered arsonists had higher previous and subsequent levels of arson recidivism.

This study scored 20 on the quality assessment tool and was therefore rated as being of high quality. The aims of the study were clear, although a strong rationale is not given for investigating differences between legal categories. The average 'at-risk' period is not specified, so it not possible to determine the extent to which incarceration following the index offence biased the results, although this weakness is acknowledged. Statistical methods were appropriate, but as noted, results were not presented with sufficient clarity. This study has greater generalisability than many, being likely to be representative of all arsonists coming before the courts in West Germany. Furthermore, its use of a broader definition of mental disorder is arguably less country specific and allows greater scope for generalising across jurisdictions. Unfortunately, although offender categories are broken down by gender, no distinction on the basis of the sex of participants is made within the analyses, and the authors pass no comment on this area.

Repo and Virkkunen (1997a)

This study compared arsonists with and without a diagnosis of schizophrenia, investigating the relationship with alcoholism, family history, offence characteristics and lifetime criminality. A retrospective case-control design was employed to explore these issues in a sample of 304 male arsonists (44 of whom had a diagnosis of schizophrenia or delusional psychosis) who had been referred for pre-trial forensic psychiatric assessment at the Helsinki University Hospital in Finland between 1978 and 1991. Outcome (recidivism) was measured from official criminal records (all offences since age 15), implying that this may have included a follow-up period as well as historical offences.

There were no significant differences found between the proportion of arsonists without schizophrenia who had committed recidivist firesetting offences (32%), when compared with the group with schizophrenia (26%), or when comparing the alcoholic arsonists who had schizophrenia (30%) with the non-alcoholic arsonists who also had schizophrenia (21%).

This study scored 18 on the quality assessment tool and was therefore rated as being of moderate quality. The aims of the study were clear and investigating the potential role of schizophrenia (or absence thereof) and alcoholism in arson recidivism was well justified. Results are presented clearly, although there is no indication that assessors were blind as to outcome or that any other confounding factors are accounted for and, as noted, the follow-up period for recidivism is ambiguous. As with their other studies the authors do acknowledge the difficulties in generalising from a high risk pre-trial psychiatric population.

Repo and Virkkunen (1997b)

This study employed a retrospective cohort study design to look at outcomes in the previously described sample of 304 male arsonists who had been referred for pre-trial forensic psychiatric assessment at the Helsinki University Hospital in Finland between 1978 and 1991 (Repo & Virkkunen, 1997a).

At the time of the follow-up in 1993, 264 of the participants were still alive, and 127 responded to the request to participate through completing additional measures. 57 (44.9%) of the respondents were interviewed using the Michigan Alcohol Screening Test (MAST) and 76 (59.8%) completed the Karolinska Scales of Personality (KSP). Outcome (recidivism) was measured from lifetime (since age 15) criminal records at the end of 1993.

In comparison to the one-time firesetters, multiple (more than one arson offence) firesetters were found to have obtained less social support ($p = .045$). Other comparisons did not show significant differences between the one-time and multiple firesetter groups. The authors note that the one-time firesetters were on average much older than the multiple firesetters at the time of their offence, so it seems unlikely that accessing support *after* the offence was the key protective factor for this group.

This study scored 17 on the quality assessment tool and was therefore rated as being of moderate quality. The comparison of one-time with multiple firesetters is a useful approach, although less rigorous than a longitudinal reconviction study. Investigating the role of personality factors and alcoholism in firesetting recidivism appears justified, although there is no indication that assessors were blind as to outcome and average length of follow-up/at-risk periods are not reported. The low response rate and purely psychiatric

population are a problem when considering generalisability, but the statistical methods used are appropriate and the authors acknowledge the limitations of the study, while perhaps showing over-reliance on non-significant findings.

Repo and Virkkunen (1997c)

This retrospective cohort study sought to identify whether young arsonists who had gone on to commit further offences of various types could be distinguished on the basis of psychiatric diagnoses or a history of conduct disorder. The sample consisted of 45 young male firesetters who were 21 years old or younger when committing their first firesetting offence and referred for pre-trial forensic psychiatric assessment at the Helsinki University Central Hospital (1978-1991). The participants are therefore presumed to be a subset of the 304 previously described (Repo & Virkkunen, 1997a). Outcome (recidivism) was measured from official criminal records during a follow-up period of 70.3 (±42.4) months after release from prison.

History of conduct disorder was found to differ significantly with respect to crimes against property, but not in relation to arson recidivism. Only descriptive statistics are presented with regard to the prevalence of other Axis I and II diagnoses between groups, with no clear trends amongst the firesetting recidivists.

This study scored 17 on the quality assessment tool and was therefore rated as being of moderate quality. Investigating the role of psychiatric diagnoses and conduct disorder in recidivism of younger firesetters appears justified, although there is no indication that assessors were blind as to outcome. The study design was appropriate and it is a strength that the average length of the follow-up/at-risk period is reported. The small sample size, limited age range, psychiatric nature of the sample, and lack of inferential

statistics/presentation of significance levels, means that this study can make only a very limited contribution to the present review.

Repo, Virkkunen, Rawlings, and Linnoila (1997b)

This study primarily investigated the prevalence of suicidal and self-harming behaviour among arsonists, but also examined whether such behaviours were linked to recidivism, therefore making it of interest to this review. A retrospective cohort study design was employed to explore these issues in a sample of 304 male arsonists who had been referred for pre-trial forensic psychiatric assessment at the Helsinki University Hospital in Finland (presumed to be the same sample described previously (Repo & Virkkunen, 1997a)).

Independent variables included a measurement of blood glucose levels, family history variables, and history of suicide attempts and slashing. Outcome (recidivism) was measured from official criminal records, at an average of 8.1 (±3.9) years follow-up. Neither a history of suicide attempts nor a history of slashing were significantly more common among those who committed recidivist firesetting offences, although the trend in each case was in that direction.

This study scored 21 on the quality assessment tool and was therefore rated as being of high quality. The aims of the study were clear and the design and statistical methods appropriate, with a good follow-up period to measure recidivism. No information is provided on whether assessors/researchers were blind to outcomes when coding data and diagnosing disorders, nor in relation to any inter-rater reliability of the measures used. The authors set a conservative level of significance ($\alpha = 0.01$) because of the number of variables tested. The authors also acknowledged the difficulties in generalising from a high

risk psychiatric population, estimating that only 10% of all arsonists in Finland are referred for this type of evaluation.

Rice and Harris (1996)

This study followed up the 243 male patients studied previously by the same researchers (Rice & Harris, 1991), all of whom had been admitted to a Canadian maximum security psychiatric institution for firesetting. A cohort study design was employed, being part retrospective and part prospective in nature. 208 of the original sample had had the opportunity to 'fail' by reoffending up to July 1993 (with an average 'at risk' period of 93.6 (±87.8) months). 33 (16%) of this 208 failed by setting a further fire.

53 independent/predictor variables were coded from hospital files, in line with the previous study (Rice & Harris, 1991). It would appear, but is not made clear, that these variables are identical to those measured in the earlier study, although some are labelled differently. Firesetting recidivism was measured using government conviction data and institutional records.

Univariate analyses indicated that the following variables were correlated with firesetting recidivism: childhood history of firesetting, young age at first firesetting, lower highest grade reached, lower aggression score, higher number of fires set, never married, no violent offence history, lower IQ, having acted alone in the firesetting offence, no concurrent criminal charges, and not having set a fire on a weekend. A multivariate prediction equation comprised the following variables (strongest first): young age at first firesetting, higher total firesetting offences, childhood history of firesetting, lower IQ, no concurrent criminal charges to the index fire, acted alone in setting the index fire, and lower aggression score.

This was the highest scoring study in the current review, with a score of 26 on the quality assessment tool, leading to a rating of high quality. The aims of the study were clear and potential risk factors were selected appropriately, with data collection tools shown to have inter-rater reliability. The authors do not pass much comment on the limitations of their study or outline measures to overcome them. Findings are reported as significant despite not meeting the authors' own suggested Bonferroni corrected level of significance (α = .001), so there is a possibility of type one (false positive) findings. In this study, however, assessors were blind to outcome at time of coding background variables and vice versa. The prospective and relatively long-term nature of the follow-up period also add to the strength of this study, although caution should be exercised in extrapolating findings from a secure psychiatric population to the wider population of arsonists.

Virkkunen, Eggert, Rawlings, and Linnoila (1996)

This prospective cohort study followed up 73 violent offenders and 41 firesetters, all of whom had been referred to the courts for forensic psychiatric evaluation in Finland. Outcome (recidivism) was measured from official criminal records at an average 53.7 (±35.9) months after release from prison.

Independent variables included biochemical measures of cerebrospinal fluid (CSF) (including 5-hydroxyindoleacetic acid (5-HIAA) and homovanillic acid (HVA)), blood glucose nadir during an oral glucose tolerance test, and plasma cholesterol.

The authors present most of the results without distinguishing between violent and firesetting offenders, either in terms of index offence or in terms of type of reoffence. Indeed, there is only one possibly relevant finding reported, that 'recidivist fire setters' showed low blood glucose nadir while there was no difference in the mean blood glucose

nadir between the overall (also including the violent offenders) recidivist and nonrecidivist groups. The paper does not make clear whether or not 'recidivist fire setters' in this context refers only to firesetting reoffences or to any recidivism.

This study scored 15 on the quality assessment tool and was therefore rated as being of moderate quality. The prospective design was a clear strength of the study, potential risk factors were selected appropriately, and potential confounding factors are acknowledged, particularly around the varying methods used and limited blinding in the process of psychiatric diagnosis. Whilst most of the data collection tools appear to have been valid and reliable, no information is given about the completeness of the data set or follow-up, and as noted above, the statistical methods used and presentation of results do not allow for conclusions to be confidently drawn to inform the present review.

Rice and Harris (1991)

This study employed a retrospective case-control design to examine 243 male patients admitted to a Canadian maximum security psychiatric institution for firesetting over an 11-year period (1973-1983). The 98 first-time firesetters were compared with the 145 repeat firesetters.

Independent/predictor variables were selected on the basis of having been included in previous similar research, or appearing in the firesetting literature, and were coded retrospectively from hospital file information.

Multiple firesetters differed from first-time firesetters in that they were younger at the time of the index fire and first documented fire, had a lower level of school adjustment, were more likely to have a personality disorder and to have been institutionalised as a child, had

more family reports of fire interest, more previous fires in institutions, and more non-fire charges, had spent longer in correctional institutions, had lower levels of interpersonal aggression, were less likely to have victimised someone they knew, and it was less likely they had a delusional motive but more likely that excitement or emotional release were motives for their index fire.

Multiple discriminant analyses produced an equation consisting of age, history of suicide attempts, family reports of childhood fire interest, months in correctional institutions, marital status, and history of aggression.

This study scored 19 on the quality assessment tool and was therefore rated as being of moderate quality. The aims of the study were clear and potential risk factors were not only selected appropriately, but data collection tools were also shown to have inter-rater reliability. Measuring recidivism not solely via official criminal records made this measure more sensitive. The authors do not pass much comment on the limitations of their study or outline measures to overcome them. They do report a suggested Bonferroni corrected level of significance ($\alpha = .001$) but then go on to report as significant those findings which do not reach this level. There is therefore a risk of type one (false positive) findings amongst the results, and it also appears that assessors were not blind to outcome at time of coding variables. The authors only report data for significant results in the published paper, which has led to criticism (see Dickens et al., 2009). Caution should also be exercised in extrapolating findings from a secure psychiatric population to the wider population of arsonists.

Sapsford, Banks, and Smith (1978)

This British observational cohort study was conducted by the Home Office Research Unit and examined data on convicted male arsonists. It consisted of two phases, the second of which is of interest to this review, where a total of 147 arsonists with fixed sentences of 18 months or more were followed up (retrospectively) for 3 to 5 years after their release from prison in 1970 to 1973. "A whole constellation of…" (p. 249) potential predictor variables were measured, but only selected variables are reported in the published paper.

Those who had been sentenced to a fixed term of 5 or more years in prison appeared to be six times more likely than those with a sentence of less than 5 years to have been reconvicted for arson by the end of the 3-year follow-up (15.2% vs 2.7%). No inferential statistics are reported in relation to this comparison. Multiple regression is reported to have identified that the single biggest predictor of arson reconviction in this study was the number of previous convictions for arson. Adding total number of previous convictions for any offence improved the predictive accuracy slightly. No quantitative information on the strength of these predictive contributions is reported. A previous history of arson was found to be significantly associated ($p < 0.005$) with ever having been diagnosed "sexually abnormal". It is important to treat this finding with caution given both the prevailing view of some professionals at that time that arson was an inherently sexualised behaviour, and the possible inclusion of a number of normative sexual behaviours within this label, reflecting societal and medico-legal values at the time of publication. It was consequently not entered into data synthesis. The total number of participants (14) receiving this label is also rather small.

This study scored 9 on the quality assessment tool and was therefore rated as being of low quality, although it is acknowledged that judging a study published in 1978 by contemporary scientific standards is somewhat problematic. The aims of this study were fairly clear, although no account is taken of potential confounding factors, and no information is provided on the validity or reliability of data collection tools, or on whether efforts were made to blind researchers to outcome when collecting data. The prison-based sample limits generalisability, although provides a useful counterbalance to the tendency towards exclusively psychiatric samples found in many other studies.

As noted, it appears that a large number of potential predictor variables were examined, but how many, their precise nature, and how and why they were selected is not reported. The risk of type one (false positive) findings amongst the results is neither acknowledged nor corrected for and the limited data that are presented are almost exclusively descriptive in nature.

Data Synthesis

The following section presents a largely qualitative synthesis of the data and findings extracted from the studies included in this review and described above. These findings allow for conclusions to be drawn with regard to the risk factors so far identified as being able to distinguish recidivistic arsonists from those arsonists who do not go on to reoffend. Findings are summarised within risk factor headings in the order in which the evidence is assessed as supporting the presence of the factor, beginning with the strongest. This judgment has been made as part of the process of data synthesis, having accounted for both the strength of findings and the assessed absolute and relative quality of the studies from

which they emerged. The process only considers the individual or univariate analyses and not the regression/predictive models which are also computed by some studies.

A standardised effect size was calculated to allow greater comparison between and within studies and to assist with the process of data synthesis. The effect size reported is Cohen's d which represents the number of standard deviations of difference observed between two means, an effect size of 0.5 therefore representing a difference between the two means of half a standard deviation (Cohen, 1992). Where not reported in the published paper, but when sufficient information is provided for it to be calculated, Cohen's d was calculated according to guidance provided for practice-based research syntheses (Dunst, Hamby, & Trivette, 2004) using the following equations:

For independent samples t-tests, Mann-Whitney U tests (means and standard deviations):

Where N_E and N_C are relatively equal:

$$d = \frac{(M_E - M_C)}{\sqrt{(SD_E^2 + SD_C^2)/2}}$$

Where N_E and N_C are relatively unequal:

$$d = \frac{(M_E - M_C)}{\sqrt{([(SD_E^2.N_E)-1]+[(SD_C^2.N_C)-1])/(N_T-2)}}$$

For independent sample Chi Square (χ^2) statistics:

$$d = \sqrt{\frac{4\chi^2}{(N - \chi^2)}}$$

For correlational designs:

Where N_E and N_C are relatively equal:

$$d = \frac{2r}{\sqrt{1-r^2}}$$

Where N_E and N_C are relatively unequal:

$$d = \left(\sqrt{\frac{N_T^2-2N_T}{N_E N_C}}\right)\left(\frac{r}{\sqrt{1-r^2}}\right)$$

Where: d = Cohen's d, M = mean score on the independent variable, SD = standard deviation, E = refers to the experimental (recidivist) group, C = refers to the comparison (nonrecidivist) group, T = refers to the total sample, χ^2 = Chi square statistic, r = Pearson's correlation coefficient, N = number of participants.

Cohen's (1992) guidance suggests that standardised mean effect sizes are interpreted using benchmarks of .20 small, .50 medium, and .80 large. It is important to note that the size of the measured correlation coefficients for arson recidivism in some studies reflect in part the base rates of recidivism in these studies. For example, correlations reported by Rice and Harris (1996) are likely to have been boosted by the fact that 16% of their whole sample fell into the recidivist firesetter group, compared to just 6.2% of the much larger sample studied recently by Edwards and Grace (2014). McGrath and Meyer (2006) propose methods for adjusting interpretive benchmarks to account for such differences, but the choice of Cohen's d rather than Pearson's r as the effect size for comparison in this review, with adjusted calculations where necessary for unequal means, reduces the impact of base rate variations.

Odds ratios, another measure of effect size, have also been reported where possible but are not calculable for all of the studies reviewed, and only for categorical variables, so are therefore not as useful for the purpose of comparing between studies. The use of Cohen's d as an effect size allows direct comparison between the majority of findings.

Where not reported in the published studies, odds ratios have been calculated for categorical variables using data presented by the authors, using the equation:

$$OR = \frac{(a*d)}{(b*c)}$$

Where the distribution of participants is as follows:

	Risk factor present	Risk factor absent
Multiple/recidivist firesetters	a	b
First/one-time firesetters	c	d

This data synthesis is presented in tabulated form below (see Table 3), followed by the key to study numbers in Table 4.

By way of comparison, a review of risk factors for sexual offence recidivism grouped investigated risk factors into the following five categories: empirically supported risk factors, promising risk factors, unsupported but with interesting exceptions, worth exploring, and not risk factors (Mann, Hanson, & Thornton, 2010). The quantity and quality of studies into sexual offence recidivism is far greater than those into arson recidivism, meaning that the present field of study is some way from being able to apply the stringent criteria adopted by Mann and colleagues to classify the level of support for risk factors. However, the principle of ranking the strength of support for risk factors has been adopted here, using the following four adapted groupings and criteria:

Reasonably well supported risk factors: At least three supporting empirical studies which are judged moderate or high quality.

Promising risk factors: At least two supporting empirical studies which are judged moderate or high quality.

Factors worth exploring further: One moderate or high quality supporting empirical study with at least a small effect size.

Factors with very limited support: One moderate or high quality supporting empirical study which did not produce even a small effect size; **or,** one supporting empirical study, which was judged of low quality.

No factors were assigned to a group as 'not risk factors', as the review concludes that the research base into arson recidivism is not yet at a stage where it would be sensible to completely rule out further study into any factor which could reasonably be hypothesised to play a role.

Table 3: Risk Factor Synthesis

Potential Risk Factor	Number of supporting studies	Supporting studies (see key)	Effect size (Cohen's d)	Effect size (applying Cohen's (1992) benchmarks)	Odds ratio	Study quality scores	Study quality level	Judged strength category of risk factor
Young age at time of first firesetting incident or conviction	4	0	.22	Small	-----	16	Moderate	Reasonably well supported
		1	.25	Small	2.51	23	High	
		10	.77	Medium	-----	26	High	
		12	.65	Medium	-----	19	Moderate	
Number of previous convictions for arson	4	0	.59	Medium	-----	16	Moderate	Reasonably well supported
		1	.25	Small	-----	23	High	
		10	.65	Medium	-----	26	High	
		13	-----	------	-----	9	Low	
Being single/never married	3	2	.41	Small	2.28	21	High	Reasonably well supported
		10	.50	Medium	-----	26	High	
		12	-----	------	-----	19	Moderate	
Young age at time of index offence or subsequent assessment	3	0	.21	Small	-----	16	Moderate	Reasonably well supported
		2	.42	Small	-----	21	High	
		12	.40	Small	-----	19	Moderate	
Personality disorder	3*	0	.28	Small	3.84	16	Moderate	Reasonably well supported
		2	.30	Small	2.40	21	High	
		12	.28	Small	1.76	19	Moderate	
Younger age at first criminal conviction	2	0	.30	Small	-----	16	Moderate	Promising
		2	.59	Medium	-----	21	High	
Multiple arson convictions at index offence	2	0	.22	Small	3.12	16	Moderate	Promising
		1	.50	Medium	3.27	23	High	
History of vandalism/property crime	2	1	.42	Small	1.41	23	High	Promising
		2	.42	Small	2.53	21	High	

Learning disability/lower IQ	2	2 10	.32 .44	Small Small	3.22 -----	21 26	High High	Promising
Poor school adjustment	2	2 12	.45 .28	Small Small	2.46 -----	21 19	High Moderate	Promising
Feelings of excitement/tension/release associated with firesetting	2	2 12	.36 .32	Small Small	8.04 3.76	21 19	High Moderate	Promising
Lower levels of violence/aggression	2	10 12	.36 .29	Small Small	----- 2.00	26 19	High Moderate	Promising
Absence of psychosis or delusional motive for firesetting	2	2 12	.34 .40	Small Small	2.86 2.57	21 19	High Moderate	Promising
Childhood history of firesetting	1	10	.56	Medium	-----	26	High	Worth exploring
Stranger victim of index offence	1	12	.58	Medium	3.22	19	Moderate	Worth exploring
Family reports of fire interest	1	12	.52	Medium	-----	19	Moderate	Worth exploring
Family history of violence	1	2	.47	Small	3.39	21	High	Worth exploring
Made attempts to extinguish	1	2	.44	Small	5.29	21	High	Worth exploring
No concurrent criminal charges	1	10	.39	Small	-----	26	High	Worth exploring
Childhood enuresis	1	2	.38	Small	3.92	21	High	Worth exploring
No domestic fire	1	2	.36	Small	0.46	21	High	Worth exploring
Lower highest school grade	1	10	.36	Small	-----	26	High	Worth exploring
Acted alone in firesetting	1	10	.36	Small	-----	26	High	Worth exploring
Any problematic family history	1	2	.35	Small	2.01	21	High	Worth exploring
Relationship difficulties	1	2	.31	Small	1.97	21	High	Worth exploring

Did not access social support	1	7	.49	Small	3.20	17	Moderate	Worth exploring
Registered with mental health services	1	0	.33	Small	4.59	16	Moderate	Worth exploring
High criminal versatility	1	0	.30	Small	3.65	16	Moderate	Worth exploring
Axis I clinical diagnosis	1	0	.29	Small	3.43	16	Moderate	Worth exploring
Childhood institutionalisation	1	12	.27	Small	1.94	19	Moderate	Worth exploring
Number of non-fire-related criminal charges	1	12	.27	Small	-----	19	Moderate	Worth exploring
Previous non-violent offence	1	0	.24	Small	4.76	16	Moderate	Worth exploring
Contact with psychiatric services as a child or adolescent	1	0	.23	Small	3.96	16	Moderate	Worth exploring
Not a pure arsonist (i.e. more likely to have also committed other types of offences)	1	0	.23	Small	0.11	16	Moderate	Worth exploring
Substance misuse history	1	0	.21	Small	2.63	16	Moderate	Worth exploring
History of suicide attempts	1	12	-----	-----	-----	19	Moderate	Very limited support
Longer (5yrs+) sentence for arson	1	13	.39	Small	6.37	9	Low	Very limited support
Presence of schizophrenia or bipolar affective disorder /presence of psychosis	1	0	.19 .13	Below benchmark Below benchmark	2.84 2.31	16	Moderate	Very limited support
Previous violent offence	1	0	.19	Below benchmark	3.30	16	Moderate	Very limited support

Number of prior charges for any offence	1	0	.17	Below benchmark	-----	16	Moderate	Very limited support
Childhood behaviour disorder	1	0	.13	Below benchmark	2.48	16	Moderate	Very limited support

Note. ----- = data not provided in published paper to allow calculation of effect size/odds ratio; *note that there is also some support for the role of personality disorder from two additional studies (Barnett et al., 1999, 1997) although the evidence is indirect so has not been included in the table.

Table 4: Key to study numbers

Study authors	Study number	Sample size (number of firesetting recidivists)
Ducat et al. (2015)	0	1052 (56)
Edwards & Grace (2014)	1	1250 (77)
Dickens et al. (2009)	2	167 (81)
Repo & Virkkunen (1997b)	7	127 (42)
Rice & Harris (1996)	10	208 (33)
Rice & Harris (1991)	12	243 (145)
Sapsford et al. (1978)	13	143 (8) [at 3-year follow-up]

Reasonably well supported risk factors

Young age at time of first firesetting incident or conviction emerges from this review as the factor most consistently found to be associated with recidivistic firesetting, with empirical evidence from four studies (Ducat et al., 2015; Edwards & Grace, 2014; Rice & Harris, 1991, 1996), two of which were judged to be of high quality and two moderate, with medium and small effect sizes (see Table 3). Reports of higher levels of both fire interest (Rice & Harris, 1991) and actual firesetting in childhood (Rice & Harris, 1996) have also been shown to be associated with likelihood of arson recidivism, providing additional indications of the role of early onset of an interest and involvement in firesetting behaviour in predicting likelihood of arson recidivism in later life. *Young age at time of index offence* (Ducat et al., 2015; Rice & Harris, 1991), *or at time of subsequent assessment* (Dickens et al., 2009), also emerges from this review separately as the fourth most supported factor, being judged a reasonably well supported risk factor for arson recidivism and further highlighting the important role of young age in risk of committing further arson offences. Two of these studies were judged to be of moderate quality, and one of high quality, and all found small effect sizes. Interestingly however, the high quality follow-up study to one of these investigations, did not find that young age significantly predicted which of the same sample went on to set further fires (Rice & Harris, 1996).

The total *number of previous arson convictions/offences* (Ducat et al., 2015; Edwards & Grace, 2014; Rice & Harris, 1996; Sapsford et al., 1978) has also been found by four separate studies to be associated with the likelihood of arson recidivism. Two of these studies were judged of high quality, one moderate and one low, and they found medium and small effect sizes. Retrospective comparisons of groups of one-time versus repeat

arsonists, which by their nature cannot identify this risk factor, have nonetheless provided additional evidence to support its relevance, with evidence of a higher number of fires set while in institutions by the recidivist group (Rice & Harris, 1991). A closely related finding indicates that one of the strongest predictors of arson recidivism is the presence of multiple arson convictions for the criterion offence (Ducat et al., 2015; Edwards & Grace, 2014), indicating that offenders who have been convicted on a single occasion of more than one offence of arson may pose additional risk of recidivism above that indicated simply by the number of occasions on which they have been convicted of arson.

Being single/never married is the third strongest factor identified by the present review. A marital/relationship status of 'single' has been shown to distinguish repeat from first-time arsonists in retrospective comparisons of these groups (Dickens et al., 2009; Rice & Harris, 1991), although importantly these studies did not control for the age of participants, so it is not known to what extent this finding could be accounted for by the younger age of the repeat arsonists. Having never been married also correlated with arson recidivism in a later follow-up study (Rice & Harris, 1996). Two of these studies were judged to be of high quality and one moderate, with medium to small effect sizes (see Table 3). It is possible that long-term intimate relationships are protective against recidivistic offending, although relationship difficulties have also been found to be related to raised likelihood of recidivism (Dickens et al., 2009). Equally it could be that the ability to form and maintain relationships helps to distinguish those offenders whose lives are generally less dysfunctional and whose functioning is more socially normative. Whilst referring to professional rather than intimate relationships, the finding that non-recidivist arsonists had accessed more social support (Repo & Virkkunen, 1997b) may be relevant to this risk factor, as it again speaks to the ability to engage meaningfully with others, and perhaps

indicates that other types of social support can be protective or suggest lower levels of risk, in addition to marital-type relationships.

The presence of a *personality disorder* diagnosis is reasonably well supported as a risk factor and has been shown to distinguish repeat from first-time arsonists in retrospective comparisons of these groups (Dickens et al., 2009; Rice & Harris, 1991), these studies being judged of high and moderate quality respectively, and finding small effect sizes. In contrast, in the follow-up study to one of these investigations, which was judged to be of high quality, personality disorder did not predict which of the same sample went on to set further fires (Rice & Harris, 1996). More recently, a personality disorder diagnosis was found to help predict firesetting recidivism with a small effect size in a larger Australian study (Ducat et al., 2015) which was judged of moderate quality, but not to distinguish one-time and recidivist firesetters in a smaller Finnish psychiatric sample (Thomson, Tiihonen, Miettunen, Sailas, et al., 2015). There are some indications from two German studies of the role of personality disorder in the findings that those 'pure' arsonists who had a diminished responsibility court verdict were likely to have set the most fires (Barnett et al., 1999) and that a 'widely defined' psychiatric group of arsonists were more likely to become recidivists than a non-psychiatric group (Barnett et al., 1997). The diminished responsibility group is thought likely to have contained high numbers of participants with personality disorders, particularly of the antisocial type (Barnett et al., 1999), and it seems reasonable to conclude the same of the widely defined psychiatric group. The indirect nature of this evidence means that it has not been included within Table 3.

Promising risk factors

Younger age at first criminal conviction predicted firesetting recidivism in two studies, one of which was judged to be of high quality and found a medium effect size (Rice & Harris, 1996), while the other was judged of moderate quality and found a small effect size (Ducat et al., 2015).

The presence of multiple arson convictions at the criterion/index offence has been found to distinguish recidivist from non-recidivist firesetters with a medium effect sizes in one high quality study (Edwards & Grace, 2014), and a small effect size in a study of moderate quality (Ducat et al., 2015).

History of vandalism/property offences. A higher number of previous vandalism offences (Edwards & Grace, 2014) and any history of property crime (Dickens et al., 2009), have been found to distinguish recidivist from one-time arson offenders. This is judged a promising risk factor, with both studies being of high quality and finding small effect sizes. It could be that some if not many of the vandalism/property offences appearing on the criminal records of arson offenders are in fact instances of firesetting that have been prosecuted or processed for legal reasons under a different offence category. Alternatively, or additionally, it could be hypothesised that the act of firesetting is just one form of a wider repertoire of vandalism/property offending carried out by firesetters, or at least by a subgroup of thereof.

Learning disability diagnosis (Dickens et al., 2009) *and lower IQ* (Rice & Harris, 1996) have been identified as factors linked to greater likelihood of recidivistic firesetting, with both of these studies showing small effect sizes and being judged high quality. A further study included in this review, judged of moderate quality, did not find significant

differences in IQ between first-time and repeat arsonist groups (Rice & Harris, 1991). Internal issues arising from childhood temperamental difficulties, introverted personalities, and communication problems have been suggested as more relevant than external problems such as alcohol, relationships or life events in explaining this risk in those with intellectual disabilities (Dickens et al., 2008).

Lower level of school adjustment has been identified within two studies as distinguishing first-time from recidivist firesetters. However, this concept is not well defined in either study, or consistent between them, and one (Dickens et al., 2009) appears to contain a reporting error by suggesting in their text that special school attendance was the relevant factor, but presenting data suggesting that it was being defined as a "poor student" that reached statistical significance, whilst special school attendance did not. The other study finding that level of school adjustment was related to multiple firesetting rated the concept on an 8-point scale from information in clinical files (Rice & Harris, 1991). These studies were judged of high and moderate quality respectively, and found small effect sizes. It should be noted that the follow-up study to one of these investigations (Rice & Harris, 1996), which was judged to be of high quality, did not find that level of school adjustment predicted arson recidivism.

Feelings of excitement/tension/release associated with firesetting. The majority of studies included in the current review did not attempt to assess offenders' motivations for committing arson, or to consider these within a theoretical framework. However, those studies that were able to evaluate such factors reported some interesting findings. Multiple firesetters have been found to be more than three times as likely as first-time arsonists to be judged to have had emotional release or excitement as a motive for setting their index

fire, although still only 13.8% of multiple firesetters had such a motivation (Rice & Harris, 1991). Similarly, a later study identified tension/excitement as a motive for firesetting in 9% of multiple firesetters but in just 1% of first-time firesetters (Dickens et al., 2009). Therefore, whilst still relatively rare amongst repeat arsonists, it does appear that this factor is extremely rare indeed amongst one-off firesetters and could therefore, where present, be an important consideration in identifying those posing the greatest risk of further firesetting. These studies were judged to be of moderate and high quality respectively, and found small effect sizes.

Lower levels of violence/aggression, including less aggression in the past year, and lower prevalence of previous violent offences, shows promise in helping to predict who will go onto commit recidivist arson (Rice & Harris, 1991; 1996), with an inverse relationship applying to likelihood of committing future violent offences. These studies were judged to be of moderate and high quality respectively, and found small effect sizes. However, it is difficult to draw conclusions with any confidence in regard to this factor given that larger and more recent studies have not found that levels of aggression or violent convictions are less common in recidivist firesetters (Dickens et al., 2009; Ducat et al., 2015; Edwards & Grace, 2014).

There is promising evidence that the *absence of psychosis or a delusional motive for firesetting* may help to predict arson recidivism. Multiple firesetters have been found to be significantly less likely than first-time firesetters to be suffering from psychosis (Dickens et al., 2009) or to have had a delusional motive for the index firesetting offence (Rice & Harris, 1991). These studies were judged to be of high and moderate quality respectively, and found small effect sizes. In the high quality follow-up to the second of these studies

the presence or absence of schizophrenia did not help to predict who went on to set further fires (Rice & Harris, 1996). Furthermore, one recent study judged of moderate quality found to the contrary that the presence of psychosis and of schizophrenia/bipolar affective disorder were more common in arson recidivists (Ducat et al., 2015), although in neither case was the effect size large enough to be even considered small. Another recent study found no difference in prevalence of psychoses between recidivist and first-time firesetters (Thomson, Tiihonen, Miettunen, Sailas, et al., 2015). The relevance of the finding that a 'widely defined' psychiatric group of arsonists were more likely to become recidivists than a non-psychiatric group (Barnett et al., 1997) is difficult to determine given the presence of large numbers of personality disordered participants in the group.

Factors worth exploring further

A single high quality study within the present review found a medium effect size supporting further exploration of *childhood history of firesetting* (Rice & Harris, 1996) as a risk factor for firesetting recidivism. An earlier study, judged to be of moderate quality, found with medium effect sizes that both having a *stranger victim of the index offence* and family reporting higher levels of *fire interest* distinguished multiple from first-time firesetters (Rice & Harris, 1991).

Another high quality study found with small effect sizes that multiple firesetters were more likely to have had a *family history of violence,* to have *made an attempt to extinguish a fire* that they had set, and *never have set a domestic fire,* to have had *any problematic family history, relationship difficulties* and *childhood enuresis* (Dickens et al., 2009). It should be noted that the relevance of childhood enuresis has also been investigated in another high quality study and not been found related to firesetting recidivism (Rice & Harris, 1996).

A single high quality study produced small effect sizes indicating the need for further exploration of the relevance to firesetting recidivism of having *no concurrent criminal charges* to their firesetting, *highest school grade* achieved, and having *acted alone in firesetting* (Rice & Harris, 1996). A study of moderate quality found small effect sizes to support a role for *childhood institutionalisation* and higher *number of non-fire-related criminal charges* (Rice & Harris, 1991).

A further moderate quality study found with a small effect size that *not having accessed social support* was more typical of multiple rather than first-time mentally disordered firesetters (Repo & Virkkunen, 1997b).

Most recently, a study judged to be of moderate quality, found small effect sizes suggesting that the following predicted arson recidivism: high levels of *criminal versatility*, *not being a pure arsonist* (i.e. having also committed other types of offences), having a *previous non-violent offence*, being *registered with mental health services*, *contact with psychiatric services as a child or adolescent*, an *Axis I clinical diagnosis*, and having had a *substance misuse history* (Ducat et al., 2015).

Factors with very limited support

While a univariate significance level was not presented and an effect size for the possible role of *history of suicide attempts* could not be calculated, this factor was entered into a prediction equation for firesetting recidivism (Rice & Harris, 1991). In contrast, ever having self-harmed did not distinguish between the first-time and repeat arsonist groups in a later study (Dickens et al., 2009).

In a prospective study, judged to be of low quality, those *sentenced to 5 or more years for arson* appeared six times more likely than those with a sentence of less than 5 years to be reconvicted for arson by the time of the 3-year follow-up (Sapsford et al., 1978). This provides some support for the suggestion that sentence length may act as a proxy measure of some underlying characteristic of the seriousness of the offence or perceived risk of the offender, which in turn can assist in the prediction of recidivism. However, further inspection and analysis of these data reveals that whilst the difference in reconviction rates is significant ($\chi^2 = 5.253$ with Yates' correction, $p = 0.02$), the effect size is small ($d = .39$), with 5 of the 33 participants in the 5 plus year group having been reconvicted of a further arson versus 3 out of 110 in the under 5 year group. This finding must therefore be treated with some caution.

A moderate quality study produced significant findings in support of a role for presence of *schizophrenia/bipolar affective disorder or psychosis,* having a *previous violent offence*, *number of prior charges for any offence*, and *childhood behaviour disorder* in predicting arson recidivism (Ducat et al., 2015). However, the effect sizes for each of these factors were below the benchmark required to be considered 'real'.

Having spent more time in prison or correctional institutions (Dickens et al., 2009; Rice & Harris, 1991) has been found to distinguish repeat from one-time arsonists in retrospective comparisons, although this is hardly surprising given that the former have by definition been convicted more times of arson offences. This factor was therefore excluded from the present review as being likely to confound the results.

Prior to the discussion section, brief comment will be passed on the reasons for certain studies being excluded from this review.

There are biochemical factors, in particular low blood glucose nadir, which a body of research indicates may be worthy of further exploration. Such factors did not emerge from the present review, with a number of studies having been excluded on the basis of the PICOS criteria because they either do not distinguish in their results between groups of violent and firesetting offenders, and/or they do not distinguish between these types of offence in their definition of recidivism (see e.g. de Jong, Virkkunen, & Linnoila, 1992; Repo, Virkkunen, Rawlings, & Linnoila, 1997a; Virkkunen, de Jong, Bartko, Goodwin, & Linnoila, 1989; Virkkunen et al., 1994). A lack of clarity in the definition of recidivism being used has already been noted with a further study which was included in this review (Virkkunen et al., 1996), where it was not possible to draw reliable conclusions specifically relevant to firesetting recidivism. A previous review of the evidence relating to mentally disordered firesetters (Smith & Short, 1995) cited one of these studies (Virkkunen et al., 1989) as providing evidence specifically relating to arson recidivism. However, this study in fact presents results relating to a group of 36 violent offenders and 22 arsonists, with findings relating to the combined group only, and does not provide a clear definition of recidivism. It is also important to note details of the participants in the studies carried out by this same group of researchers which are included in this review (Repo et al., 1997b; Repo & Virkkunen, 1997a, 1997b, 1997c; Virkkunen et al., 1996). Most, if not all, of these five studies have as their participants all or some of the same sample of 304 male arsonists referred for pre-trial forensic psychiatric assessment at the Helsinki University Hospital in Finland between 1978 and 1991. This causes some difficulty for the present review given that it effectively means that the same group of participants feature in 38% of the studies included in the review. If seen as one study rather than five, then the number of independent/predictor variables assessed becomes very large

and further increases the risk of type one errors appearing within this group of studies. So far as possible, this has accounted for in the assessment of the relative weight of evidence provided.

Other studies (see e.g. O'Sullivan & Kelleher, 1987) which have been cited (see Dickens et al., 2009) as containing evidence of differences between recidivist and non-recidivist firesetters, did not meet the inclusion criteria for the present systematic review as the data they provide are of a purely descriptive rather than inferential nature.

DISCUSSION

Main findings

This review has sought to investigate the nature, consistency and strength of empirically derived risk factors for arson recidivism in adult offenders. Fifteen studies met the criteria for inclusion in the review, and evidence was found with varying levels of support for 41 potential risk factors.

Only seven of the 15 studies included in the review contributed towards the identification of potential risk factors, with five of these providing the majority of the evidence (Dickens et al., 2009; Ducat et al., 2015; Edwards & Grace, 2014; Rice & Harris, 1991, 1996). Of the eight which did not contribute risk factors, two studies provided possible supporting evidence for the role of personality disorder as a risk factor, but used country-specific legal categories for comparison as opposed to medical diagnostic criteria and lacked clarity in their reporting of results (Barnett et al., 1999, 1997). The remaining studies either reported findings in such a way as to not be fully interpretable (Virkkunen et al., 1996), did not report necessary inferential statistics (Repo & Virkkunen, 1997c; Soothill et al., 2004), or none of the reported analyses reached significance (Repo et al., 1997b; Repo & Virkkunen, 1997a; Thomson, Tiihonen, Miettunen, Sailas, et al., 2015).

The strongest evidence was found for the following five factors, all of which were judged to be reasonably well supported as risk factors: young age at time of first firesetting incident or conviction, number of previous arson convictions/offences, being single/never married, young age at time of index offence or subsequent assessment, and presence of personality disorder. Other factors were categorised as promising, worth exploring, or as having only very limited support, based on the process of data synthesis.

Studies included within the review did not all investigate the same factors. The level of divergence in their focus is exemplified by the fact that no single potential risk factor emerged with more than four supporting studies, while no fewer than 28 of the 41 identified factors had only one study providing supporting evidence.

A range of childhood developmental and adjustment factors have been identified as having a role in the prediction of arson recidivism, although this area is complicated by the range of specific issues examined in different studies, and a lack of clear definitions to allow comparison between studies. Poor school adjustment (Dickens et al., 2009; Rice & Harris, 1991) is judged as a promising risk factor, while others, such as the finding that multiple firesetters were more likely to have been institutionalised as a child (Rice & Harris, 1991), have had a problematic family history (Dickens et al., 2009), as well as that recidivist firesetters had reached a lower 'highest grade' at school and were more likely to have set fires in childhood (Rice & Harris, 1996), are deemed worth exploring further.

One notable factor that warrants brief further discussion, despite only being identified as risk factor by one of the included studies (Rice & Harris, 1991) is that of an unusually strong interest in fire, often simply termed 'fire interest'. Research in this area carried out using self-report questionnaires and modified attentional Stroop tasks has been largely limited to adolescent populations (see e.g. Gallagher-Duffy, MacKay, Duffy, Sullivan-Thomas, & Peterson-Badali, 2009; Hoerold & Tranah, 2014). In research with adults the favoured method has generally been to rely on family reports of childhood interests (see e.g. Rice & Harris, 1991). There have been some attempts to measure the concept by other means in adults, for example it features a as subscale of the Fire Setting Scale (FSS; Gannon & Barrowcliffe, 2012) and as the main focus of the Fire Interest Rating Scale

(FIRS; Murphy & Clare, 1996). There is little further published use of these tools, but there are nonetheless good theoretical grounds for proposing a role for fire interest within the range of factors underpinning problematic firesetting behaviour in adults (Gannon, Ó Ciardha, et al., 2012) and this factor is the strongest of a group of factors emerging from the present review as worth exploring further.

Strengths and limitations

An early twenty-year follow-up study of convicted arsonists in England and Wales (Soothill & Pope, 1973) was excluded from the current review as it was purely descriptive in nature. In this study only three of the 67 men and women on whom full information was available went on to be convicted of a further arson offence in the twenty-year follow-up period (from 1951 to 1971). The authors observed that these three men may well be the "type of arson cases" (p. 137) that are seen in studies using samples purely drawn from prison and secure hospital settings. Given that many of the studies which did meet the inclusion criteria for this review are based on just such samples, this only serves to reinforce the point that findings of studies into firesetting cannot be extrapolated with much confidence beyond the specific population from which their sample is drawn. The same lead author (Soothill et al., 2004) noted that most arson recidivism studies concentrate on either psychiatric or prison populations. In their studies (Soothill et al., 2004; Soothill & Pope, 1973) only around one third of those convicted of arson in England and Wales in any given year were awarded a custodial sentence, suggesting that studies of incarcerated populations are likely to feature samples which are not representative of all arsonists appearing at court. It is also interesting to note that while rates of arson recidivism are relatively low compared to the rates at which arsonists go on to commit

other crimes, the rate at which they are convicted of future arson rose over the second half of the twentieth century (Soothill et al., 2004).

The vast majority of the research reviewed has focused exclusively or predominantly on male offenders, and where female offenders are included as a minority the results and analyses are not broken down by gender. Therefore whilst some results can be generalised with moderate confidence to a wider population of convicted male arsonists, much more caution must be exercised when extrapolating to a female population. Only one included study provided information on whether repeat firesetting was more likely in the male or female participants, identifying no significant difference in their sample (Dickens et al., 2009).

The included studies have been conducted across a variety of jurisdictions, specifically Canada, England and Wales, New Zealand, Australia, the former West Germany, and Finland. It is encouraging that research has not been confined to just one or two countries, but also problematic that the synthesised findings presented here cannot be argued to be specific to one particular national population or criminal justice system. To highlight this point, had this review been conducted using identical criteria but with the additional requirement that research had focused on a UK population, only three studies would have been included.

Low detection rates pose a problem for any recidivism research, and perhaps particularly so given detection rates for arson offending. This causes issues both in terms of those identified to enter a study population by having been convicted of an index offence, and in terms of how many subsequent (or pre-existing) recidivistic offences are actually detected by the authorities or researchers. Whilst there are no simple solutions to this problem, it is

important that it is acknowledged, and important that caution is taken in extrapolating findings from groups of convicted arsonists to the wider population of deliberate firesetters, the majority of whom may avoid contact with criminal justice agencies. It must be acknowledged that the research reviewed helps to identify factors associated with further *detected* firesetting behaviour, not necessarily with the extent of actual firesetting. This issue is partially addressed by those studies which include wider measures of recidivism than just official convictions, but such measures have largely only been possible in studies of psychiatric patients, and will still likely not capture all instances of firesetting.

A number of studies in this review focus solely on psychiatric populations or those referred for forensic psychiatric assessment. The extent to which the findings of such studies can be generalised to the wider population of convicted arsonists must be limited. Much more generalizable are the findings of studies using court data to include all convicted arsonists within a specified jurisdiction in a set time period. However, this latter type of study is usually much more restricted in the range of variables measured, not having the detailed diagnostic, childhood, family, and offence-motive information that can be extracted from examination of psychiatric reports and files.

The possibility of false positive (type one error) findings in some of the studies within this review has already been highlighted. This possibility must also be acknowledged within the review itself. Such a review focuses by its nature on evidence of the existence rather than absence of significant findings, although attempts have been made to highlight contradictory evidence where it is presented in the studies reviewed.

Methodological differences between included studies are a further confounding factor in this review, with key differences being observed in design, range/definition of variables studied, and definition/measurement of recidivism, as well as population studied. The calculation and comparison of effect sizes within the review has gone some way towards addressing these differing approaches. Long-term prospective cohort studies are noticeable for their rarity, and it is noteworthy that a number of the included studies are not explicit about their retrospective nature, perhaps not wishing to remove the possibility that the reader may be lulled into a sense that the study was prospective.

There are additional factors which have been found to differentiate between firesetters and non-firesetters, but which do not emerge from the present review, possibly because they have not been investigated with sufficient rigour in studies focusing on arson recidivism. Of the male firesetter characteristics summarised by Gannon and Pina (2010) the following in particular are notable by their absence here: poor assertiveness and communication skills, low self-esteem, high levels of impulsivity, and substance dependence. The evidence for a role for affective disorders and schizophrenia is very limited, with more promising evidence suggesting that it may be the absence of psychosis which in fact helps to predict recidivism, although studies lack sufficient detail to explore the role of acute symptomology. It would be premature to suggest that any of the above factors do not also play a role in characterising recidivist firesetters.

The majority of studies also focus exclusively or predominantly on static variables and do not tend to explore offender motivation in a way that is consistent with proposed theories and typologies/classifications of firesetting behaviour. This limits the information

available about why offences were committed, which plays a crucial role in understanding and assessing risk of recidivism.

There are therefore limitations to the research within this review, and consequently to the review itself. Nonetheless, the review has been able to identify some key factors which, it is reasonable to conclude, can aid the prediction of firesetting recidivism. Furthermore, it has identified a number of additional factors where evidence is far from conclusive, but which can help to narrow and target the scope of future research.

Implications for practice and policy

This review highlights specific factors associated with arson recidivism, and it is clear that many of these factors are not the same as those which are routinely found to be associated with either non-violent or violent recidivism. Indeed, this is also the specific finding of a number of studies included within the review (see e.g. Edwards & Grace, 2014; Rice & Harris, 1996). The importance therefore of specifically assessing risk of arson recidivism in those offenders convicted of such offending, alongside other appropriate assessments, is emphasised. There remains a marked lack of evidence with regard to female arsonists, and future research should seek to include female participants and present separate analyses for male and female offenders where possible.

Gannon and Pina (2010) highlighted that the then current edition of the HCR-20 professional guidelines for assessing violence risk (Webster, Douglas, Eaves, & Hart, 1997) viewed arson as a "less clear" case of violence, and suggested that the intentions underlying the offence should be considered in order to decide whether to apply the HCR-20. Without offering an explanation for the change of position, the updated HCR-20 guidelines (Douglas, Hart, Webster, & Belfrage, 2013) appear to classify arson as a violent

offence. This third version of the HCR-20 defines violence by proposing that, "Violence occurred when (a) a person engaged in an act (or omission) (b) with some degree of wilfulness that (c) caused or had the potential to cause (d) physical or serious psychological harm to (e) another person or persons." (Douglas et al., 2013, p. 37). The authors acknowledge that within their definition, "the physical or serious psychological harm must affect one or more people aside from the actor," (p. 3) and that it excludes, "property damage … unless carried out in a manner that is intended to cause fear of harm or severe psychological harm in others," (p. 37), but later state unequivocally that, "arson, firesetting, and similar acts meet the definition of violence according to the HCR-20^{V3}." (p. 69). This does not address the possibility that many offences of arson may involve no intent to cause injury or fear to other people (albeit that depending on the context this risk may be inherent in the behaviour). The suggestion that it may be appropriate to use the HCR-20 to assess arsonists whose firesetting is carried out with the intention of harming others, on the basis that this is consistent with the HCR-20 definition of violence (Gannon & Pina, 2010; Taylor & Thorne, 2012) is also problematic without evidence to support the idea that similar factors underpin the offending of arsonists as underpin violent offending. As the present review demonstrates, the evidence suggests these factors may well differ, and that arson recidivism may even be more likely in those with lower levels of violence and aggression (Rice & Harris, 1991, 1996). The results of this review therefore cast further doubt on the orthodoxy of assessing arson risk routinely within the context of conventional violence risk assessments (see also Doley et al., 2011). The current guidance within the HCR-20 that it can be applied carte blanche to all arson offenders is then clearly unsatisfactory, and the need for the development and validation not just of actuarial tools but also of Structured Professional Judgement (SPJ) tools for the assessment of arsonists is

reinforced. Such a tool is reported to be in the early stages of development (Doley et al., 2011), while another, the Northgate firesetter risk assessment, has been published (Taylor & Thorne, 2012) but appears thus far to lack any testing of its validity or reliability. The St Andrew's Arson and Fire Risk Instrument (SAFARI) has been designed to augment HCR-20 assessment, but has the identification of treatment targets as opposed to the assessment of risk as its main focus (Long, Banyard, Fulton, & Hollin, 2014) and has only been tested with a very small group of exclusively female patients. It can be concluded then that at present there exist no established SPJ tools to predict arson recidivism in adults, and only one proposed actuarial tool, thus far validated only in New Zealand (Edwards & Grace, 2014).

The challenge faced in developing an SPJ tool for firesetting is exemplified by this review identifying far more evidence in relation to static factors associated with arson recidivism than it has with regard to dynamic factors. As noted by the authors of one of the included studies (Edwards & Grace, 2014) in their development of an actuarial prediction model based on static factors, the next challenge is to move towards a third-generation model of arson recidivism which includes dynamic factors. The practical importance of such a development is that it would allow criminal justice practitioners and agencies to assess not just underlying static risk levels, but also progress over time in custody, in treatment, and during supervision orders, as well as allowing for more defensible and reliable judgements to be made by those considering discretionary release applications.

Conclusion

This review has highlighted a number of factors which have been found to be associated with arson recidivism. The five factors most reliably linked to repeat firesetting appear to

be young age at first firesetting incident or conviction, number of previous arson offences, being single/never married, young age at time of index offence or subsequent assessment, and presence of personality disorder. Following this, young age at first criminal conviction, multiple arsons at the index offence, a history of vandalism, having an intellectual disability, poor school adjustment, feelings of tension or excitement associated with firesetting, lower levels of violence and aggression, and the absence of psychosis or a delusional motive have all been deemed promising risk factors. In addition, a number of other factors worthy of additional research have been identified. The methodological limitations of a number of studies, and the differences between them, along with the range of quality levels observed, mean that these findings remain tentative. These limitations highlight the need for future research to be as methodologically robust as possible, and to seek to test the relevance and applicability of the range of 'international' factors highlighted above to the specific jurisdiction in which they will be used.

CHAPTER FOUR:

A RETROSPECTIVE INVESTIGATION OF RISK FACTORS FOR RECIDIVISM IN CONVICTED ADULT MALE AND FEMALE ARSONISTS

ABSTRACT

Arson remains relatively under-researched compared to other types of serious offending, with most studies examining psychiatric populations and neglecting female subjects. This study aimed to explore differences between recidivist and first-time arsonists and explore the role of differential risk factors for recidivism for female and male arsonists. A retrospective case-control methodology was employed to study 1805 convicted arsonists (including 302 females) serving sentences in England and Wales on 31st March 2013. The 261 recidivist arsonists were compared with the 1544 first-time arsonists on a range of potential risk factors drawn from Offender Assessment System (OASys) and previous conviction data. Recidivists were more likely to have: committed their first arson at a young age, a history of criminal damage offending, experience of psychiatric disturbance, carried out their index offending alone, exhibited behavioural problems in childhood and to lack interpersonal skills. Separate analyses compared recidivist and first-time arsonists within gender. Female recidivists could be identified by higher levels of violent offending, and having been a patient in a secure psychiatric unit. Male recidivists were more likely to have multiple arson convictions at index, a thrill seeking motivation, and to have been homeless and socially isolated. Gender-specific actuarial tools to aid the prediction of arson recidivism were developed with AUCs = .81. The utility of the tools in clinical forensic risk assessment is discussed, along with the need to test and refine them further through prospective research.

INTRODUCTION

Arson presents a major problem and challenge to society. Almost half of all fires attended by the fire services in England are started deliberately, and such fires account for around 25% of all fire-related deaths (Department for Communities and Local Government, 2014). In the period from 2009 to February 2014 it has been calculated that of the 214 fatalities in deliberate fires in buildings, 45% were attributable to suicide (Arson Prevention Forum, 2014), leaving 122 fatalities attributable to arson likely not committed by the victim. The annual economic cost of arson in England during 2008 was estimated at £1.7bn of a total £8.3bn cost of fire (Department for Communities and Local Government, 2011). Of this sum, £345m is borne by the criminal justice system (Arson Prevention Forum, 2014). Parliamentary questions have revealed that approximately 1,500 offenders are convicted at court for a primary offence of arson each year (Hansard, 2014). In this context, and given evidence that deaths from deliberately started fires are declining at a slower rate than those from accidental fires (Arson Prevention Forum, 2014), there is clear benefit in trying to understand what motivates people to deliberately set fires and to determine which arsonists are most likely to go on to repeat their behaviour.

The Criminal Damage Act 1971 defines arson as occurring when a person without lawful excuse destroys or damages any property by fire, and sets a maximum sentence of life imprisonment for such an offence. The term firesetting is often preferred by researchers due to the international variations in legal definitions of arson, and in order that the focus of discussions is on all of those demonstrating the behaviour of intentional firesetting and not necessarily just those convicted of an offence of arson (Gannon & Pina, 2010).

Historically the literature has focused far more on firesetting carried out by children, and particularly by adolescents, than by adults. A systematic review to identify risk factors for firesetting recidivism in children and adolescents (Kennedy et al., 2006) identified previous firesetting behaviour as the biggest predictor of recidivism.

Mentally disordered firesetters

Relatively recent reviews of the literature (Gannon & Pina, 2010; Tyler & Gannon, 2012) highlight the lack of robust or conclusive research to determine whether or not firesetters show higher levels of psychopathology than other types of offender. There is evidence to suggest that convicted arson offenders in Sweden are more than twenty times more likely to be suffering from schizophrenia than the general population (Anwar, Långström, Grann, & Fazel, 2011), and a large US epidemiological study found that those reporting a history of firesetting were more than ten times as likely to meet diagnostic criteria for conduct disorder and antisocial personality disorder, and twice as likely to meet the diagnostic criteria for obsessive-compulsive disorder (Vaughn et al., 2010).

A study of admissions to English medium secure forensic psychiatric services reported that arson was identified in 12% of cases where criminal behaviour led to the admission, and that 6% of admissions for non-criminalised behaviour disorder were attributed to firesetting (Coid, Kahtan, Gault, Cook, & Jarman, 2001).

It has been concluded however that most firesetters who come to the attention of the authorities are not suffering from mental health problems (Tyler & Gannon, 2012). 50% of sentenced female prisoners and 64% of sentenced male prisoners in England and Wales have been found to have a personality disorder, while 70% of sentenced women and 72% of sentenced men have two or more mental disorders. No more than one in ten sentenced

prisoners have no mental disorder at all, while prevalence rates for those on remand are even higher (Singleton, Meltzer, Gatward, Coid, & Deasy, 1998). In the context of these levels of mental disorder within the prison system, it may not be justifiable to draw a distinction between those in prison and those in contact with forensic psychiatric services. A number of the most often cited firesetting studies have been conducted with samples taken from psychiatric referrals/inpatients (see e.g. Dickens et al., 2009; Rice & Harris, 1991, 1996), with a lack of empirical evidence to determine whether findings are applicable to a wider criminal justice population.

Theories which seek to explain firesetting behaviour are discussed in detail in chapter one, with the most recent, the M-TTAF (Gannon, Ó Ciardha, et al., 2012) helpfully integrating a range of factors which may create vulnerability for, and maintain, firesetting behaviour. The inclusion of mental health as a moderator of other risk factors within the M-TTAF is a positive step in moving away from an arguably unjustifiable distinction and consequential discrete approaches to mentally disordered and non-disordered firesetters, and towards a holistic understanding of the behaviour.

Reconviction rates

Research suggest that the majority of arsonists are not reconvicted for further arson offences, although a review (Brett, 2004) found considerable variation in recidivism rates across studies, with retrospective studies and those investigating psychiatric populations seeming to indicate higher rates. Research with large criminal justice samples in England and Wales found arson recidivism rates of 4% (Soothill & Pope, 1973) and 10.7% (Soothill et al., 2004) over 20-year follow-ups. Recent international research has found arson recidivism rates of 6.2% over a 10-year follow-up in New Zealand (Edwards &

Grace, 2014) and 5.3% over an average 7-year follow-up in Australia (Ducat et al., 2015). In what appears a consistent finding, firesetters in these studies were reconvicted for other types of offences at much higher rates than they were for arson. It is not therefore justifiable to treat all arson offenders as inherently high risk of committing further arson, but given the harm caused by those who do go on to set more fires, there is a clear need to identify factors which can help to identify those most at risk. The issue of low detection and conviction rates for arson offending is addressed in the systematic review (see Chapter three). Actual levels of reoffending will be higher than those reported in official data, although it may be reasonable to conclude that the level of undetected community firesetting among previous arson offenders will be limited by the greater attention paid to them by law enforcement authorities.

Aetiology and risk factors for firesetting recidivism

The ability to make and control fire has been and is fundamental to human survival and progress. The process of experimenting or playing with fire can be considered to have a normative role in childhood development with one US study finding that 66% of boys and 58% of girls had engaged in fire play, with boys more likely to have done so away from the home, and on more than one occasion (Kafry, 1980). In a much larger Canadian sample, 74% of boys and 62% of girls reported having deliberately set at least one fire during childhood, although more than half of each group had not done so within the past year (MacKay, Paglia-Boak, Henderson, Marton, & Adlaf, 2009). Clearly most children do not continue this behaviour into adulthood, with rates of self-reported deliberate firesetting among adults being in the range of 1% (Blanco et al., 2010; Vaughn et al., 2010) to 11% (Barrowcliffe & Gannon, 2015; Gannon & Barrowcliffe, 2012).

It is important then to try to understand the psychological processes that play a role in moving from normative fire play to adult recidivistic arson. Key risk factors for recidivism in child and adolescent firesetters have been identified to include higher levels of fire interest, covert antisocial behaviour, lower social skills, and family dysfunction (Kennedy et al., 2006). The progression from playing with fire at a young age as part of experimentation with peers to setting fires individually has been proposed as a key marker of the development of what could be seen as pathological firesetting (Jackson et al., 1987). Within this model of recidivistic arson, social disadvantage and a perceived inability to effect social change, along with an aversion to interpersonal conflict, lead to violence being inflicted on property rather than against people. The consequences of this firesetting, be they in terms of the inherent excitement of the act, or the immediate and longer term responses of others then serve to reinforce the behaviour (Jackson et al., 1987). Evidence that arsonists may show lower levels of physical aggression and assertiveness than other types of offender (Jackson et al., 1987; Rice & Harris, 1991) provides some support to this conceptualisation. The evidence suggests therefore that those who develop into recidivistic firesetters may lack the abilities or skills to deal with both internal (cognitive, emotional) and external conflict, and use firesetting as a way of resolving their difficulties.

The emergence of the M-TTAF (Gannon, Ó Ciardha, et al., 2012) has further assisted with understanding the progression or development of firesetting in adulthood, with five provisional prototypical trajectories leading to, and in some cases explaining the reinforcement of, deliberate firesetting. The suggested trajectories are: **Antisocial cognition**, consisting of those who are generally criminal, associate with an antisocial peer group and set fires instrumentally as part of a wider criminal lifestyle and mind-set; **Grievance**, incorporating those with high levels of anger and aggression but poor

assertiveness and a tendency to ruminate over perceived wrongs. Cognitive scripts of these firesetters may fuse fire with indirect aggression and fires are set as a warning or retribution; **Fire interest**, the predominant motivation being an intense emotional arousal achieved via setting fires, or alternatively fire may be used as a key coping mechanism to reduce emotional arousal at time of high stress. A lifelong association with fire may be common, but this group are not likely to live a more generally criminal lifestyle; **Emotionally expressive/need for recognition**, hypothesised to include those for whom communication and social skills deficits are paramount, alongside either serious deficits in emotional regulation which lead to use of fire as a cry for help or suicide attempt, or with a need for recognition which is achieved through 'saving' others from a fire they themselves have set; and a **Multi-faceted** trajectory, again typified by fire interest, but in this case alongside antisocial cognitions as part of a much wider criminal repertoire, and also including problems with communication and self-regulation.

Doley and colleagues (2011) reviewed the literature on risk factors for recidivistic arson and concluded that fire interest, detected and undetected firesetting, substance abuse, and young age are the most likely risk factors for firesetting recidivism. They also identified that emotions experienced in close temporal proximity to the offence may be of key importance, and that it is important to further investigate the role of setting fires alone, and setting fires without apparent triggers. The authors specifically recommend as a result of their review that more retrospective research be carried out with firesetters in purely forensic settings, in addition to the ideal of long-term prospective reconviction studies. The non-systematic nature of the above review limits the utility of its findings somewhat. The recently completed systematic review of risk factors for arson recidivism in adults presented in Chapter three found strongest evidence to support the role of five risk factors:

young age at time of first firesetting incident or conviction, number of previous arson convictions/offences, being single/never married; young age at time of index offence or subsequent assessment, and presence of personality disorder. A number of promising risk factors were also identified, these being: young age at first criminal conviction, multiple arsons at the index offence, a history of vandalism, having an intellectual disability, poor school adjustment, feelings of tension or excitement associated with firesetting, lower levels of violence and aggression, and the absence of psychosis or a delusional motive. Further exploration of the motivations and modi operandi of arson offenders is required in order to better understand the role of and interactions between such factors.

Actuarial prediction of firesetting

The role of actuarial risk prediction tools is discussed in the systematic review (see Chapter three) where it is highlighted that no established tools exist for the prediction of risk of arson recidivism. This presents problems for clinicians who may wish to adopt the established approach of anchoring structured professional judgement around actuarial predictions of risk. It also presents a challenge to contemporary practice within criminal justice services in relation to assessment of suitability for offending behaviour programmes. For example, NOMS routinely uses Risk Matrix 2000 (RM2000; Thornton, 2007) scores as a means of selecting higher risk offenders into Sex Offender Treatment Programmes (SOTPs), and OASys Violence Predictor (OVP; Howard & Dixon, 2012) scores to identify suitability for violence interventions such as the Self Change Programme (SCP). Without a specialist tool to identify who is at most risk of future firesetting, practitioners overseeing interventions such a the Firesetting Intervention Program for Prisoners (FIPP; Gannon et al., 2015) may find it difficult to target those most in need of

therapy. One potential consequence of this is the delivery of intensive treatment to those offenders for whom it is unnecessary, and associated greater public expense.

Some researchers have employed regression or similar techniques to begin to develop actuarial prediction models, but these have not led to established tools of the kind that exist for assessing risk in violent and sexual offenders.

The area under the receiver operating characteristic (ROC) curve (AUC) is a statistic for measuring the strength of predictive accuracy of a risk model or tool. An AUC of 0.5 indicates only chance level prediction, while an AUC of 1 indicates perfect predictive accuracy. In recidivism research, the AUC indicates the probability of a model correctly distinguishing a randomly chosen recidivist from a randomly chosen non-recidivist.

Ducat and colleagues (2015) developed a predictive model of arson recidivism which incorporated 16 factors and achieved an AUC = .74. The strongest predictors in this model included criminal versatility and number of past criminal offences, as well as contact with mental health services, personality and mental illness diagnoses, and multiple arson charges at index. A more succinct model was developed by Edwards and Grace (2014) consisting of only three factors, first arson under 18-years of age, multiple arsons for criterion offence, and number of prior vandalism offences. This model had an AUC = .70, falling to .67 for the 10-point scale which they devised for possible use as an actuarial assessment.

The role of gender

One of the key weaknesses shared by studies empirically investigating risk factors for arson recidivism has been a lack of female offenders in the samples studied, partly

reflecting lower rates of arson offending amongst women. For example, a recent large scale study in New Zealand featured only 4 females (0.3%) in a total sample of 1250 (Edwards & Grace, 2014). 143 (13.6%) out of 1052 participants in an Australian sample were female (Ducat et al., 2015), but only 10 were recidivists, and this study did not seek to examine risk factors independently for female offenders. Other influential studies have featured no female participants at all (see e.g. Rice & Harris, 1991, 1996).

In one of the few studies to directly compare male and female arsonists, Dickens and colleagues (2007) investigated the same sample as in their later recidivism study (Dickens et al., 2009) and found the female arsonists to be older and more likely to have been diagnosed with a psychiatric illness. Male arsonists had higher levels of criminal versatility and substance abuse, while female arsonists were more likely to have been the victims of sexual abuse. Links between childhood abuse and self-injury are well established (Lang & Sharma-Patel, 2011) and research has indicated that internalising behaviour plays a role in the link between abuse and firesetting in children, although interestingly not as strong a role as that played by externalising (Root, Mackay, Henderson, Del Bove, & Warling, 2008). Research in secure psychiatric populations has suggested that women may be more likely than men to have set serious fires within a prison or secure hospital (Long, Fitzgerald, & Hollin, 2015; Tennent et al., 1971).

Gannon, Tyler, Barnoux, and Pina (2012) identify a particular lack of research into female firesetters, while noting that many of the sociodemographic factors common to male firesetters are also found in female firesetters. Gannon (2010) also highlights the lack of research comparing female arsonists with male arsonists, or with female controls, and discusses the consequent greater difficulties in assessing risk and planning treatment for

female arsonists. This serves to emphasise the difficulties faced in determining whether or to what extent findings of many studies to date are actually applicable to female firesetters.

Evidence that the predictive validity of many widely used risk assessment tools is highly variable in female populations (Geraghty & Woodhams, 2015) also reinforces the need for tools to be carefully developed and validated, paying attention to how the risk factors of different groups of offenders, particularly men and women, may differ.

Offender Assessment System (OASys)

The Offender Assessment System (OASys; Home Office, 2006) is the main risk assessment tool used within the National Offender Management Service (NOMS) in England and Wales. OASys was introduced in 2001 and is now used with adult offenders across the prison and probation services in England and Wales. It combines actuarial assessment with structured clinical judgement to provide standardised assessments of offenders' risks and needs and is used to assist with the management of offenders throughout their sentence (Howard & Dixon, 2012). The ubiquitous use of OASys makes it ideal for study as it would be highly advantageous if currently collected data could be used to assist with actuarial risk assessment of arsonists and potentially contribute to the development of Structured Professional Judgement risk assessment tools. OASys data is used to generate scores on risk predictor tools for each offender undergoing assessment. These tools consist of a mixture of static and some dynamic variables, allowing for change in scores as the OASys assessment is updated throughout an offender's sentence. The most well-known of these risk predictor tools are the OASys Violence Predictor (OVP; Howard & Dixon, 2012) and the Offender Group Reconviction Scale version 3 (OGRS3; Howard,

Francis, Soothill, & Humphreys, 2009). No scale currently exists within OASys to predict risk of arson recidivism.

The present study

The present study will seek to identify factors predicting recidivism in an English and Welsh forensic arsonist population. It will investigate a criminal justice sample as likely to be more representative of the general population of arsonists than a number of previous studies which have been carried out in forensic psychiatric settings. The study will seek to redress the balance of prior research with a focus on adult rather than juvenile firesetting, and will include a focus on gender, to address another key area of need in the research base. The aim will not be to search for gender differences but rather to investigate where possible the relevance of different factors separately for men and women. The use of OASys data as the source of many potential risk factor variables will assist in ensuring practical applicability of findings to clinicians.

The main aim of the study is therefore to empirically investigate the ability of previously identified or proposed risk factors for arson and arson recidivism to distinguish between recidivist and first-time adult arsonists.

The specific research hypotheses are as follows:

1. Recidivist and first-time arsonists will differ on a range of variables which have previously been identified or proposed as risk factors for arson and/or arson recidivism.
2. There will be differential risk factors for recidivism for female and male arsonists.

The research will also have the following aims:

3. To explore the ability of identified factors to predict arson recidivism.
4. To develop actuarial models and tools to aid in the prediction of arson recidivism.

METHOD

The present empirical research took the form of a retrospective case-control study, that being defined as an approach which examines the presence of certain risk factors in a population with (cases) and without (controls) a certain outcome of interest (Centre for Reviews and Dissemination, 2009), in this instance recidivist versus first-time arson offenders. The research is not prospective and longitudinal in nature, which would be the ideal for evaluating recidivism risk factors, but would require the project to span many years. However, the current investigation could help to inform future prospective research.

Sample

The sample comprised all offenders in England and Wales with a primary index conviction for arson who were serving a sentence either in prison or under mandatory community probation supervision on 31st March 2013 and had a valid completed and up to date Offender Assessment System (OASys) report. Offenders under community supervision included those sentenced to immediate community orders and those sentenced to terms of imprisonment but subsequently released on licence into the community. This resulted in a sample of 1809 individuals.

Measures

OASys

The Offender Assessment System (OASys; Home Office, 2006) is the main risk assessment tool used within the National Offender Management Service (NOMS) in England and Wales. OASys allows for the structured clinical assessment of risks and needs and is used to assist with the management of offenders throughout their sentence (Howard

& Dixon, 2012). OASys assessments are completed by qualified probation officers and other staff (predominantly probation service officers and prison officers) who have received specific training in the use of the tool. OASys data were obtained from the NOMS national OASys research database, having already undergone checks for integrity and completeness as part of routine processes conducted by researchers within NOMS (Howard & Dixon, 2012). The research database was supplied in the form of an MS Excel spreadsheet.

The OASys consists of considerable demographic information followed by an analysis of the index offence(s) and sections covering the following ten criminogenic factors: Accommodation; Education, training and employment; Financial management and income; Relationships; Lifestyle and associates; Drugs; Alcohol misuse; Emotional wellbeing; Thinking and behaviour; and Attitudes. These are followed by a risk of harm analysis and sentence plan. The majority of variables analysed in the present study were drawn from questions within the ten criminogenic factors. Each factor contains between 4 and 10 questions, all of which are scored either 0/2 for no/yes responses, or 0/1/2 generally corresponding to an assessment of no/some/significant problems in a particular area. Free text boxes which allow assessors to comment further on specific areas of assessment did not form part of the research database and were not analysed.

OASys assessors make scoring decisions according to guidance within the user manual (Home Office, 2006), having studied case documentation and conducted at least one interview with the offender. OASys user manual guidance for the scoring of offence motive and other selected variables is included at Appendix 5.

OASys assessments are intended to be dynamic in nature and are updated periodically throughout an offender's sentence. The OASys research database provided data from the most recent assessment completed on each offender prior to 31st March 2013. The cross-sectional nature of the research did not allow for any measurement of change in assessments during sentence.

Previous Convictions

The Police National Computer (PNC) research database contains criminal records data of all cautions, convictions and sanctions for offenders in England and Wales. The operational PNC database is used by all police forces in England and Wales. PNC data were obtained in order to provide more detailed information on current and previous offending than contained within OASys.

Procedures

OASys and PNC data were matched using a number of identifiers (PNC number, surname, first initial, date of birth and gender). Unique identifiers were allocated and the datasets merged to provide one anonymised database for analysis. Four cases failed to match to a PNC record and so were excluded from the analysis, resulting in final sample of 1805 cases.

The chosen outcome/dependent variable was recidivist versus first-time arsonist. Participants were classified as recidivist arsonists (one or more previous arson convictions in addition to the index offence) or first-time arsonists (no previous arson convictions), similar to other research using the same methodology (Dickens et al., 2009; Rice & Harris, 1991).

A variety of possible predictor/independent variables were measured using OASys data and criminal convictions data from the PNC. Variables were selected on the basis of their approximation or connection to factors identified in previous research or theory, and particularly in the systematic review reported in Chapter three of this thesis, as having a possible role in predicting firesetting recidivism. Not all variables were directly comparable to previously identified risk factors, and not all potential risk factors identified in the literature could be tested, as the research was limited to those variables measured by OASys and the PNC.

Ethics

Ethical approval for the research was obtained via the University of Birmingham ethical review process (reference ERN_13-1114) and approval also granted by the NOMS National Research Council (NRC; reference 2013-232, see Appendix 6). The research was conducted in line with the British Psychological Society's (2010, 2014) code of human research ethics and the Health and Care Professions Council's (2012) standards of conduct, performance and ethics.

Approval for access to PNC data was granted via the Police Information Approvals Panel (PIAP), with the data subsequently supplied by Justice Statistics Analytical Services (JSAS), part of the Ministry of Justice. Access to OASys data was granted and the data supplied by the OASys Data Evaluation and Analysis Team (O-DEAT) within NOMS Planning and Analysis group.

Consent from participants was not sought. NOMS and the Ministry of Justice routinely use data for research and analysis under the research exemption afforded by Section 33 of the Data Protection Act 1998 (The Stationery Office, 1998). The results of the research do not

identify any individual participants as data subjects, and the aims of the research were consistent with the reasons for which the data are collected, including assessing risk of recidivism and harm, reducing reoffending, and the protection of the public.

Some of the data are sensitive, but their use met the exemption criteria set out in paragraph 9 of the Data Protection (Processing of Sensitive Personal Data) Order 2000 (The Stationery Office, 2000) in that it was in the substantial public interest, necessary for research purposes, did not support measures or decisions with respect to any particular data subject, and was unlikely to cause substantial damage or distress to any person.

Treatment of Data

The merged anonymised data were entered into the IBM Statistical Package for the Social Sciences (SPSS), Version 21, for analysis. All analyses were conducted for the sample as a whole, and separately for male and female offenders.

OASys variables coded 0/1/2 were recoded to absent (0) or present (1 or 2) for analysis.

Due to the nature of the OASys assessment which allows some fields to be left blank, and the realities of operational practice, many variables did not have data available for every subject and there are consequently variations in sample size for the analysis of different variables.

Possible predictor/independent variables were grouped conceptually for analysis and the independent groups of recidivist and first-time arsonists were compared using Pearson's Chi Square statistic or Fisher's exact test (for low expected cell frequencies) for dichotomous/categorical variables. Continuous variables were first tested for skewness and kurtosis in line with Kim's (2013) recommendations for large samples. With such a large

sample, in order to avoid rejecting the null hypothesis of normality too easily, it is preferable not to test for the significance of skewness and kurtosis statistics (Field, 2009), but rather to rely on visual inspection of data distribution (which was conducted using bar charts and distribution curves) and application of cut-off reference values of an absolute skew value of over 2 and an absolute excess kurtosis value of over 4 (Kim, 2013). Continuous variables comparisons were made using independent samples t-tests where parametric conditions (assumptions of normality) were met, and Mann-Whitney U tests where not.

Prior to the multivariate analysis, continuous variables were collapsed into dichotomous variables around the mean (for total numbers of offences), for presence/absence (of individual types of offences), and into under-18 versus over-18 years of age (for age at first conviction/sanction). Dichotomisation was carried out to allow for the later development of simple actuarial tools with potential for application in clinical and forensic settings.

Significant univariate independent variables were entered in binomial logistic regression equations, initially as a conceptual group. Significant factors within these equations were entered into final logistic regression equations to build predictive models for the whole sample, and separately for female and male offenders. Receiver Operating Characteristic (ROC) curve analysis, using the area under the ROC curve, was used to measure the accuracy of these models in predicting membership of the recidivist group. Finally, actuarial risk tools with associated risk bandings were constructed.

An alpha criterion for significance = .05 was applied for all analyses. A total of 55 potential predictor variables or risk factors were tested, resulting in a risk of type one

errors in the results. Consideration was therefore given to the application of a Bonferroni correction. The Šidák method of calculating this correction (Šidák, 1967), which provides slightly more power and is more precise than the more common method of Bonferroni calculation, would result in a criterion alpha = .00093. The .01 level would correct to .00018 and the .001 level to .00002. There are persuasive arguments against the adjustment of significance levels for multiple tests relating to pre-established hypotheses, on the basis that such adjustments address the universal null hypothesis, which is of little interest, and because of the resultant increase in likelihood of type two errors (Perneger, 1998). It is also of note that none of the most recent arson recidivism studies included within the systematic review presented in Chapter three (Dickens et al., 2009; Ducat et al., 2015; Edwards & Grace, 2014; Thomson, Tiihonen, Miettunen, Sailas, et al., 2015) make any adjustment for the multiple tests they employ. Significance levels of results will therefore be presented without application of an adjusted alpha criterion, but probability levels below .05 will be presented to five decimal places to allow examination of whether the adjusted criterion is also met.

All tests were conducted two-sided on the basis that the hypotheses did not specify the direction of any specific relationships being investigated.

RESULTS

Demographics

A total of 1805 arsonists were studied, 302 of whom were female, 1503 male. 261 (14.5%) of the whole sample were recidivist arsonists, and 1544 (85.5%) first-time arsonists.

213 (14.2%) of males were recidivists compared to 48 (15.9%) of females. These rates did not differ significantly (χ^2 (1) = 0.60, p = .437, OR = 0.874 (0.621, 1.229)).

Demographic details of the sample are presented in Table 5.

Table 5: Sample demographics

	Whole sample (n = 1805) n (%)	**Recidivist arsonists (n = 261) n (%)**	**First time arsonists (n = 1544) n (%)**
Gender			
Female	302 (16.7%)	48 (18.4%)	254 (16.5%)
Male	1503 (83.3%)	213 (81.6%)	1290 (83.5%)
Ethnicity			
White – North European	1606 (89.0%)	236 (90.4%)	1370 (88.7%)
White – South European	24 (1.3%)	2 (0.8%)	22 (1.4%)
Black	67 (3.7%)	3 (1.1%)	64 (4.1%)
Asian	61 (3.4%)	5 (1.9%)	56 (3.6%)
Chinese, Japanese or other South East Asian	5 (0.3%)	0 (0.0%)	5 (0.3%)
Arabic or North African	8 (0.4%)	1 (0.4%)	7 (0.5%)
Unknown	34 (1.9%)	14 (5.4%)	20 (1.3%)
Mean (SD) age at sanction	32.73 (11.76)	33.86 (11.54)	32.54 (11.80)

The average age of first-time arsonists (M = 32.54, SD = 11.80) and recidivist arsonists (M = 33.86, SD = 11.54) at the point at which they were sanctioned for the index offence did not differ significantly (t(1803) = -1.69, p = .092). Female first-time arsonists were

younger (M = 34.42, SD = 11.03) than female recidivists (M = 38.46, SD = 11.70) at this point ($t(300) = -2.31$, p = <.05). Male first-time arsonists (M = 32.17, SD = 11.91) on the other hand did not differ significantly in age from male recidivists (M = 32.83, SD = 11.27, $t(1501) = -.756$, p = .45).

Data on ethnicity was limited to the six police identity codes, which are somewhat outdated in their terminology and exclusion of mixed ethnic identities, and are based on the judgement of a police officer rather than self-declaration. 89.0% of the sample were White – North European, with the next largest groups being Black (3.7%) and Asian (3.4%). The very small number of recidivist arsonists in non-white ethnic groups precluded any analysis of how risk factors may vary by ethnic group.

Univariate analysis by variable category

Criminal history

With regard to their criminal histories, arson recidivists were younger than first-time arsonists at their first ever arson conviction (M = 24.61 years, SD = 10.72 vs. M = 32.53 years, SD = 11.78, $t(1803) = 10.875$, p < .00001). Male recidivists were also younger at their first ever criminal sanction (M = 16.69 years, SD = 5.43 vs. M = 20.52 years, SD = 10.48, $t(1501) = 8.108$, p < .00001), but female recidivists were not significantly younger than female first-time arsonists (M = 25.60 years, SD = 12.20 vs. M = 26.37 years, SD = 12.00, $t(300) = 0.402$, p = .688).

Arson recidivists had a higher total number of offences on their PNC record (M = 33.07, SD = 38.42 vs. M = 19.95, SD = 25.83, $U = 264969.5$, p < .00001), and a higher number of violent offences (M = 3.82, SD = 5.77 vs. M = 2.64, SD = 3.91, $U = 221420.5$, p =

.00864), although this difference in number of violent offences was not found in the male-only group (M = 3.61, SD = 5.34 vs. M = 2.70, SD = 3.73, *U* = 148464.5, p = .054). Recidivists had a higher number of theft/stealing offences (M = 11.36, SD = 22.31 vs. M = 5.63, SD = 11.61, *U* = 243309.5, p < .00001), although this difference in number of theft/stealing offences was not found in the female-only group (M = 10.31, SD = 33.59 vs. M = 2.87, SD = 7.44, *U* = 6831.5, p = .143).

Arson recidivists had committed more criminal damage offences than first-time arsonists (M = 3.51, SD = 5.11 vs. M = 1.78, SD = 3.27, *U* = 255636.5, p < .00001) and more harassment offences (M = 1.04, SD = 2.60 vs. M = 0.64, SD = 1.51, *U* = 224612.5, p = .00030), but not more drug related offences (M = 0.62, SD = 1.62 vs. M = 0.77, SD = 1.77, *U* = 191729.0, p = .115).

Full results for criminal history variables are presented in Table 6.

Table 6: Comparisons of criminal history variables between recidivist and first-time arsonists

Variable		Total N (recidivists)	Arson recidivists Mean (SD)	First-time arsonists Mean (SD)	Test statistic and value	P value	95% CI of the difference	
							Lower	Upper
Age at first arson conviction	Whole sample	1805 (261)	24.61 (10.72)	32.53 (11.78)	$t^{ne} = 10.875$	**<.00001**	6.393	9.446
	Females	302 (48)	30.04 (12.23)	34.43 (11.02)	t = 2.480	**.01368**	0.905	7.862
	Males	1503 (213)	23.38 (9.96)	32.16 (11.89)	$t^{ne} = 11.560$	**<.00001**	7.277	10.263
Age at first criminal sanction	Whole sample	1805 (261)	18.33 (7.93)	21.48 (10.95)	$t^{ne} = 5.586$	**<.00001**	2.044	4.262
	Females	302 (48)	25.60 (12.20)	26.37 (12.00)	t = 0.402	.688	-2.966	4.489
	Males	1503 (213)	16.69 (5.43)	20.52 (10.48)	$t^{ne} = 8.108$	**<.00001**	2.903	4.759
Total number of offences on PNC record	Whole sample	1805 (261)	33.07 (38.42) Mdn = 21.00	19.95 (25.83) Mdn = 10.00	U = 264,969.5 z = 8.157	**<.00001**	-	-
	Females	302 (48)	33.96 (54.78) Mdn = 14.00	12.57 (21.55) Mdn = 6.00	U = 8,245.0 z = 3.888	**<.00001**	-	-
	Males	1503 (213)	32.87 (33.84) Mdn = 23.00	21.40 (26.35) Mdn = 11.50	U = 180,819.5 z = 7.405	**<.00001**	-	-
Number of violent offences on PNC record	Whole sample	1805 (261)	3.82 (5.77) Mdn = 2.00	2.64 (3.91) Mdn = 1.00	U = 221,420.5 z = 2.626	**.00864**	-	-
	Females	302 (48)	4.75 (7.39) Mdn = 2.00	2.34 (4.73) Mdn = 0.00	U = 7,167.5 z = 2.059	**.03949**	-	-
	Males	1503 (213)	3.61 (5.34) Mdn = 2.00	2.70 (3.73) Mdn = 1.00	U = 148,464.5 z = 1.929	.054	-	-
Number of theft/stealing offences on PNC record	Whole sample	1805 (261)	11.36 (22.31) Mdn = 4.00	5.63 (11.61) Mdn = 2.00	U = 243,309.5 z = 5.507	**<.00001**	-	-
	Females	302 (48)	10.31 (33.59) Mdn = 0.50	2.87 (7.44) Mdn = 0.00	U = 6,831.5 z = 1.464	.143	-	-
	Males	1503 (213)	11.60 (18.97)	6.17 (12.20)	U = 169,607.0	**<.00001**	-	-

			Mdn = 5.00	Mdn = 2.00	z = 5.591			
Number of criminal damage offences on PNC record	Whole sample	1805 (261)	3.51 (5.11) Mdn = 2.00	1.78 (3.27) Mdn = 1.00	U = 255,636,5 z = 7.271	**<.00001**	-	-
	Females	302 (48)	3.58 (5.25) Mdn = 1.00	1.04 (2.30) Mdn = 0.00	U = 8,217.5 z = 4.279	**<.00002**	-	-
	Males	1503 (213)	3.50 (5.09) Mdn = 2.00	1.92 (3.41) Mdn = 1.00	U = 172,413.0 z = 6.193	**<.00001**	-	-
Number of drug related offences on PNC record	Whole sample	1805 (261)	0.62 (1.62) Mdn = 0.00	0.77 (1.77) Mdn = 0.00	U = 191,729.0 Z = -1.577	.115	-	-
	Females	302 (48)	0.13 (0.49) Mdn = 0.00	0.47 (1.42) Mdn = 0.00	U = 5,468.5 z = -1.748	.080	-	-
	Males	1503 (213)	0.74 (1.76) Mdn = 0.00	0.83 (1.83) Mdn = 0.00	U = 132,936.0 z = -.929	.353	-	-
Number of harassment offences on PNC record	Whole sample	1805 (261)	1.04 (2.60) Mdn = 0.00	0.64 (1.51) Mdn = 0.00	U = 224,612.5 z = 3.612	**.00030**	-	-
	Females	302 (48)	0.96 (1.70) Mdn = 0.00	0.47 (1.97) Mdn = 0.00	U = 7,416.5 z = 3.161	**.00157**	-	-
	Males	1503 (213)	1.06 (2.77) Mdn = 0.00	0.67 (1.39) Mdn = 0.00	U = 150,347.5 z = 2.650	**.00805**	-	-

Note. t = t test; t^{ne} = t test for unequal variances used where Levene's test p<.05; U = Mann-Whitney U test.

Offence characteristics / motivations

Male arson recidivists were twice as likely as male first-time arsonists to have been convicted of multiple counts of arson at their index conviction (27.2% vs. 13.6%, χ^2 (1) = 26.058, p < .00001, OR = 2.384 (1.695, 3.354)), but this did not apply to female recidivists, of whom 8.3% had multiple counts of arson at index, compared to 10.2% of first-time female offenders (Fisher's Exact test, p = 1.000, OR = 0.797 (0.625, 2.397)).

The index offences of arson recidivists were less likely than those of first-time arsonists to include physical violence towards a partner (4.2% vs. 10.3%, χ^2 (1) = 8.099, p = .00443, OR = 0.380 (0.190, 0.758)), although the difference was not significanct in the female-only group (0.0% vs. 4.9%, Fisher's Exact test, p = .220, OR = 0.825 (0.780, 0.873)).

There were less likely to be other offenders involved in the index offences of recidivist arsonists than in the index offences of first-time arsonists (7.7% vs. 22.1%, χ^2 (1) = 28.767, p < .00001, OR = 0.294 (0.183, 0.471)).

A sexual motivation was more common, although still rare, in the index offences of male recidivist arsonists than in the index offences of male first-time arsonists (5.1% vs. 1.7%, Fisher's Exact test, p = .01002, OR = 3.045 (1.355, 6.842)), while such a motivation was not judged to be present in any of the index offences of the female-only group.

A thrill-seeking motivation was more common in the index offences of male recidivist arsonists than in the index offences of male first-time arsonists (28.6% vs. 14.6%, χ^2 (1) = 21.986, p < .00001, OR = 2.334 (1.625, 3.352)), but not in the female-only group (6.7% vs. 5.7%, Fisher's Exact test, p = .733, OR = 1.181 (0.323, 4.327)).

Alcohol acted as a disinhibitor in the index offences of more male recidivist than first-time arsonists (76.5% vs. 65.3%, χ^2 (1) = 9.683, p = .00186, OR = 1.727 (1.220, 2.445)), but the trend among females, albeit non-significant, was in the opposite direction (62.8% vs. 72.2%, χ^2 (1) = 1.562, p = .211, OR = 0.650 (0.330, 1.281)).

Full results for offence characteristics and motivation variables are presented in Table 7.

Table 7: Comparisons of offence characteristics / motivation variables between recidivist and first-time arsonists

Variable		Total N (recidivists)	% yes within arson recidivists	% yes within first-time arsonists	χ^2	P value	OR	95% CI for OR	
								Lower	Upper
Multiple (2+) counts of arson at index conviction	Whole sample	1805 (261)	23.8	13.0	20.676	**<.00001**	2.082	1.510	2.871
	Females	302 (48)	8.3	10.2	[F]	1.000	0.797	0.265	2.397
	Males	1503 (213)	27.2	13.6	26.058	**<.00001**	2.384	1.695	3.354
Index offence involves physical violence to partner	Whole sample	1491 (216)	4.2	10.3	8.099	**.00443**	0.380	0.190	0.758
	Females	268 (45)	0.0	4.9	[F]	.220	0.825	0.780	0.873
	Males	1223 (171)	5.3	11.4	5.884	**.01528**	0.431	0.215	0.867
Direct contact with victim of index offence	Whole sample	1630 (235)	38.3	49.2	9.666	**.00188**	0.640	0.482	0.849
	Females	283 (46)	30.4	35.9	0.499	.480	0.782	0.396	1.547
	Males	1347 (189)	40.2	52.0	9.011	**.00268**	0.621	0.454	0.849
Repeat victimisation of same person	Whole sample	1495 (218)	8.3	14.1	5.525	**.01875**	0.549	0.330	.0911
	Females	269 (45)	6.7	6.7	[F]	1.000	0.995	0.276	3.591
	Males	1226 (173)	8.7	15.7	5.811	**.01593**	0.511	0.293	0.890
Stranger victim in index offence	Whole sample	1559 (224)	21.4	21.0	0.024	.877	1.028	0.728	1.451
	Females	272 (45)	15.6	13.2	0.175	.676	1.210	0.495	2.954
	Males	1287 (179)	22.9	22.6	0.010	.919	1.020	0.700	1.485
Other offenders involved in index offence	Whole sample	1772 (260)	7.7	22.1	28.767	**<.00001**	0.294	0.183	0.471
	Females	300 (48)	2.1	18.3	7.980	**.00473**	0.095	0.013	0.709
	Males	1472 (212)	9.0	22.9	21.226	**<.00001**	0.332	0.204	0.542
Peer influence in index offence	Whole sample	1676 (252)	6.0	14.2	12.876	**.00033**	0.383	0.223	0.659
	Females	281 (47)	2.1	11.5	[F]	.059	0.167	0.022	1.258
	Males	1395 (205)	6.8	14.7	9.263	**.00234**	0.425	0.241	0.749
Sexual Motivation in index offence	Whole sample	1547 (221)	4.1	1.2	7.426	**.00643**	2.920	1.304	6.540
	Females	271 (44)	0.0	0.0	[a]	[a]	[a]	[a]	[a]
	Males	1276 (177)	5.1	1.7	[F]	**.01002**	3.045	1.355	6.842

Financial motivation in index offence	Whole sample	1582 (223)	5.4	10.7	5.993	**.01436**	0.476	0.260	0.873
	Females	273 (44)	0.0	4.4	[F]	.374	0.833	0.789	0.879
	Males	1309 (179)	6.7	11.9	4.261	**.03900**	0.530	0.287	0.977
Thrill seeking motivation in index offence	Whole sample	1569 (227)	24.2	13.1	19.103	**.00001**	2.118	1.504	2.984
	Females	273 (45)	6.7	5.7	[F]	.733	1.181	0.323	4.327
	Males	1296 (182)	28.6	14.6	21.968	**<.00001**	2.334	1.625	3.352
Depression, stress or other highly emotional state motivated index offence	Whole sample	1719 (253)	88.5	78.6	13.391	**.00025**	2.105	1.402	3.161
	Females	2960 (48)	89.6	85.9	0.470	.493	1.413	0.524	3.813
	Males	1423 (205)	88.3	77.1	13.131	**.00029**	2.241	1.434	3.501
Emotional state affected judgement or reduced self-control in index offence	Whole sample	1699 (249)	79.9	66.1	18.766	**.00001**	2.044	1.472	2.839
	Females	297 (48)	87.5	75.1	3.505	.061	2.321	0.941	5.722
	Males	1402 (201)	78.1	64.2	14.894	**.00011**	1.990	1.396	2.837
Drugs acted as disinhibitor in index offence	Whole sample	1601 (226)	26.5	25.7	0.065	.798	1.042	0.758	1.434
	Females	278 (41)	12.2	22.4	2.189	.139	0.482	0.180	1.290
	Males	1323 (185)	29.7	26.4	0.870	.351	1.176	0.836	1.656
Alcohol acted as disinhibitor in index offence	Whole sample	1714 (243)	74.1	66.5	5.480	**.01924**	1.440	1.060	1.957
	Females	291 (43)	62.8	72.2	1.562	.211	0.650	0.330	1.281
	Males	1423 (200)	76.5	65.3	9.683	**.00186**	1.727	1.220	2.445

Note. [F] Fisher's Exact Test used due to low expected cell frequencies; [a] Not calculated due to lack of cases.

Childhood / developmental variables

Childhood behavioural problems were much more common in arson recidivists than first-time arsonists (53.4% vs. 31.3%, χ^2 (1) = 42.305, p < .00001, OR = 2.524 (1.898, 3.356)). Male recidivists were more likely than male first-time arsonists to have experienced abuse or separation as a child (80.0% vs. 62.8%, χ^2 (1) = 22.011, p < .00001, OR = 2.368 (1.639, 3.421)), but this difference was not apparent in the female-only group (80.4% vs. 76.4%, χ^2 (1) = 0.341, p = .559, OR = 1.267 (0.572, 2.808)).

Learning difficulties were more prevalent in the recidivist group (34.7% vs. 21.4%, χ^2 (1) = 20.062, p < .00001, OR = 1.949 (1.450, 2.618)), although despite the effect being slightly greater for females than males, the difference in the female-only group did not quite reach significance (30.4% vs. 18.0%, χ^2 (1) = 3.624, p = .057, OR = 1.998 (0.971, 4.113)).

Male recidivists were more likely than male first-time offenders to have had poor school attendance (72.9% vs. 57.6%, χ^2 (1) = 16.308, p = .00005, OR = 1.979 (1.415, 2.767)), problems with reading, writing or numeracy (41.3% vs. 30.7%, χ^2 (1) = 9.466, p = .00209, OR = 1.592 (1.182, 2.144)), and to have no qualifications (42.7% vs. 30.7%, χ^2 (1) = 10.956, p = .00093, OR = 1.681 (1.233, 2.291)).

Full results for childhood and developmental variables are presented in Table 8.

Table 8: Comparisons of childhood / developmental variables between recidivist and first-time arsonists

Variable		Total N (recidivists)	% yes within arson recidivists	% yes within first-time arsonists	χ^2	P value	OR	95% CI for OR	
								Lower	Upper
Poor school attendance	Whole sample	1508 (245)	70.6	56.5	16.976	**.00004**	1.853	1.378	2.493
	Females	253 (46)	60.9	50.7	1.554	.213	1.511	0.787	2.900
	Males	1255 (199)	72.9	57.6	16.308	**.00005**	1.979	1.415	2.767
Problems with reading, writing or numeracy	Whole sample	1774 (261)	39.1	30.2	8.125	**.00437**	1.482	1.130	1.945
	Females	299 (48)	29.2	27.9	0.033	.857	1.065	0.539	2.103
	Males	1475 (213)	41.3	30.7	9.466	**.00209**	1.592	1.182	2.144
Learning difficulties	Whole sample	1510 (245)	34.7	21.4	20.062	**<.00001**	1.949	1.450	2.618
	Females	252 (46)	30.4	18.0	3.624	.057	1.998	0.971	4.113
	Males	1258 (199)	35.7	22.1	16.826	**.00004**	1.956	1.414	2.705
No qualifications	Whole sample	1513 (245)	42.4	32.3	9.520	**.00203**	1.549	1.172	2.048
	Females	253 (46)	41.3	40.1	0.023	.880	1.051	0.549	2.013
	Males	1260 (199)	42.7	30.7	10.956	**.00093**	1.681	1.233	2.291
Childhood experience of abuse or separation from parents/guardians	Whole sample	1519 (246)	80.1	65.0	21.245	**<.00001**	2.161	1.548	3.016
	Females	254 (46)	80.4	76.4	0.341	.559	1.267	0.572	2.808
	Males	1265 (200)	80.0	62.8	22.011	**<.00001**	2.368	1.639	3.421
Childhood behavioural problems	Whole sample	1457 (232)	53.4	31.3	42.305	**<.00001**	2.524	1.898	3.356
	Females	245 (42)	42.9	24.6	5.766	**.01634**	2.295	1.152	4.573
	Males	1212 (190)	55.8	32.6	37.349	**<.00001**	2.611	1.906	3.577

Adult adjustment variables

Recidivist arsonists were more likely to lack interpersonal skills than first-time arsonists (60.6% vs. 42.8%, χ^2 (1) = 26.274, p < .00001, OR = 2.054 (1.544, 2.714)), and less likely to have a problematic current relationship with a partner (28.4% vs. 40.1%, χ^2 (1) = 13.006, p = .00031, OR = 0.591 (0.443, 0.789)), although on this variable the difference did not reach significance in the female-only group, despite the marginally greater effect (31.3% vs. 45.7%, χ^2 (1) = 3.417, p = .065, OR = 0.541 (0.280, 1.045)).

Male recidivist arsonists were more likely to have had previous problems with close relationships than male first-time arsonists (81.5% vs.70.0%, χ^2 (1) = 11.036, p = .00089, OR = 1.890 (1.292, 2.764)). Interestingly, there was a non-significant tendency towards female recidivists being less likely to have experienced such problems, albeit with a very high base-rate (80.4% vs. 88.9%, χ^2 (1) = 2.476, p = .116, OR = 0.511 (0.219, 1.193)).

Male recidivist arsonists were more likely to be of no fixed abode or in transient accommodation than male first-time arsonists (51.6% vs. 30.3%, χ^2 (1) = 37.439, p < .00001, OR = 2.459 (1.832, 3.301)), but this was not the case for female recidivists (35.4% vs. 34.9%, χ^2 (1) = 0.004, p = .947, OR = 1.022 (0.536, 1.949)).

Female recidivists were less likely than female first-time offenders to have problems with binge drinking (18.8% vs. 49.2%, χ^2 (1) = 15.155, p = .00010, OR = 0.238 (0.111, 0.512)), a finding that was not replicated in the male-only group (37.1% vs. 42.5%, χ^2 (1) = 2.219, p = .136, OR = 0.797 (0.590, 1.075)).

Full results for the adult adjustment variables are presented in Table 9.

Table 9: Comparisons of adult adjustment variables between recidivist and first-time arsonists

Variable		Total N (recidivists)	% yes within arson recidivists	% yes within first-time arsonists	χ^2	P value	OR	95% CI for OR	
								Lower	Upper
Of no fixed abode / in transient accommodation	Whole sample	1778 (261)	48.7	31.0	30.941	**<.00001**	2.105	1.613	2.746
	Females	300 (48)	35.4	34.9	0.004	.947	1.022	0.536	1.949
	Males	1478 (213)	51.6	30.3	37.439	**<.00001**	2.459	1.832	3.301
Unemployed	Whole sample	1778 (261)	62.8	59.1	1.316	.251	1.172	0.894	1.537
	Females	300 (48)	54.2	50.0	0.280	.597	1.182	0.636	2.195
	Males	1478 (213)	64.8	60.9	1.182	.277	1.183	0.874	1.601
Problematic current relationship with partner	Whole sample	1805 (261)	28.4	40.1	13.006	**.00031**	0.591	0.443	0.789
	Females	302 (48)	31.3	45.7	3.417	.065	0.541	0.280	1.045
	Males	1503 (213)	27.7	39.0	9.959	**.00160**	0.599	0.435	0.826
Previous problems with close relationships	Whole sample	1520 (246)	81.3	73.1	7.323	**.00681**	1.602	1.136	2.259
	Females	254 (46)	80.4	88.9	2.476	.116	0.511	0.219	1.193
	Males	1266 (200)	81.5	70.0	11.036	**.00089**	1.890	1.292	2.764
Domestic violence perpetrator	Whole sample	1806 (261)	29.1	37.2	6.290	**.01214**	0.694	0.521	0.924
	Females	302 (48)	16.7	23.2	1.007	.316	0.661	0.293	1.490
	Males	1503 (213)	31.9	39.9	4.925	**.02647**	0.706	0.518	0.961
Problems with binge drinking	Whole sample	1778 (261)	33.7	43.6	8.989	**.00272**	0.657	0.499	0.866
	Females	300 (48)	18.8	49.2	15.155	**.00010**	0.238	0.111	0.512
	Males	1478 (213)	37.1	42.5	2.219	.136	0.797	0.590	1.075
History of problems with alcohol use	Whole sample	1521 (246)	82.5	75.2	6.102	**.01350**	1.556	1.093	2.214
	Females	253 (46)	69.6	80.7	2.768	.096	0.547	0.267	1.121
	Males	1268 (200)	85.5	74.2	11.864	**.00057**	2.055	1.355	3.117
Socially isolated	Whole sample	1522 (246)	67.9	53.8	16.702	**.00004**	1.818	1.361	2.428
	Females	254 (46)	69.6	70.7	0.022	.882	0.948	0.473	1.901
	Males	1268 (200)	67.5	50.5	19.624	**<.00001**	2.038	1.481	2.805
	Whole sample	1522 (246)	73.2	57.7	20.652	**<.00001**	2.001	1.478	2.709

Problems with self-image	Females	254 (46)	84.8	76.9	1.372	.242	1.671	0.703	3.977
	Males	1268 (200)	70.5	53.9	18.817	**.00001**	2.041	1.472	2.830
Lacks interpersonal skills	Whole sample	1522 (246)	60.6	42.8	26.274	**<.00001**	2.054	1.554	2.714
	Females	254 (46)	60.9	41.3	5.804	**.01599**	2.207	1.148	4.241
	Males	1268 (200)	60.5	43.1	20.612	**<.00001**	2.024	1.487	2.755

Mental health variables

Recidivist arsonists were more likely to have had a history of psychiatric treatment than first-time arsonists (43.9% vs. 26.3%, χ^2 (1) = 29.108, p < .00001, OR = 2.195 (1.642, 2.933)), to have ever been a patient in a special hospital or regional secure unit (25.7% vs. 11.8%, χ^2 (1) = 30.208, p < .00001, OR = 2.588 (1.827, 3.667)), and to have current psychiatric problems at the point of assessment (50.4% vs. 37.5%, χ^2 (1) = 14.274, p = .00016, OR = 1.691 (1.285, 2.225)). Psychiatric problems were also more likely to be assessed as having acted as a disinhibitor in the index offences of recidivists (33.0% vs. 17.9%, χ^2 (1) = 26.945, p < .00001, OR = 2.258 (1.650, 3.089)). Currently receiving or awaiting psychiatric treatment distinguished female recidivists from female first-time arsonists (52.1% vs. 25.2%, χ^2 (1) = 14.040, p = .00018, OR = 3.227 (1.713, 6.078)), but did not distinguish within the male-only group (19.2% vs. 16.0%, χ^2 (1) = 1.361, p = .243, OR = 1.247 (0.860, 1.809)).

Current psychological problems (depression, anxiety or obsessive compulsive disorder) were found more frequently in male recidivists than in male first-time arsonists (69.0% vs. 57.0%, χ^2 (1) = 9.984, p = .00158, OR = 1.678 (1.214, 2.318)), but no such difference was found in the female-only group (76.1% vs. 82.7%, χ^2 (1) = 1.090, p = .296, OR = 0.666 (0.309, 1.434)).

Full results for the mental health variables are presented in Table 10.

Table 10: Comparisons of mental health variables between recidivist and first-time arsonists

Variable		Total N (recidivists)	% yes within arson recidivists	% yes within first-time arsonists	χ^2	P value	OR	95% CI for OR	
								Lower	Upper
Psychiatric problems disinhibitor in index offence	Whole sample	1554 (221)	33.0	17.9	26.945	**<.00001**	2.258	1.650	3.089
	Females	277 (45)	51.1	24.1	13.451	**.00024**	3.286	1.703	6.340
	Males	1277 (176)	28.4	16.6	14.135	**.00017**	1.991	1.383	2.865
Current psychological problems (depression, anxiety or obsessive compulsive disorder)	Whole sample	1522 (246)	70.3	61.2	7.330	**.00678**	1.502	1.117	2.019
	Females	254 (46)	76.1	82.7	1.090	.296	0.666	0.309	1.434
	Males	1268 (200)	69.0	57.0	9.984	**.00158**	1.678	1.214	2.318
History of self-harm, attempted suicide, suicidal thoughts or feelings	Whole sample	1522 (246)	66.7	58.5	5.665	**.01730**	1.416	1.062	1.888
	Females	254 (46)	87.0	78.8	1.567	.211	1.789	0.713	4.490
	Males	1268 (200)	62.0	54.6	3.752	.053	1.357	0.996	1.850
Current psychiatric problems	Whole sample	1522 (246)	50.4	37.5	14.274	**.00016**	1.691	1.285	2.225
	Females	254 (46)	65.2	49.0	3.950	**.04687**	1.949	1.002	3.788
	Males	1268 (200)	47.0	35.3	9.877	**.00167**	1.625	1.198	2.204
History of severe head injury, fits, or periods of unconsciousness	Whole sample	1422 (218)	9.2	4.8	6.759	**.00933**	1.996	1.175	3.391
	Females	242 (42)	9.5	3.5	2.903	.088	2.902	0.810	10.405
	Males	1180 (176)	9.1	5.1	4.499	**.03392**	1.869	1.040	3.358
History of psychiatric treatment	Whole sample	1447 (230)	43.9	26.3	29.108	**<.00001**	2.195	1.642	2.933
	Females	249 (45)	66.7	34.8	15.525	**.00008**	3.746	1.891	7.421
	Males	1198 (185)	38.4	24.6	15.213	**.00010**	1.911	1.375	2.655
Ever medicated for mental health problems	Whole sample	1455 (233)	48.5	38.9	7.532	**.00606**	1.481	1.118	1.962
	Females	248 (45)	62.2	49.8	2.294	.130	1.663	0.858	3.226
	Males	1207 (188)	45.2	36.7	4.877	**.02721**	1.423	1.039	1.949
	Whole sample	1419 (219)	16.0	10.1	6.585	**.01028**	1.696	1.129	2.549

Ever failed to co-operate with psychiatric treatment	Females	243 (42)	23.8	16.9	1.114	.291	1.535	0.690	3.416
	Males	1176 (177)	14.1	8.7	5.118	**.02368**	1.724	1.070	2.777
Ever been an inpatient in a special hospital or regional secure unit	Whole sample	1428 (222)	25.7	11.8	30.208	**<.00001**	2.588	1.827	3.667
	Females	245 (42)	47.6	15.3	22.092	**<.00001**	5.044	2.465	10.323
	Males	1183 (180)	20.6	11.1	12.554	**.00040**	2.079	1.377	3.139
Currently receiving or awaiting psychiatric treatment	Whole sample	1805 (261)	25.3	17.6	8.798	**.00302**	1.590	1.168	2.164
	Females	302 (48)	52.1	25.2	14.040	**.00018**	3.227	1.713	6.078
	Males	1503 (213)	19.2	16.0	1.361	.243	1.247	0.860	1.809

Cognitive skills variables

The proportion of the sample judged to have cognitive skills deficits was generally high, and many of the variables did not distinguish significantly between recidivist and first-time arsonists; none did so within the female-only group.

Male recidivist arsonists were more likely to have been judged to have problems with rigid/concrete thinking (77.3% vs. 62.4%, χ^2 (1) = 16.112, p = .00006, OR = 2.046 (1.435, 2.918)), to have poor consequential thinking (93.0% vs. 86.6%, χ^2 (1) = 6.812, p = .00906, OR = 2.049 (1.183, 3.549)), to have poor perspective taking skills (82.6% vs. 71.9%, χ^2 (1) = 10.695, p = .00107, OR = 1.856 (1.275, 2.700)), and to lack realistic goals (79.7% vs. 68.2%, χ^2 (1) = 10.452, p = .00122, OR = 1.830 (1.263, 2.650)).

Full results for the cognitive skills variables are presented in Table 11.

Table 11: Comparisons of cognitive skills variables between recidivist and first-time arsonists

Variable		Total N (recidivists)	% yes within arson recidivists	% yes within first-time arsonists	χ^2	P value	OR	95% CI for OR	
								Lower	Upper
History of aggressive/controlling behaviour	Whole sample	1518 (245)	68.6	68.2	0.014	.905	1.018	0.758	1.366
	Females	254 (46)	52.2	52.9	0.008	.930	0.972	0.513	1.842
	Males	1264 (199)	72.4	71.2	0.116	.734	1.060	0.756	1.487
Temper control problems	Whole sample	1778 (261)	70.5	66.2	1.870	.171	1.221	0.917	1.626
	Females	300 (48)	60.4	57.9	0.102	.749	1.108	0.590	2.081
	Males	1478 (213)	72.8	67.8	2.066	.151	1.268	0.917	1.753
Poor problem solving skills	Whole sample	1778 (261)	92.3	90.6	0.775	.379	1.244	0.764	2.027
	Females	300 (48)	87.5	88.9	0.077	.781	0.875	0.341	2.243
	Males	1478 (213)	93.4	91.0	1.371	.242	1.408	0.792	2.502
Poor consequential thinking	Whole sample	1778 (261)	90.8	86.2	4.209	**.04021**	1.587	1.017	2.474
	Females	300 (48)	81.3	84.1	0.244	.621	0.818	0.367	1.819
	Males	1478 (213)	93.0	86.6	6.812	**.00906**	2.049	1.183	3.549
Lacks realistic goals	Whole sample	1514 (243)	77.0	68.5	6.881	**.00871**	1.534	1.112	2.114
	Females	254 (46)	65.2	70.2	0.438	.508	0.796	0.405	1.565
	Males	1260 (197)	79.7	68.2	10.452	**.00122**	1.830	1.263	2.650
Poor perspective taking skills	Whole sample	1778 (261)	79.7	70.7	9.001	**.00270**	1.629	1.182	2.246
	Females	300 (48)	66.7	64.3	0.100	.752	1.111	0.578	2.135
	Males	1478 (213)	82.6	71.9	10.695	**.00107**	1.856	1.275	2.700
Rigid/concrete thinker	Whole sample	1514 (244)	75.0	61.4	16.312	**.00005**	1.885	1.381	2.572
	Females	254 (46)	65.2	56.3	1.242	.265	1.458	0.749	2.838
	Males	1260 (198)	77.3	62.4	16.112	**.00006**	2.046	1.435	2.918

Multivariate Analyses

Regression model for the whole sample

A binomial logistic regression equation for the whole sample was calculated for each category of predictor variables, by entering all variables within the category which discriminated significantly ($p < .05$) between recidivist and first-time arsonists in the univariate analyses. All variables which were significant ($p < .05$) in these equations were then entered into a final logistic regression equation.

The enter or forced entry method was chosen as there were generally good theoretical and empirical grounds for the variables being entered into the equation, and because this method is more likely than stepwise approaches to limit the impact of random variation in the data and to be replicable (Field, 2009) and therefore have higher external validity.

The above procedure led to 20 variables being entered into the final regression. This was a satisfactory number given the recommended minimum ratio of 10 cases (recidivists) per predictor variable (Harrell, Lee, & Mark, 1996).

Multicollinearity diagnostics were conducted to ensure that one of the assumptions of logistic regression, that predictor variables are not highly correlated, was not violated. Field (2009) reviews opinions on interpretation of such diagnostics and recommends that Variance Inflation Factors (VIF) above 10 and tolerance statistics of below 0.1 indicate problems with multicollinearity, while tolerance statistics below 0.2 are also concerning. In the present model all VIFs were below 1.6 and tolerance statistics above 0.6, indicating a lack of collinearity between predictor variables.

The -2 Log Likelihood (-2LL) reduced from 1016.77 when only the constant was included in the model to 740.16 for the final model, indicating a significant improvement in the predictive ability of the model (χ^2 (20) = 276.61, p < .001). A non-significant Hosmer and Lemeshow test also indicated that the final model was a good fit to the data (χ^2 (8) = 4.69, p = .79).

The Pseudo R Square statistics, measuring the improvement in the fit of the model over the baseline model were .20 (Cox and Snell R Square) and .36 (Nagelkerke R Square), and the model was able to correctly classify 88.5% of offenders into recidivist or first-time arsonists groups. 98.2% of first-timers were correctly classified, and 32.8% of recidivists.

The final regression equation included eight variables which made a statistically significant contribution. These factors are presented in Table 12 (see Appendix 7 for full results of this regression).

By far the strongest predictor of being an arson recidivist was having been convicted for a first arson offence under the age of 18 years. The Odds Ratio (OR) of 45.12, 95%CI (21.05, 96.71) indicates that in this sample the odds of being an arson recidivist were 45 times higher if the offender was convicted of their first arson offence under- rather than over- the age of 18.

The second strongest predictor in the model was the absence of other offenders involved in the index offence (OR = 0.17, 95%CI (0.08, 0.38)), indicating that the odds of being a recidivist arsonist were 6 times lower for those whose index offence was committed along with other offenders.

The third strongest predictor in the model was having any criminal damage conviction (OR = 2.43, 95%CI (1.53, 3.87)), indicating that the odds of being an arson recidivist were more than doubled for those who had any history of criminal damage convictions, compared to those who did not.

The remaining significant predictors of arson recidivism in the equation were: not being a perpetrator of domestic violence (OR = 0.51, 95%CI (0.33, 0.78)), having 22 or more offences on their PNC record (OR = 1.77, 95%CI (1.13, 2.78)), first criminal sanction not being prior to 18 years (OR = 0.58, 95%CI (0.36, 0.92)), not having a history of problems with binge drinking (OR = 0.64, 95%CI (0.42, 0.97)), and having a thrill-seeking motivation in the index offence (OR = 1.78, 95%CI (1.02, 3.12)).

The area under the ROC curve (AUC) was calculated for the final model (AUC = .84, 95%CI (.80, .87), $p < .001$), indicating that the chance of the model correctly distinguishing a randomly chosen recidivist from a randomly chosen first-time arsonist was 84%.

Table 12: Significant variables in the whole sample regression equation

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
First arson under 18	3.809	.389	95.907	1	**.000**	45.118	21.050	96.705
First sanction under 18	-.546	.236	5.341	1	**.021**	.579	.364	.920
22+ offences on PNC	.571	.230	6.141	1	**.013**	1.770	1.127	2.780
Any criminal damage conviction	.888	.237	14.038	1	**.000**	2.429	1.527	3.865
Other offenders involved	-1.781	.415	18.390	1	**.000**	.168	.075	.380
Thrill seeking motivation in index	.577	.285	4.105	1	**.043**	1.782	1.019	3.115
Domestic violence perpetrator	-.676	.216	9.792	1	**.002**	.509	.333	.777
Binge drinker	-.452	.216	4.355	1	**.037**	.637	.417	.973
Constant	-3.560	.380	87.525	1	**.000**	.028		

Regression model for the female-only sample

Following the above category-by-category regression approach to the female portion of the sample led to the identification of seven variables to enter the final equation. This did not meet the minimum ratio of 10 cases (recidivists) per predictor variable (Harrell et al., 1996), given the 48 female recidivists in the sample. Four of these seven variables were therefore selected to enter the final regression based on beta weights obtained when each variable was entered individually into a simple binomial logistic regression equation.

Multicollinearity diagnostics revealed that all VIFs were below 1.1 and tolerance statistics above 0.9, indicating a lack of collinearity between predictor variables.

The -2 Log Likelihood (-2LL) reduced from 224.49 when only the constant was included in the model to 183.94 for the final model, indicating a significant improvement in the predictive ability of the model (χ^2 (4) = 40.55, $p < .001$). A non-significant Hosmer and Lemeshow test also indicated that the final model was a good fit to the data (χ^2 (5) = 1.46, $p = .92$).

The Pseudo R Square statistics, measuring the improvement in the fit of the model over the baseline model were .15 (Cox and Snell R Square) and .25 (Nagelkerke R Square), and the model was able to correctly classify 84.9% of offenders into recidivist or first-time arsonists groups. 99.0% of first-timers were correctly classified, and 16.7% of recidivists.

Three of the four predictor variables entered into the final regression made a significant contribution to the predictive equation, the results being presented in Table 13.

Female recidivist arsonists were predicted by having a first arson conviction under the age of 18 years (OR = 9.06, 95%CI (1.71, 48.11)), ever having been a patient in a special

hospital or medium secure unit (OR = 3.58, 95%CI (1.65, 7.76)), and having any criminal damage conviction (OR = 2.62, 95%CI (1.23, 5.59)).

The AUC was calculated for the final model (AUC = .77, 95%CI (.69, .85), $p < .001$), indicating that the chance of the model correctly distinguishing a randomly chosen recidivist from a randomly chosen first-time arsonist was 77%.

Table 13: Variables in the female regression equation

	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for the OR	
							Lower	Upper
First arson under 18	2.209	.852	6.698	1	**.010**	9.063	1.707	48.110
Other offenders involved	-1.737	1.047	2.750	1	.097	.176	.023	1.371
Ever been an inpatient in a special hospital or regional secure unit	1.276	.395	2.750	1	**.001**	3.581	1.652	7.760
Any criminal damage conviction	.963	.386	6.223	1	**.013**	2.621	1.229	5.587
Constant	-2.457	.329	55.646	1	**.000**	.086		

Regression model for the male-only sample

Following the same category-by-category regression approach to the male portion of the sample led to the identification of 16 variables to enter the final equation, which was satisfactory given the 213 male recidivists in the sample.

Multicollinearity diagnostics revealed that all VIFs were below 1.5 and tolerance statistics above 0.6, indicating a lack of collinearity between predictor variables.

The -2 Log Likelihood (-2LL) reduced from 872.59 when only the constant was included in the model to 615.82 for the final model, indicating a significant improvement in the predictive ability of the model (χ^2 (16) = 256.77, $p < .001$). A non-significant Hosmer and

Lemeshow test also indicated that the final model was a good fit to the data (χ^2 (8) = 3.69, p = .88).

The Pseudo R Square statistics, measuring the improvement in the fit of the model over the baseline model were .22 (Cox and Snell R Square) and .39 (Nagelkerke R Square), and the model was able to correctly classify 89.0% of offenders into recidivist or first-time arsonists groups. 98.5% of first-timers were correctly classified, and 34.4% of recidivists.

The final regression equation included seven variables which made a statistically significant contribution. These factors are presented in Table 14 (see Appendix 8 for full results of this regression).

The strongest predictor of being a male arson recidivist was having been convicted for a first arson offence under the age of 18 years (OR = 49.48, 95%CI (21.87, 111.93)). The second strongest predictor in the model was the absence of other offenders involved in the index offence (OR = 0.14, 95%CI (0.06, 0.34)), indicating that the odds of being a recidivist arsonist were 7 times lower for those whose index offence was committed along with other offenders. The third strongest predictor in the model was having any criminal damage conviction (OR = 2.55, 95%CI (1.49, 4.36)).

The remaining significant predictors of arson recidivism in the male equation were: not being a perpetrator of domestic violence (OR = 0.45, 95%CI (0.28, 0.71)), having a thrill-seeking motivation in the index offence (OR = 2.31, 95%CI (1.32, 4.05)), being of no fixed abode or in transient accommodation (OR = 1.65, 95%CI (1.07, 2.54)), and having 22 or more offences on their PNC record (OR = 1.71, 95%CI (1.05, 2.77)).

The AUC was calculated for the final model (AUC = .85, 95%CI (.81, .88), p < .001), indicating that the chance of the model correctly distinguishing a randomly chosen recidivist from a randomly chosen first-time arsonist was 85%.

Table 14: Significant variables in the male regression equation

	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
First arson under 18	3.902	.417	87.742	1	**.000**	49.477	21.871	111.928
Any criminal damage conviction	.935	.275	11.557	1	**.001**	2.546	1.485	4.364
22+ offences on PNC	.534	.248	4.649	1	**.031**	1.706	1.050	2.773
Other offenders involved	-1.948	.445	19.188	1	**.000**	.143	.060	.341
Thrill seeking motivation in index	.837	.286	8.533	1	**.003**	2.309	1.317	4.047
No fixed abode or transient accommodation	.502	.220	5.204	1	**.023**	1.652	1.073	2.543
Domestic violence perpetrator	-.797	.235	11.506	1	**.001**	.451	.284	.714
Constant	-4.263	.490	75.603	1	**.000**	.014		

Development of actuarial prediction tools

Results of the univariate and regression analyses were used to construct simple actuarial prediction tools for predicting which convicted arsonists had previous convictions for arson. Models were developed first for the whole sample, and then separately for the female and male samples. The utility and limitations of these models will be addressed within the discussion.

Standardised beta weight regression coefficients for significant predictors in each model were used to assist in determining points to be allocated for each item in the risk tools, similar to the methodology employed by Edwards and Grace (2014).

For this portion of the analysis, after necessary reversal of negatively weighted items, all missing items of OASys data were assigned a zero score status in order to test the applicability of the tools to the whole sample as they might apply in an operational setting where some missing data is commonplace. Criminal history variables were present for all cases. Three risk bandings were then created, as opposed to the four applied by Edwards and Grace (2014), and are presented for each tool in tabulated form. Band widths were chosen for each tool to provide the best balance between specificity and sensitivity and to maximise the operational utility of the tools. The percentage of recidivists in each risk band increases as the risk bands increase, while the total number of subjects in each risk bands decreases. Using bands of equal points' width would have led to excessive clustering of cases in the middle bands.

Whole sample

The whole sample (male and female) tool (n = 1805) was coded as follows:

First arson conviction under 18 years-old: Yes = 3 points; No = 0 points.

Other offender(s) involved in index offence: Yes = 0 points; No = 2 points.

Any criminal damage conviction(s): Yes = 1 point; No = 0 points.

22 or more offences on PNC record: Yes = 1 point; No = 0 points.

Thrill seeking motivation in index offence: Yes = 1 point; No = 0 points.

History of problems with binge drinking: Yes = 0 points; No = 1 point.

Scores on this tool ranged from 0 to 9 and the AUC of the tool when applied to the whole sample was .79 (95%CI (.76, .82), p < .001), with proposed risk bands presented in Table 15.

First criminal sanction over the age of 18 and not being a domestic violence perpetrator were not included in this tool despite their significance in the regression equation, due to the lack of a theoretical justification or hypothesis to support their involvement. It is also noted that their inclusion in the tool would provide negligible improvement in predictive ability.

Table 15: Risk bands for the whole sample actuarial risk tool

Risk Band	Score on risk tool	N in risk band (total = 1805)	% of sample in risk band	No of recidivists in risk band (total = 261)	% of risk band who are recidivists
Low	0 - 3	1020	56.5	51	5.0
Medium	4 - 5	679	37.6	127	18.7
High	6 - 9	106	5.9	83	78.3

Female-only sample

The female-only tool (n = 302) was coded as follows:

First arson conviction under 18 years-old: Yes = 2 points; No = 0 points.

Ever a patient in a special hospital or regional secure unit: Yes = 1 point; No = 0 points.

Any criminal damage conviction(s): Yes = 1 point; No = 0 points.

Other offender(s) involved in index offence: Yes = 0 points; No = 1 points.

History of problems with binge drinking: Yes = 0 points; No = 1 point.

Scores on this tool ranged from 0 to 6 and the AUC of the tool when applied to the whole female sample was .81 (95%CI (.75, .88), p < .001), with proposed risk bands presented inTable 16.

The other offender(s) involved and binge drinking items were added to the female risk tool in addition to the three significant predictors in the regression equation due to their clear value as univariate predictors and their impact in improving the predictive ability of the tool. The inclusion of these items was justified as it was hypothesised that offending with others and binge drinking may both be acting as proxies for a level of social involvement that protects against repeated arson offending.

Table 16: Risk bands for the female-only actuarial risk tool

Risk Band	Score on risk tool	N in risk band (total = 302)	% of sample in risk band	No of recidivists in risk band (n = 48)	% of risk band who are recidivists
Low	0 - 2	218	72.2	15	6.9
Medium	3	54	17.9	15	27.8
High	4 - 6	30	9.9	18	60.0

Male-only sample

The male-only tool (n = 1503) was coded as follows:

First arson conviction under 18 years-old: Yes = 3 points; No = 0 points.

Other offender(s) involved in index offence: Yes = 0 points; No = 2 points.

Any criminal damage conviction(s): Yes = 1 point; No = 0 points.

22 or more offences on PNC record: Yes = 1 point; No = 0 points.

Thrill seeking motivation in index offence: Yes = 1 point; No = 0 points.

No fixed abode/transient accommodation: Yes = 1 points; No = 0 point.

Scores on this tool ranged from 0 to 9 and the AUC of the tool when applied to the whole male sample was .81 (95%CI (.78, .84), $p < .001$), with proposed risk bands shown in Table 17.

Not being a domestic violence perpetrator was not included in this tool despite its significance in the regression equation, due to the lack of a theoretical justification or hypothesis to support its involvement. It is also noted that the inclusion of this item in the tool would provide only marginal improvement in predictive ability.

Table 17: Risk bands for the male-only actuarial risk tool

Risk Band	Score on risk tool	N in risk band (total = 1503)	% of sample in risk band	No of recidivists in risk band (total = 213)	% of risk band who are recidivists
Low	0 - 3	916	60.9	47	5.1
Medium	4 - 5	500	33.3	98	19.6
High	6 - 9	87	5.8	68	78.2

DISCUSSION

This study aimed to empirically investigate the ability of previously identified or proposed risk factors for arson and arson recidivism to distinguish between recidivist and first-time adult arsonists. Recidivist arsonists differed from first-time arsonists on a wide range of factors. Consistent with previous research findings, recidivists were younger at the time of their first arson offence (Ducat et al., 2015; Edwards & Grace, 2014; Rice & Harris, 1991, 1996) and were generally more criminal (Ducat et al., 2015), having a higher total number of criminal offences on record, and higher numbers of criminal damage (Dickens et al., 2009; Edwards & Grace, 2014) and harassment offences. Male but not female recidivists were younger at the time of their first criminal sanction, bringing into question the applicability of this previously identified risk factor (Dickens et al., 2009; Ducat et al., 2015) to female arsonists in the England and Wales criminal justice system.

Female but not male recidivists had significantly greater numbers of past violent offences, an outcome which must be examined in the context of previous findings that firesetting recidivists are more likely to have a prior violent offence (Ducat et al., 2015), that they may be less aggressive or violent (Rice & Harris, 1991, 1996) and evidence that violence and aggression do not discriminate between the groups (Dickens et al., 2009; Edwards & Grace, 2014). It may therefore be that female recidivist arsonists are more generally violent, but that this factor is not relevant, or less pronounced, in male recidivists.

A key finding was that recidivist arsonists were much more likely to have committed their index arson offence alone. This replicates a finding from a study of Canadian high security psychiatric patients (Rice & Harris, 1996), and suggests that it is of relevance to both men and women in the England and Wales criminal justice system. This risk factor was more

pronounced among women than men, although it must be noted that 80% of all index offences were committed alone, and that the majority of first-time arsonists also offended alone.

Male arson recidivists were more likely to have been convicted of multiple counts of arson at their index offence (Ducat et al., 2015; Edwards & Grace, 2014), to have used alcohol as a disinhibitor in the offence, and to have had a thrill-seeking motivation. This latter finding may link to previous research which indicates arson recidivists are more likely to experience feelings of excitement or tension associated with their firesetting (Dickens et al., 2009; Rice & Harris, 1991). Importantly, these findings related to male but not female arsonists in the present study. In a further possibly associated finding, no female arsonists were judged to have had a sexual motivation in their index offence, but this motivation was present for 5.1% of recidivist male arsonists, significantly more than the 1.7% in the first-time group. In total 2.2% (28) of 1276 men for whom this item was assessed were deemed to have had a sexual motivation in the index arson offence. This figure is remarkably similar to the 2.5% of male arson offenders assessed as having a sexual motive in a previous study (Rice & Harris, 1991). It has previously been concluded that sexual motivation does not play a role in arson offending (Quinsey et al., 1989), although later reanalysis of these phallometric data did indicate greater arousal to firesetting themes among a significant minority of arsonists when compared to controls (Harris, Rice, Quinsey, Chaplin, & Earls, 1992). The present study also identifies a small subgroup of arson recidivists for whom sexual motive appears to have a role, although a lack of detailed information on motive in the OASys data mean that firm conclusions cannot be drawn. Given that male recidivists were less likely than first-time arsonists to have had a direct victim in their index offence, or to have used physical violence to a partner in the

offence, it does not seem likely that sexual motive has been inferred by assessors purely on the basis of victim choice. A sexual motive may have been recorded by assessors in cases where arson was used to destroy evidence of sexual offending, but such cases are likely to be very rare and this would not necessarily explain the greater prevalence among recidivists.

It was not possible to assess for the presence of pyromania in the present study, but with indications that around 3 to 4% (Lewis & Yarnell, 1951; Lindberg et al., 2005) of arsonists meet full diagnostic criteria for the disorder, it would be interesting in future to explore whether sexually motivated arsonists comprise a subset of those who could be diagnosed with pyromania.

Childhood behavioural problems (Ducat et al., 2015) were found to be more common among recidivist than first time arsonists, with the definition of this OASys item including (but not independently assessing) the setting of fires as a child. Learning difficulties were also more commonly found in the recidivist group, in line with previous findings (Dickens et al., 2009; Rice & Harris, 1996).

Poor school adjustment has previously been found more commonly in recidivist firesetters (Dickens et al., 2009; Rice & Harris, 1991), but in the present study poor school attendance, literacy problems and a lack of qualifications only emerged as relevant in identifying male recidivists, but not females. Similarly, childhood experience of abuse or separation from caregivers only distinguished recidivist from first-time arsonists in the male group, although 77.3% of women and 65.5% of men had experienced such problems, indicating they were a common feature of the arsonists in general.

Recidivist arsonists were found to lack interpersonal skills but were no more likely to be unemployed than first-time offenders. The male recidivists were more likely to be socially isolated and of no fixed abode, a finding which appears consistent previous indications that male arson recidivists in Finland were less likely to have accessed social support (Repo & Virkkunen, 1997b).

A history of relationship difficulties and single status (Dickens et al., 2009) as well as never having married (Rice & Harris, 1991, 1996) have previously been identified as more common in recidivist firesetters. The results regarding relationships in the present study are somewhat complicated by a lack of clear information on relationship status and history. Unfortunately there is no specific recording in OASys of whether an offender is in or has been in an intimate relationship. Therefore findings that recidivists are less likely than first-time arsonists to have a problematic current relationship with a partner, and that male recidivists are less likely to have had previous problems in relationships or been violent to a partner, may in fact reflect them being less likely to have been in a relationship at all. The findings suggest that more needs to be understood about the close relationships of arsonists, and that relationships should be an important consideration in assessment and intervention work. The presence or absence of such problems may do less to help identify recidivist women than men, but gender differences in this area are currently far from clear.

Female recidivists were much less likely than first-time offenders to have problems with binge drinking, whereas for male arsonists it was a history of alcohol problems more generally that helped to identify the recidivists. It is possible that for women an involvement in binge drinking actually identifies those with a level of social involvement that protects against repeated arson offending in way that it may not do for other types of

offence. They could also indicate that alcoholism plays more of a role in male arson recidivism, but both of these conclusions are speculative and require further investigation.

The present study did not include diagnostic assessments of personality disorder or specific mental illnesses, but was instead reliant on ratings made in OASys assessments. Nonetheless, a clear pattern emerges of arson recidivists experiencing greater levels of psychiatric disturbance. They were more likely to have had a history of psychiatric treatment and to have been medicated for such, to have been a patient in a special hospital or regional secure unit, to have current psychiatric problems, and for psychiatric problems to have acted as a disinhibitor in the index offence. Self-harm, attempted suicide (Rice & Harris, 1991), suicidal thoughts or feelings, as well as a history of severe head injury, fits, or periods of unconsciousness, were also more likely to have featured in the histories of the recidivists. The latter finding, affecting 9.2% of the recidivist group, could provide additional support for the role of traumatic brain injury in predicting higher levels of criminality in general (Williams et al., 2010). The role of self-harm and suicidality warrants further investigation. Fire may be used as a means of attempting self-harm or suicide, but it is not clear whether this fully explains its role in the recidivist group, or if other mechanisms are also involved.

Currently awaiting or receiving psychiatric treatment was of particular value in identifying female recidivists, while for men, the presence of current psychological problems such as depression, anxiety, or obsessive compulsive disorder were of more value. This could perhaps reflect a greater availability of mental health treatment and support for women in the criminal justice system, and a greater willingness on the part of staff to refer women as opposed to men for such intervention. The lack of clear diagnostic information or

assessment by mental health professionals as part of OASys means that the present study cannot draw conclusions on the role of any specific disorder, but it can be concluded that higher levels of mental disorder were present in the recidivist group.

Findings are consistent with previous studies which have identified personality disorder (Dickens et al., 2009; Ducat et al., 2015; Rice & Harris, 1991) and mental illness (Ducat et al., 2015) as predictive of arson recidivism, although they are unable to shed further light on earlier findings that recidivists may in fact be less likely to be experiencing psychotic symptoms or to have delusional motives for their firesetting (Dickens et al., 2009; Rice & Harris, 1991). Many offenders suffering from psychosis are likely to have been sentenced to or transferred to secure psychiatric facilities and therefore not to have featured in this study. Higher levels of personality disorder, particularly antisocial personality disorder, in the recidivist group can also be hypothesised on the basis of the greater levels of childhood dysfunction and behavioural problems outlined above, which could be indicative of conduct disorder, and the earlier onset and higher overall levels of criminality.

The usefulness of the OASys cognitive skills deficits variables in distinguishing between recidivist and first-time arsonists was limited, although very high levels of such deficits were found in both groups. Male recidivists were more likely than first-time offenders to have been judged to have problems with rigid/concrete thinking, consequential thinking, perspective taking, and goal-setting.

It is of note that ratio of females to males (1:6) in the sample, with 16.7% being female, is not dissimilar to the ratio of 1:7 (14.2% female) reported for arson convictions in England and Wales in 2000 – 2001 (Soothill et al., 2004). However, comparison must be made with

caution as the earlier figures relate to conviction data whereas the current sample will have been influenced by court sentencing decisions.

Predictive models

The marginally greater accuracy of the gender-specific actuarial prediction tools when compared to that developed on the combined sample warrants a specific focus on them, over and above the combined tool. A first arson conviction under the age of 18, committing the arson index offence alone, and a history of criminal damage convictions feature in both tools. For women, the other two factors scored are: ever having been a patient in a secure hospital and not having a history of binge drinking. For men, the additional items are: 22 or more offences on their PNC record, a thrill-seeking motivation in the index offence, and being of no fixed abode/transient accommodation. A heavier weighting applied to the first arson under 18 and offending alone items for men. The AUC for each of the gender-specific tools was .81. It is possible that some of the differences in risk factors identified for men and women may have been artefacts of the relative lack of power in the female sample, due to the smaller sample size. However, evidence that the separate male and female models were better predictors than the combined model supports the hypothesis that there are some differences in risk factors for arson recidivism for female and male arsonists.

The actuarial prediction model developed by Edwards and Grace (2014) using a large, but almost exclusively male, prospective sample in New Zealand, consisted of only three factors, first arson under 18-years of age, number of prior vandalism offences, and multiple arsons for criterion offence. Vandalism and criminal damage can be taken to be broadly equivalent conviction types across the two jurisdictions, so the present study

provides support for the importance of the first two of these factors. Multiple arsons for the criterion or index offence was important in the present study for distinguishing male but not female recidivists. For men, the odds of being a recidivist if this item was present were 2.4 times higher than if it was not. The variable entered the regression equation for men but did not emerge as one of the significant predictors from this equation and so was not incorporated within the final prediction tool. Adding this item to the male prediction tool in fact marginally reduced the AUC, suggesting that the variation of this factor is already accounted for within other items in the tool.

As identified within the systematic review in Chapter three, the number of previous convictions for arson was reasonably well supported as a risk factor for further arson recidivism. The retrospective case-control design of the present study precluded the ability to study this factor. It may therefore be that the actuarial tools presented here would need to be adapted to incorporate this risk factor, although it is of note that a number of other factors often have a stronger relationship with recidivism than prior arson (Ducat et al., 2015; Edwards & Grace, 2014).

It would not currently be justifiable to use these prediction tools as the sole basis for decisions on legal disposal or parole matters, nor would it be reasonable to view the recidivism rates within risk bands as applicable to prospective samples. Clearly there will be many arsonists who have committed one-off offences and are not currently serving a sentence for that offence, so this study cannot be used to suggest any specific rate of prospective recidivism for arson offenders. However, in the absence of any such tools which have been validated prospectively with a UK arson population, it may be justifiable to use these tools alongside case formulation based on established theoretical approaches

(Gannon, Ó Ciardha, et al., 2012; Jackson et al., 1987) as a way of helping to guide clinical decision making, particularly in terms of intensity of treatment and supervision that may be warranted. Further work to identify gender-specific treatment needs (Gannon et al., 2013) and develop appropriate intervention programmes (Gannon et al., 2015) is required. It is proposed that these tools in their present form have promise in identifying groups likely to be at greater risk of arson recidivism and it seems reasonable to conclude that, as a group, those arsonists scoring highly on the appropriate gender-specific prediction tool are more likely to commit further arson offences than those with low scores. The tools should be tested and refined in prospective recidivism studies to more thoroughly investigate this assertion.

Methodological considerations

A key weakness of the present study is the retrospective case-control design. Such a design does not allow the identification of those who will go on to recidivate, only of those who already have. It is therefore not the optimal means of identifying factors which predict recidivism, but nonetheless provides much useful information.

The methodology is also likely to have inflated the apparent role of having a first arson conviction under the age of 18, and consequently boosted the AUCs of the models generated. Many first-time offenders under this age will not have entered the adult criminal justice system, so this factor was by definition more likely to be identified in recidivists. Nonetheless, it has been identified as an important predictor in previous studies and so whilst the associated odds ratios must be treated with a great deal of caution, its utility as a risk factor is not in serious doubt.

The study is likely to be highly representative of arson offenders within the England and Wales criminal justice system, including as it did all such offenders with a valid OASys assessment on the study date. It will however have excluded those offenders who received psychiatric disposal, so it cannot be said to represent all identified arsonists, and far less all those who set fires unlawfully, the majority of whom go unapprehended.

The cross-sectional nature of the research did not allow for the analysis of change over time on OASys assessments. It has been shown that approximately 10% of answers to the dynamic questions on OASys change on each subsequent reassessment (Howard & Moore, 2009). Future research could seek to track how such changes influence the predictive ability of the items and actuarial models. The research findings are also dependent on the quality of OASys assessments, for which inter-rater reliability is only moderate, and reliability has been shown to vary across sections of the assessment (Morton, 2009). Missing data within the OASys dataset was also a weakness, although the large overall sample size and the applicability of actuarial models back to the full dataset while scoring missing variables as zero, suggest that missing data did not overly impact on the analyses.

Analyses in the female-only group were hampered by a lack of power, given the relatively smaller sample size. Whilst a weakness in comparison to the rest of the analyses, this study still represents a substantial step forward in the understanding of risk factors relevant specifically to the prediction of arson recidivism in women.

The study could also be subject to criticism for the decision not to apply an alpha correction for multiple comparisons. This decision was taken in light of other comparable research which has not applied such correction, but the appropriate Šidák correction and

significance levels to sufficient decimal places are presented to allow the reader to re-evaluate findings.

Conclusions and future directions

It is concluded that the analysis of arson risk factors independently for men and women is of great value and not only increases the ability to predict recidivism, but also allows the clearer identification of factors relevant to individuals. This process could lead to more gender-specific interventions and supervision approaches. It also avoids the possibility that interactions between possible risk factors and gender could cancel each other out if data are only analysed collectively.

Criminal history variables were generally predictive for both men and women, with young age at first arson and a history of criminal damage being particularly common among recidivists. Likewise, for both men and women, recidivists were more likely to lack interpersonal skills, to have experienced psychiatric disturbance, to have carried out their index offending alone, and to have exhibited behavioural problems in childhood.

Factors which specifically helped to distinguish female recidivists from first-time arsonists included a higher number of violent convictions, not engaging in binge drinking, currently receiving or awaiting psychiatric treatment, and ever having been a patient in a special hospital or regional secure unit. Unfortunately no measure was available of how many of these admissions were related to firesetting behaviour. Factors of particular help in making the distinction for male recidivists included having multiple arson convictions at index, a thrill seeking motivation, homelessness and social isolation.

The data presented here could in future be further analysed using cluster analysis or similar techniques to examine the fit of targeted variables to the proposed M-TTAF trajectories (Gannon, Ó Ciardha, et al., 2012). Whilst not all variables proposed within the M-TTAF were measured, this could nonetheless provide some indication of how variables co-exist for individual offenders, and the fit of any patterns to pre-existing theory.

As already indicated, it may be that items indicating a lack of current relationship problems and domestic violence in male recidivists, are in fact helping to identify those who do not have a current relationship, and have not had in the past. This would be consistent with previous findings (Dickens et al., 2009; Rice & Harris, 1991, 1996), and could be explored in future research to investigate whether better measures of relationship history can help to increase the predictive ability of the risk tools developed.

It is acknowledged that OASys is not intended as a psychological assessment tool, but in any future revision there are changes that could be considered by NOMS to increase its utility. For example, some basic psychometric screening and inclusion of mental health screening data would be of great value, as would clearer information on the relationship histories of offenders. Clearer and more focused scoring criteria for some items could also increase their utility for research purposes, and would be likely to increase their inter-rater reliability. The introduction of a section of the assessment tailored to offence type could also be of great value, for example by assessing for arsonists those factors that are of most use in assessing risk, and of factors identified as treatment needs, allowing for targeted interventions and later assessment of change and risk reduction.

Results appear to support the suggestion that emotions experienced in close temporal proximity to firesetting are of key importance for some arsonists (Doley et al., 2011;

Gannon, Ó Ciardha, et al., 2012), and particularly so for recidivists. It is of interest however, that in this study a thrill seeking motivation appears to have been a particularly male phenomenon. This finding may relate to the personality trait of sensation seeking (Zuckerman, 1971), of which thrill-seeking is an element and is found at higher levels in men than women (Zuckerman, Eysenck, & Eysenck, 1978). This further emphasises the need for future research to utilise more detailed and accurate measures both of personality and of emotions experienced in the context of offending.

Along with other recent studies (Ducat et al., 2015; Edwards & Grace, 2014) these findings also confirm that the lower levels of violence and aggression found in recidivists detained in a mental health facility (Rice & Harris, 1991, 1996) are not replicated in wider criminal justice samples.

Prospective research is now required to further investigate the relevance of factors measured within OASys, and ideally with greater clarity of information on psychiatric, personological and motivational variables. Such research could also test and refine the actuarial models proposed here.

CHAPTER FIVE:

DISCUSSION

The main aim of this thesis was to contribute to the understanding of both static and dynamic risk factors for arson recidivism, and to aid forensic clinicians in the process of assessing risk of recidivism in arson offenders. Chapter one briefly outlined some of the key characteristics of adult firesetters before tracking the development of attempts to understand firesetting from a psychological perspective. These were traced from early psychoanalytical approaches (Freud, 1932; Yarnell, 1940), through behaviour- and motive-based typologies (Inciardi, 1970; Prins et al., 1985; Rix, 1994) and crime scene and offender profiling (Canter & Fritzon, 1998; Kocsis & Cooksey, 2002), to the emergence of the first genuinely multi-factor theories of deliberate firesetting (Fineman, 1995; Jackson et al., 1987). Finally, the development of Multi-Trajectory Theory of Adult Firesetting (M-TTAF; Gannon, Ó Ciardha, et al., 2012) was described, and the lack of validated risk assessment tools for the assessment of risk of recidivism in arsonists was highlighted. The literature indicates a wide variety of motivational, behavioural, clinical and forensic features of firesetters, which have been variously proposed as dimensions or collapsed into typologies. Only recently with the M-TTAF have these ideas been integrated into a coherent model which can explain a broad range of recidivistic arson, although the relative dearth of research into arson and firesetting limits the theory's level of detail. Very few studies have considered the situational determinants that precipitate the onset and maintenance of fire interest and deliberate firesetting, or the protective factors which may prevent potential firesetters from committing an offence. Similarly the psychometric measures developed to date for use with firesetters have tended to focus on highly specific

factors, rather than attempting to integrate multiple domains. This has inevitably limited what has been measured and researched and ultimately the findings.

Chapter two provided a review of the Fire Setting Scale (FSS; Gannon & Barrowcliffe, 2012), in terms of its psychometric properties and concluded that the FSS shows promise as a psychometric assessment to measure the key factors of fire interest and antisociality associated with firesetting in the general population. Although the FSS was designed primarily for use with undetected firesetters in the community, the potential for it to be of value with forensic populations was also explored, with possible avenues of further research outlined that could lead to it playing a role within emerging Structured Professional Judgement approaches to risk assessment of convicted arsonists.

A systematic review to investigate the nature, consistency and strength of risk factors for arson recidivism in adult offenders was the focus of Chapter three. No previous such review could be identified in the literature, highlighting the importance of undertaking this work. Fifteen studies met the criteria for inclusion, although fewer than half of the studies actually contributed to the identification of risk factors, largely due to methodological shortcomings. Some studies lacked clarity regarding definitions of recidivism and it was therefore not always clear whether solely arson recidivism or recidivism more widely was being discussed. Studies were rated on a quality assessment tool designed specifically for the purpose, the majority being rated of moderate quality, but with considerable variation between studies. Wherever possible standardised effect sizes were calculated to aid the process of data synthesis. Identified risk factors were ranked in terms of the varying strength of their empirical support, with five factors emerging as being reasonably well supported: young age at time of first firesetting incident or conviction, number of previous

arson convictions/offences, being single/never married, young age at time of index offence or subsequent assessment, and presence of personality disorder. A lack of female subjects was a weakness of many studies reviewed, leading to a lack of clarity over the applicability of findings to women. Similarly, questions were raised over the applicability to offenders in the England and Wales criminal justice system of findings from psychiatric samples and across varying jurisdictions.

The findings of the review highlighted the clear need for larger scale representative research to further investigate the role of a variety of potential risk factors for arson recidivism, and for the need to include sufficient numbers of female subjects to be able to analyse results independently for women and men. The empirical research presented in Chapter four sought to meet these needs by further investigating the role of many of the potential risk factors identified in the systematic review. The retrospective case-control study compared a large sample of recidivist and first-time arsonists on a range of variables measured in OASys assessments, as well as on criminal history variables. Recidivist arsonists were found to differ from first-time arsonists on a wide range of factors. Notably, recidivists were younger at the time of their first arson offence, were generally more criminal, with criminal damage and harassment offences particularly prevalent. Male but not female recidivists were younger at the time of their first criminal sanction, whereas female but not male recidivists had significantly greater numbers of past violent offences. Recidivist arsonists were much more likely to have had childhood behavioural problems, to lack interpersonal skills, and to have committed their index arson offence alone. They also showed greater levels of psychiatric disturbance, suicide/self-harm, and were more likely to have a history of severe head injury, fits, or periods of unconsciousness.

Male arson recidivists were more likely than first-time arsonists to have been convicted of multiple counts of arson at their index offence, to have used alcohol as a disinhibitor in the offence, and to have had a thrill-seeking motivation. They were also more likely to have been socially isolated and of no fixed abode.

Somewhat counter-intuitive findings relating to relationship histories of recidivists were interpreted in the light of the outcome of the systematic review and the limitations of the OASys tool as a means of gathering data. For example, the finding that male recidivists were less likely than first-time arsonists to have current relationship problems or a history of domestic violence is hypothesised to be due to a number of them lacking any meaningful history of intimate relationships, consistent with past findings (Dickens et al., 2009; Rice & Harris, 1991, 1996). Likewise, it was hypothesised that the finding that female recidivists were much less likely than first-time arsonists to have problems with binge drinking, may speak to some greater level of social and peer-group involvement or integration that in fact protects against what the evidence suggests is the largely solitary pastime of repeated arson offending. Measures with greater validity and reliability than the current OASys tool would be required in order to further test these tentative hypotheses.

Logistic regression was used to develop predictive models for arson recidivism for the whole sample, and separately for women and men. These models were then operationalised into risk prediction tools. ROC analysis confirmed the utility of the tools with the development sample, and importantly the gender-specific tools were superior to that developed on the whole sample, supporting the hypothesis that there are differential risk factors for men and women. A first arson conviction under the age of 18, committing the arson index offence alone, and a history of criminal damage convictions featured in

both the female and male tools. For women, the other two factors scored were: ever having been a patient in a secure hospital and not having a history of binge drinking. For men, the additional items were: 22 or more offences on their PNC record, a thrill-seeking motivation in the index offence, and being of no fixed abode/transient accommodation.

The measurement of fire interest is a feature of the FSS and was therefore considered within the psychometric critique presented in Chapter two, and was identified in Chapter three as worth exploring further as a risk factor for recidivistic arson. No measure of fire interest is available within OASys and it is not routinely assessed for arsonists within the criminal justice system so could unfortunately not be measured in the empirical study. The targeted assessment of fire interest in incarcerated arsonists could be of great value in identifying the minority of potentially high risk offenders with this risk factor. Questionnaire measures such as the FSS offer one approach, although may be hindered by their transparency when used in forensic settings. Another approach to measuring fire interest has been the design of a fire-specific pictorial modified Stroop task (Gallagher-Duffy et al., 2009; Gallagher-Duffy, 2008; Hoerold & Tranah, 2014). Such an approach has the obvious merit of not relying on self-report, particularly important perhaps given the very transparent nature of the items within the FSS and other self-report measures discussed. Gallagher-Duffy and colleagues (2009) found that 13- to 16-year-old firesetters referred to their clinic showed greater fire-specific attentional bias than those referred for other types of offending, and non-referred controls. They also found a link between fire-specific bias on the Stroop and self-reported firesetting frequency. Interestingly however, they found a negative relationship between fire-specific attentional bias and self-reported fire interest. This could indicate that even when prepared to self-report some level of firesetting behaviour, young people are aware that it may be undesirable to disclose an

interest in fire, and that they are able to manipulate traditional questionnaire measures to disguise such interest. The use of validated impression management and self-deception scales such as the Paulhus Deception Scales (PDS; Paulhus, 1998) could help to control for such problems, but there is a strong case for further exploring the use of Stroop and other attentional-based measures in the assessment of fire interest, in particular with adult clinical and forensic populations. Research within the field of sexual interests may provide valuable pointers in this regard, with researchers having developed measures of sexual interests using Stroop (Ó Ciardha & Gormley, 2009), and other related approaches using attention and reaction-time measures (see e.g. Glasgow, 2009; Gress & Laws, 2009a, 2009b) which are increasingly seen as more practical, economical, and less ethically challenging than traditional plethysmography approaches to measuring sexual arousal. Pictorial attention-based measures have the further advantage of being applicable to offenders with mild learning disabilities (Glasgow, Osborne, & Croxen, 2003), who may lack the linguistic and cognitive abilities to complete self-report questionnaire measures.

Theoretical and clinical implications

The thesis did not seek explicitly to validate or test pre-existing theories of firesetting behaviour. Nonetheless, it can be seen that results certainly support elements of the model of recidivistic arson proposed by Jackson and colleagues (1987), with the antecedent events or setting conditions of psychosocial disadvantage, dissatisfaction with life and the self and actual or perceived ineffective social interaction, being seen as particularly prevalent in arson recidivists. Likewise, findings indicate that a number of factors featured within tier one of the M-TTAF (Gannon, Ó Ciardha, et al., 2012) are of particular relevance to recidivists and should be the focus of additional attention in this group. These

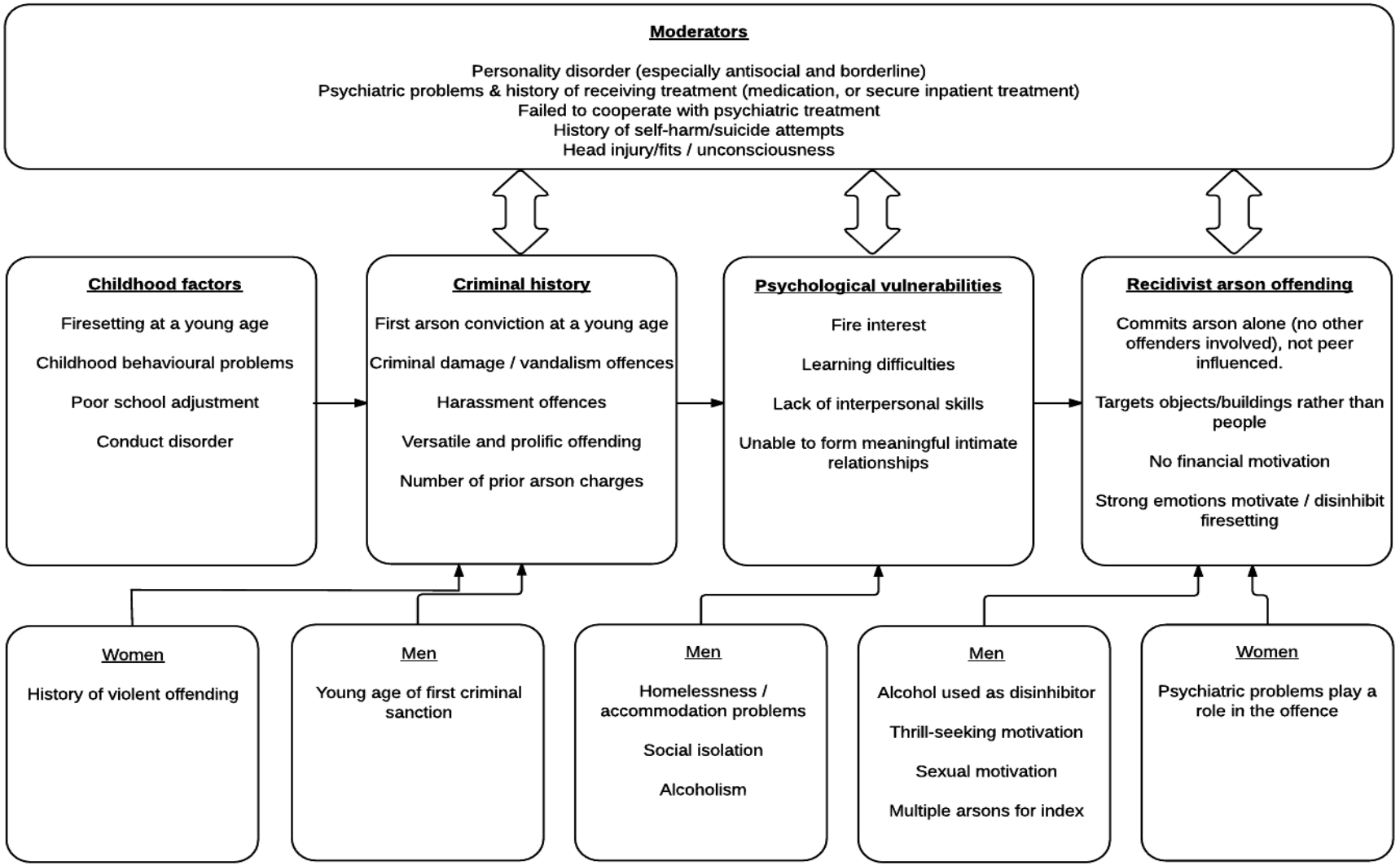
include: childhood behaviour and schooling difficulties along with learning difficulties and head injury within the **developmental context;** very high levels of cognitive skills deficits and a lack of interpersonal and relationship skills within **psychological vulnerabilities;** a role for social isolation and perhaps for mental health crises as **proximal factors and triggers;** as well as the proposed role for mental health and poor self-image as **moderators** of underlying vulnerabilities. When considering the M-TTAF trajectories, a thrill-seeking motivation is proposed as belonging primarily to the fire interest trajectory (Gannon, Ó Ciardha, et al., 2012). The finding that 28.6% of male recidivists were judged to have this motivation compared to 14.6% of male first-time arsonists and 6.7% of female recidivists seems to suggest a bigger role for sensation or thrill-seeking personality traits, particularly for male recidivists, than that of being synonymous with fire interest.

There are of course factors within the M-TTAF which were not addressed in detail within the thesis, such inappropriate fire scripts and offence-supportive attitudes. Their absence here does not mean that they do not also play a key role in recidivistic arson. Indeed, it could be hypothesised that these factors are likely to be more deeply entrenched in such offenders. Further work of a more targeted nature is required to further investigate their role.

Figure 4 presents a summary of factors identified as most able to distinguish arson recidivists from first-time arsonists, based on findings of the thesis as a whole. By viewing these factors as areas of particular clinical need for recidivist arsonists it is proposed that this model can add to the clinical utility of the M-TTAF in its specific application to recidivists, and can thereby help to direct intervention towards the areas of greatest additional clinical need for this group. Referring to the proposed recidivism model may

also help to guide functional analyses for these offenders and to assist in highlighting areas worthy of additional attention to when examining the most relevant M-TTAF trajectory for the offender. To aid this process, the model emphasises factors of particular relevance for women and men, but does not intend to imply that factors highlighted as particularly applicable or prevalent for one gender are not also relevant in many cases for the other gender.

Figure 4: Preliminary model of arson recidivism: Factors distinguishing female and male recidivistic arsonists from first time arsonists



Assessment implications

Findings of the thesis strongly support the need to consider multiple factors when formulating and assessing risk in firesetters (Gannon, Ó Ciardha, et al., 2012; Gannon et al., 2013; Green et al., 2014). In recent years there have been moves towards the development of so-called third-generation or Structured Professional Judgement (SPJ) tools for the assessment of firesetting risk. Such tools tend to combine assessment of actuarial risk factors with a structured approach to assessing the strength of clinical factors which are theoretically and/or empirically linked to the type of risk being assessed.

The HCR-20 (Douglas et al., 2013), one of the most widely used SPJ tools for violence risk, is identified as being of use with firesetters in secure settings if their firesetting behaviour can accurately be conceptualised as violent (Gannon & Pina, 2010). However, this assertion is open to challenge given evidence within this thesis that there are likely to be some important differences in risk factors between violent and arson recidivists, and scope clearly exists for a more focused SPJ tool specifically for use with firesetters and arsonists. The only established examples of this type of assessment for firesetters are solely for use with juveniles. For example, the Firesetting Risk Assessment Tool for Youth (FRAT-Y; Stadolnik, 2010) which is for use with children aged 5 to 17.

Doley and colleagues (2011) indicated that work was underway on the development and validation of such a tool for adults and other emerging models of this type include the Northgate firesetter risk assessment (Taylor & Thorne, 2012), and the St Andrew's Arson and Fire Risk Instrument (SAFARI) which was designed to augment HCR-20 assessment, but has the identification of treatment targets as opposed to the assessment of risk as its main focus (Long et al., 2014). As the authors of these tools acknowledge, they do not yet

have sufficient evidence available in terms of their reliability and validity for them to be used in the assessment of risk.

In the longer term the ideal may be a combined assessment tool incorporating a gender-specific actuarial prediction tool, an objective measurement of fire interest, be that a questionnaire or an attentional-based measure such as Stroop, alongside an SPJ tool, again ideally gender-specific. Such an approach could allow for risk to be predicted as accurately as possible, but equally importantly could support formulation of the idiosyncratic factors which motivate firesetting in an individual, and allow exploration of the cognitive, affective and behavioural processes at work. Many of these factors could then also be viewed as treatment needs, assisting in the targeting of intervention work, and allowing for the assessment of change in a way that actuarial risk tools are often unable to do.

The actuarial risk tools developed in Chapter four have promise in identifying groups likely to be at greater risk of arson recidivism and it was concluded that, as a group, those arsonists scoring highly on the appropriate gender-specific prediction tool are more likely to commit further arson offences than those with low scores. The use of the tools alongside established case formulation approaches is proposed as a way of helping to guide clinical decision making, particularly in terms of intensity of treatment and supervision that may be warranted for arson offenders.

Limitations

Limitations have been identified within each chapter of the thesis, and apply also to the thesis as a whole. The ability to review a psychometric tool directly applicable to the assessment of arson recidivism in Chapter two was hampered by the lack of any such tool in the literature. Indeed, the need for such tools has been discussed throughout the thesis.

The low detection and conviction rate for arson was highlighted in the thesis as placing limitations on recidivism research, and this impacted both on the studies reviewed within Chapter three and the research presented in Chapter four. The lack of female firesetters included in most of the study samples in the systematic review limited the applicability of findings to female offenders, although efforts were made to address this issue in the research in Chapter four. Likewise, the tendency of many of the studies reviewed to focus more on static variables rather than dynamic factors such as offender motivations was addressed to some extent in Chapter four. The systematic review, like all such reviews, may have been subject to publication bias, although extensive efforts were taken to avoid this through contact with experts in the field.

The retrospective nature of the empirical research conducted is a weakness which also limits the confidence in the risk prediction models and tools developed. Likewise the limitations of the OASys data have been highlighted, and missing data would have been a greater concern were it not for the large sample size. The dichotomous measurement of most risk factors within the study also arguably limits the sensitivity of the research and whilst it was judged necessary in order to deal with the large number of variables studied, it could have led to a failure to identify more complex relationships which may have been occurring.

Conclusions and future directions

Future research should seek to address the limitations of research identified within the systematic review and the limitations of this thesis. Specifically future recidivism research should where possible be prospective in nature and seek to measure and study the impact of dynamic as well as static factors. Findings of the thesis help to identify the types of

information that should be routinely collected by criminal justice agencies if they wish to assist researchers and clinicians in moving beyond static actuarial risk assessment to a more in-depth exploration of motivational factors. The measurement of fire interest in arson offenders, employing measures outlined above, would be of particular benefit to researchers, as would improved measures of relationship history and skills, and mental illness and personality disorder. Psychiatric variables have generally been well measured in studies of psychiatric samples, but not in criminal justice samples, and this remains a challenge to overcome. Emotions experienced in close temporal proximity to offending also warrant better measurement and further study, given the close conceptual link between emotions and motivations. This may be best achieved through smaller scale qualitative research using functional analyses and offence chains to explore motivations and offending pathways in more detail (see e.g. Barnoux, Gannon, & Ó Ciardha, 2015; Tyler et al., 2014). The value of continuing to explore differential pathways and risk factors for male and female firesetters has also been demonstrated, and further analyses such as structural equation modelling (SEM) and discriminant analysis could help to identify more discrete offence pathways within these subgroups.

The actuarial tools developed in Chapter four should be tested and refined in prospective recidivism studies and the utility of additional items relating to relationship history and past arson convictions should be explored.

The thesis has drawn broad conclusions relating to groups of arsonists, which it is hoped can assist in the development of actuarial risk tools and contribute to higher quality individualised risk assessments in clinical and forensic settings. Whilst taking account of actuarial measures, such assessments should seek to understand the underlying functions

of firesetting behaviour for individual offenders, thereby both assessing the dynamic nature of that risk and identifying appropriate treatment pathways to manage and reduce the likelihood of further harm.

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APPENDICES

Appendix 1: Details of experts contacted by email

Professor Geoff Dickens, Abertay University, Dundee; University of Northampton.

Dr Rebekah Doley, Bond University, Australia.

Dr Lauren Ducat, Centre for Forensic Behavioural Science, Swinburne University of Technology. Australia.

Professor Brian Francis, Lancaster University.

Dr Katarina Fritzon, Faculty of Society and Design, Bond University, Australia.

Professor Theresa Gannon, Centre of Research & Education in Forensic Psychology, University of Kent.

Dr Helinä Häkkänen-Nyholm, Forensic Psychology Research Group, University of Helsinki.

Dr Grant T Harris, formerly Waypoint Centre for Mental Health Care; and Queen's University, Ontario. Canada. RIP.

Dr Troy McEwan, Centre for Forensic Behavioural Science, Swinburne University of Technology. Australia.

Dr Eila Repo-Tiihonen, Medical Director, Niuvanniemi Hospital, Finland.

Professor Marnie E Rice, Waypoint Centre for Mental Health Care; McMaster University; University of Toronto; Queen's University, Ontario. Canada.

Professor John L Taylor, Northumbria University.

Professor Matti Virkkunen, Psykiatrian osasto, University of Helsinki, Finland.

Dr Michael Williams. University of Canterbury, Christchurch, NZ.

Appendix 2: Template of email sent to experts listed in Appendix 1

Dear.....

I am a forensic psychologist with the England and Wales Prison Service and also completing a Doctorate with the University of Birmingham.

I am currently conducting a systematic review of studies into risk factors for arson recidivism in adult offenders. As you are someone with experience and expertise in the arson/firesetting field I am writing to ask if you have, or are aware of, any unpublished research studies, data, or other work in this area which may be of relevance to my review? I would also be very grateful if you were able to alert me to any relevant research which may currently be underway or 'in press'.

I am keen to be as inclusive as possible with my review, and to include any research that has not been published.

Many thanks for you your time, and I hope to hear from you soon

Appendix 3: Example of search syntax

Database: PsycINFO <1967 to August Week 3 2015>
Search Strategy:
---

1 exp Arson/ (407)
2 arson*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (651)
3 fire sett*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (235)
4 fire-sett*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (235)
5 firesett*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (298)
6 exp Pyromania/ (89)
7 pyromani*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (177)
8 1 or 2 or 3 or 4 or 5 or 6 or 7 (934)
9 exp Risk Assessment/ or exp At Risk Populations/ or exp Risk Management/ or exp Risk Factors/ or exp Risk Taking/ (115037)
10 risk*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (280609)
11 predict*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (328253)
12 protect*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (71621)
13 exp sociocultural factors/ (96565)
14 sociocultural factor*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (37237)
15 socio-cultural factor*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (512)
16 socio-economic factor*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (450)
17 socioeconomic factor*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (1950)
18 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 (692154)
19 exp Recidivism/ (4565)
20 recidiv*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (7321)
21 reoffend*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (843)
22 re-offend*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (420)
23 re offend*.mp. [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures] (420)
24 19 or 20 or 21 or 22 or 23 (7878)
25 8 and 18 and 24 (52)

Appendix 4: Allocated scores for studies on the Quality Assessment Tool

Quality Assessment Tool Screening Questions → **Study ↓**	**1** Clear Focus	**2** Sample recruitment	**3** Sample representative	**4** Design	**5** Comparator selection	**6** Comparator measurement	**7** Outcome measurement	**8** Identification of bias	**9** Accounting for bias	**10** Blinding	**11** Data collection	**12** Completeness of follow-up	**13** Length of follow-up	**14** Statistical methods	**15** Presentation of results	TOTAL SCORE	**Quality Level**
Thomson et al. (2015)	2	1	1	1	2	1	0	2	1	0	1	2	0	2	2	**18**	M
Ducat, McEwan, & Ogloff (2015)	2	2	1	2	2	1	2	1	0	0	1	0	0	1	1	**16**	M
Edwards & Grace (2014)	2	2	2	2	1	2	1	1	1	0	2	2	2	2	2	**24**	High
Dickens et al. (2009)	2	1	1	1	2	1	2	2	1	0	2	2	0	2	2	**21**	High
Soothill, Ackerley, & Francis (2004)	1	2	2	1	0	1	1	2	1	0	0	2	2	0	1	**16**	M
Barnett, Richter, & Renneberg (1999)	2	2	2	2	1	1	1	0	0	0	0	1	2	2	0	**16**	M
Barnett, Richter, Sigmund, & Spitzer (1997)	2	2	2	2	1	1	1	2	0	0	0	2	2	2	1	**20**	High
Repo & Virkkunen (1997a)	2	1	1	2	2	1	1	1	0	0	1	2	0	2	2	**18**	M
Repo & Virkkunen (1997b)	1	1	1	2	2	2	1	2	1	0	1	0	0	2	1	**17**	M
Repo & Virkkunen (1997c)	2	1	1	2	2	1	1	1	0	0	1	2	1	1	1	**17**	M

Repo, Virkkunen, Rawlings, & Linnoila (1997b)	2	1	1	2	2	1	1	1	0	0	1	2	2	2	2	**20**	High
Rice & Harris (1996)	2	1	1	2	2	2	2	1	2	2	2	2	2	2	1	**26**	High
Virkkunen, Eggert, Rawlings, & Linnoila (1996)	1	1	1	2	2	1	0	2	1	1	2	0	1	0	0	**15**	M
Rice & Harris (1991)	2	1	1	1	2	2	2	0	1	0	2	2	0	2	1	**19**	M
Sapsford, Banks, & Smith (1978)	1	1	1	1	0	0	1	1	0	0	0	1	1	0	1	**9**	Low

Appendix 5: Scoring guidance for selected OASys variables

Variable	OASys definition / scoring guidance
Direct contact with victim of index offence	Is there any evidence of direct contact between the offender and the victim(s), for example, any offence of inter-personal violence, or a dishonesty offence which involved meeting the victim(s)? Is there evidence that the offender stalked the victim, either in person or by telephone or other means? Is there clear evidence that the offender targeted a particular victim for some reason, perhaps chose to burgle that particular house because they believed the victim kept a good deal of money around the home?
Repeat victimisation of same person	Repeat victimisation is defined as more than one offence against the same victim on separate occasions. Each separate offence would normally be on a different day; two offences against the same victim on the same day without a significant amount of time passing would not constitute repeat victimisation. A series of sexual or violent assaults over a period of weeks, months or years would most certainly be included, as would the repeat burglary of the same premises.
Stranger victim in index offence	For the purpose of this item the offence is defined as being against a stranger if the offender did not know, or have any knowledge of the offender, before the offence.
Sexual motivation in index offence	If a sexual offence is among the current convictions, sexual motivation should be judged to be present. Any aspect of sexual behaviour during the offences must be counted. In some offences there may not appear to be an obvious sexual motivation initially, but if they contain sexual elements, then sexual motivation needs to be recorded.
Financial motivation in index offence	Does the crime provide a source of income and financial reward for the offender? Most *'*professional offenders*'* will be financially motivated, but nearly all offences involving an element of dishonesty will have some financial motivation to them.
Thrill seeking motivation in index offence:	Some offences are committed to relieve boredom. The need for excitement and to create a *'*buzz*'* is a common motivation amongst young offenders. Typical *'*thrill seeking*'* offences would be taking and driving away motor vehicles, or drug taking. But thrill seeking is not exclusively linked to the young or specific types of offences. Consider especially any offence that appears to involve a great deal of risk or danger for little tangible reward.
Depression, stress or other highly emotional state motivated index offence	Was the offence committed while the offender was suffering from depression, stress or other highly emotional states that clouded their judgement? If so did the offence relieve these feelings?
Childhood experience of abuse or separation from parents/guardians	Score 2 if the offender did not have a stable childhood because of permanent or long-term separations from parents or guardians, or because they suffered from inconsistent care, neglect or abuse. They may describe relationships with their siblings or their parents as punishing, unpleasant, uncaring, hostile or indifferent. Include those who: experienced any sexual contact or abuse, or any sexual offence by a family member who was older than them; experienced any physical or emotional abuse for a period of six months or longer; experienced a single incident of physical or emotional abuse of such severity as to

	permanently affect them; who were raised in a household where the social services or courts intervened because of child neglect or abuse. Score 1 if the offender experienced some problems as a child. These could be similar to those described above but less severe and / or of a temporary nature, for example during short term fostering. Include those who experienced any non-contact sexual offence with a non-family member, or experienced any form of physical or emotional abuse for a period of less than six months. Score 0 if the offender had stable and satisfying relationships during their childhood. They may describe some minor difficulties, but these were resolved; They feel they were cared for and respected as a child; There will be no evidence or record of any form of sexual, physical, or emotional abuse.
Childhood behavioural problems	Tick if there is any evidence that the offender had any behavioural problems as a child. These would include: periods of disruptive and aggressive behaviour at home or in school; a history of starting fires; cruelty to animals; vandalism; early on-set or inappropriate sexual behaviour. Evidence suggesting problems would include contact with child guidance clinics, removal from school, intervention by the police or social services, and removal from the parental home on grounds of being beyond care and control. Evidence might be gathered from official records or from the offender's own account of their early life
Problematic current relationship with partner	This relates to the state of the offender's current relationship with their spouse or partner. Score 2 if: the offender acknowledges that their relationships are destructive or damaging to either partner, or there is evidence to suggest this is so; the relationship is directly linked to offending; the offender is single and pre-occupied, and unhappy with their status. Score 1 if: the relationship has some problems but there is still a level of respect, care and support, and the couple are making efforts to make the relationship work; the offender is single but not totally happy, and wants a partner but is content and able to live with their present situation. Score 0 if: the offender's relationships appear to be positive, mutually supportive and caring; the relationship is strong and likely to act as a protective factor against further offending; the offender is single and content and happy to be so.
Previous problems with close relationships	Score 2 if: there is clear evidence, or if the offender acknowledges that there were serious problems, such as physical, emotional or sexual abuse, with their previous relationships; the offender has a history of selecting inappropriate partners (e.g. abusive or addictive partners); the previous relationships they describe were destructive or damaging to either partner; most relationships seem short term, superficial and unsustainable and fail to provide the support which might lead to a cessation of offending; the offender is single and has had no relationships but would desperately like one (including those who appear unable to initiate or maintain a relationship); there is clear evidence that current or past offending is directly linked to relationship difficulties. Score 1 if: the offender has a mixed history of both positive and negative partnerships; they have had only short-term relationship and would like something more permanent; they have a history of choosing inappropriate partners, but recognise this and are taking steps to break the cycle.

	Score 0 if the offender: has a history of relationships that have been mutually supportive, positive, stable and rewarding (they may only report one long-term relationship or may have had several interspersed with periods of being alone, but it is unlikely they will have had a large number of short-term relationships, and will recognise the difference between the exploratory stages and more committed relationships; has no history of relationships through choice, but appears capable of starting and maintaining a relationship.
Problems with self-image	Score 2 if the offender: has a very poor self-image and is very unhappy and discontented with themselves as individuals; has attempted suicide or has self-harmed; values themselves very highly but their self-image is based on inappropriate factors (e.g., how good they are at fighting, the number of knives they own, their standing in a criminal sub-culture, the amount of money they make from crime), and they are unaware of the inappropriate basis of their self-image; has a sense of grandiosity, a self-image which is not at all grounded in any reality; makes entirely unrealistic claims about themselves or what they have done. Score 1 if the offender has: aspects about themselves that they do not like, or would like to change; their dislike will be less severe than those scoring 2; a high self-image especially in the company of those with similar values, and they recognise that this is not a generally accepted view. Score 0 if the offender is reasonably happy with themselves. Like everyone they will have aspects about themselves that they do not like but overall they are content with who they are as a person. Their self-image is based on normal social values
Binge drinker	Binge drinking can be defined as periods of sporadic excessive consumption of alcohol interspersed with periods of relative abstinence. The offender may not consume alcohol (or very little alcohol) for many days, weeks or even months but will then consume large quantities, becoming quickly intoxicated. A binge may last for a number of hours or for a period of days. Score 2: They will admit to or there will be evidence that they binge drink (have periods of moderate drinking / abstinence interspersed with episodes of excessive alcohol consumption). This will have had a detrimental effect on all areas of their life. They may have experienced drinking to unconsciousness, blackouts and being unable to account for periods of time when drinking. Those who have had several incidents of excessive alcohol use in the last six months which do not amount to a binge pattern, but are 'out of character' may also be scored 2, especially if these incidents were clearly related to their offending. Score 1 if the offender: has a pattern of drinking which could be described as binges (e.g. drinking heavily at weekends), but this will not as yet have resulted in the serious problems described in those scoring 2. Score 0 if there is no evidence that the offender: is a binge drinker or has in the last six months started drinking excessively on occasions. Those offenders who do not drink alcohol at all or only drink alcohol in moderation, and those who have previously had an alcohol misuse problem with excessive alcohol consumption or binge drinking, but have not consumed alcohol for over 1 year will definitely score 0. But those who drink on a regular basis, but do not have a pattern of binge drinking (near abstinence interspersed with episodes of excessive consumption), should score 0 even if their overall alcohol intake is at a level which may lead to problems.

Appendix 6: Evidence of ethical approval

From: Gemma Williams (Research Support Group) [xxxxx@bham.ac.uk]
Sent: 17 February 2014 13:42
To: 'Louise Dixon'
Subject: RE: Ethics Amendments Form ERN_13-1114A

Dear Dr Dixon

Re: "A retrospective investigation of risk factors for recidivism in incarcerated adult male and female arsonists"
Application for amendment ERN_13-1114A

Thank you for the above application for amendment, which was reviewed by the Science, Technology, Engineering and Mathematics Ethical Review Committee.

On behalf of the Committee, I can confirm that this amendment now has full ethical approval.

…

If you require a hard copy of this correspondence, please let me know.

Thank you,

Gemma Williams
Deputy Research Ethics Officer
Research Support Group
Finance Office
Aston Webb, B Block
Edgbaston, Birmingham
B15 2TT
Tel: xxxxx
Email: xxxxx@bham.ac.uk

Appendix 7: Regression model for the whole sample

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
First arson under 18	3.809	.389	95.907	1	**.000**	45.118	21.050	96.705
First sanction under 18	-.546	.236	5.341	1	**.021**	.579	.364	.920
22+ offences on PNC	.571	.230	6.141	1	**.013**	1.770	1.127	2.780
Any criminal damage conviction	.888	.237	14.038	1	**.000**	2.429	1.527	3.865
Other offenders involved	-1.781	.415	18.390	1	**.000**	.168	.075	.380
Thrill seeking motivation in index	.577	.285	4.105	1	**.043**	1.782	1.019	3.115
Domestic violence perpetrator	-.676	.216	9.792	1	**.002**	.509	.333	.777
Binge drinker	-.452	.216	4.355	1	**.037**	.637	.417	.973
Multiple (2+) arsons at index	.192	.265	.527	1	.468	1.212	.721	2.038
Psychiatric problems disinhibitor in index offence	.326	.236	1.911	1	.167	1.386	.873	2.200
Abuse or separation in childhood	.013	.234	.003	1	.957	1.013	.640	1.602
Childhood behavioural problems	.074	.222	.110	1	.740	1.076	.696	1.665
No fixed abode or transient accommodation	.351	.208	2.856	1	.091	1.421	.945	2.136
Previous problems with close relationships	.235	.255	.851	1	.356	1.265	.768	2.085
History of problems with alcohol use	.489	.274	3.188	1	.074	1.630	.953	2.787
Lacks interpersonal skills	.203	.215	.891	1	.345	1.225	.804	1.867
Ever been an inpatient in a special hospital or regional secure unit	.353	.286	1.529	1	.216	1.424	.813	2.492
History of severe head injury, fits, or periods of unconsciousness	.600	.350	2.932	1	.087	1.822	.917	3.621
History of psychiatric treatment	.310	.249	1.557	1	.212	1.364	.838	2.220
Rigid/concrete thinker	.385	.240	2.569	1	.109	1.470	.918	2.353
Constant	-3.560	.380	87.525	1	**.000**	.028		

Appendix 8: Regression model for the male sample

	B	S.E.	Wald	df	Sig.	Odds Ratio (OR)	95% C.I. for OR	
							Lower	Upper
First arson under 18	3.902	.417	87.742	1	**.000**	49.477	21.871	111.928
First sanction under 18	-.460	.256	3.230	1	**.072**	.631	.382	1.043
Any criminal damage conviction	.935	.275	11.557	1	**.001**	2.546	1.485	4.364
22+ offences on PNC	.534	.248	4.649	1	**.031**	1.706	1.050	2.773
Multiple (2+) arsons at index	.461	.266	3.011	1	.083	1.586	.942	2.671
Other offenders involved	-1.948	.445	19.188	1	**.000**	.143	.060	.341
Sexual motivation in index	1.024	.609	2.827	1	.093	2.784	.844	9.185
Depression, stress or other highly emotional state motivated index	.478	.328	2.123	1	.145	1.613	.848	3.070
Thrill seeking motivation in index	.837	.286	8.533	1	**.003**	2.309	1.317	4.047
Abuse or separation in childhood	-.076	.253	.089	1	.765	.927	.564	1.523
Childhood behavioural problems	.295	.230	1.644	1	.200	1.344	.855	2.111
No fixed abode or transient accommodation	.502	.220	5.204	1	**.023**	1.652	1.073	2.543
Previous problems with close relationships	.421	.286	2.159	1	.142	1.523	.869	2.670
Domestic violence perpetrator	-.797	.235	11.506	1	**.001**	.451	.284	.714
History of problems with alcohol use	.462	.309	2.231	1	.135	1.587	.866	2.911
Rigid/concrete thinker	.511	.262	3.792	1	.051	1.667	.997	2.787
Constant	-4.263	.490	75.603	1	**.000**	.014		

Appendix 9: Glossary of specialised terms not defined elsewhere

Term	Definition
Criminogenic	(Of a system, situation, or place) causing or likely to cause criminal behaviour: Source: Oxford Dictionaries online.
Criterion (offence)	A principle or standard by which something may be judged or decided. Origin: Early 17th century: from Greek kritērion 'means of judging', from kritēs (see critic). Source: Oxford Dictionaries online. Used here to refer to the specific offence being studied or focused on for the purpose of a particular piece of research.
Disposal (legal, psychiatric)	In Criminal Procedure, the sentencing or other final settlement of a criminal case. Source: www.thefreedictionary.com Used to refer to the outcome for the offender of a criminal case. Includes prison and community sentences, cautions, reprimands, final warnings, and mental health orders.
Incarcerate	Imprison or confine. Origin: Mid-16th century (earlier (late Middle English) as incarceration): from medieval Latin incarcerat- 'imprisoned', from the verb incarcerare, from in- 'into' + Latin carcer 'prison'. Source: Oxford Dictionaries online. Used to include imprisonment and detention under mental health orders.
Index offence	The most serious offence for which an offender is currently serving a sentence in prison, under community supervision, or under mental health detention.
Jurisdiction	The official power to make legal decisions and judgements. A system of law courts; a judicature. The territory or sphere of activity over which the legal authority of a court or other institution extends. Origin: Middle English: from Old French jurediction, from Latin jurisdictio(n-), from jus, jur- 'law' + dictio 'saying' (from dicere 'say'). Source: Oxford Dictionaries online.
Modus operandi	A particular way or method of doing something. Origin: Latin, literally 'way of operating'. Source: Oxford Dictionaries online.
Parole Board	The Parole Board for England and Wales is an independent body that carries out risk assessments on prisoners to determine whether they can be safely released into the community. The Parole Board is an executive non-departmental public body, sponsored by the Ministry of Justice. Source: www.gov.uk
Penile Plethysmography (PPG)	See phallometry.
Phallometry	The measurement of changes in penile diameter in response to presentations of sexual stimuli. Source: www.thefreedictionary.com

Recidivism	Used to refer specifically to repeat offending which leads to further criminal sanction. Distinct from reoffending.
Reoffending	Used to refer to all repeat offending, regardless of whether detected.
Sanction	A threatened penalty for disobeying a law or rule. A consideration operating to enforce obedience to any rule of conduct. Verb: Impose a sanction or penalty on Origin: Late Middle English (as a noun denoting an ecclesiastical decree): from French, from Latin sanctio(n-), from sancire 'ratify'. Source: Oxford Dictionaries online. Used within forensic psychology as distinct from conviction, sentence or punishment because it includes all formal criminal sanctions (convictions, cautions, reprimands, and final warnings) as well as mental health orders.