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Adults with intellectual disabilities and/or autism who deliberately set fires: A systematic review

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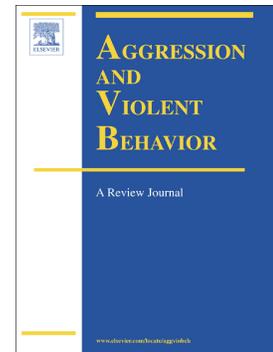
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Adults with intellectual disabilities and/or autism who deliberately set fires: A systematic reviewCollins, J¹, Barnoux, M^a, Langdon, P.E.^b^aTizard Centre, University of Kent, UK^bCentre for Educational Development, Appraisal and Research (CEDAR), The University of Warwick, UK and Coventry and Warwickshire NHS Partnership Trust, UK**Abstract**

Fire setting behaviour has devastating consequences and a significant number of adults who set fires have intellectual disabilities and/or autism. However, there has been no comprehensive review of the characteristics and treatment needs of this group of offenders, with existing reviews being limited in terms of sample population and methodological rigour. The purpose of this review was to systematically examine and synthesise existing research to determine what is known about adults with intellectual disabilities and autism who set fires. PsychINFO, PsychARTICLES, Medline, CINAHL Plus with Full Text, Criminal Justice Abstracts, SCOPUS, Open Grey, and the University of Kent arson library were searched for articles. The methodological quality of studies was assessed using the Mixed Methods Appraisal Tool. Searches resulted in 100 articles that met the specific inclusion criteria. Findings indicated adults with intellectual disabilities and autism share some characteristics with other adults who set fires (e.g. aggression, impulsivity). They also face additional challenges, which may have implications for treatment and risk formulation (e.g. communication difficulties, lack of support). However, current research is generally of poor methodological quality, limiting our ability to understand the unique characteristics and treatment needs of this population.

Key Words

Intellectual disabilities; Learning disabilities; Autism; Developmental disabilities; Firesetting; Arson

AbbreviationsMMAT²**Funding**

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Introduction

The Fire and Rescue Service attended to 83,221 incidents of deliberate fire setting over the financial year 2018 to 2019 in England, which resulted in 50 fire-related fatalities and 1,014 non-fatal casualties requiring hospital treatment (Home Office, 2019). Further, the economic cost of deliberate fire setting is estimated to be as high as £1.45 billion within England and Wales (Arson Prevention Forum, 2017) with sentencing guidelines acknowledging the wide impact of fire setting (i.e., economic, social, financial, psychological; Sentencing Council, 2018). Consequently, approximately

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² Mixed Methods Appraisal Tool (Hong et al., 2018)

1% of the prison population in England and Wales has a conviction for Arson (n= 759 males, n=88 females) and a further 953 adults, with a conviction of Arson, are under the supervision of the National Probation Service (n=766 males, n= 187 females: Ministry of Justice, 2019a). The most recent statistics report that in December 2018, there were 510 adults (n = 368 males, n = 142 females) with a conviction for Arson detained under Part III of the Mental Health Act (2007) in hospitals across England and Wales (Ministry of Justice, 2019b). A proportion of these individuals will have intellectual disabilities and autism, as fire setting amongst this group is frequently reported within the literature (e.g. Lees-Warley & Rose, 2015; Simpson & Hogg, 2001). However, our current understanding of the characteristics and treatment needs of adults with intellectual disabilities and autism who set fires is limited.

Different terminology, with somewhat different meanings, has been used within the literature to describe offending behaviour that involves fire. In England and Wales, the term ‘Arson’ is a legal term used to describe the crime of either intentionally or recklessly starting a fire in order to destroy or damage property (Criminal Damages Act, 1971). However, not all intentional acts of starting a fire result in a conviction of Arson. For example, an offender who has committed Arson where a person has died may result in a Murder conviction, rather than Arson.

The term, ‘pyromania’ refers to an impulse control disorder characterised as repeatedly setting deliberate fires to either relieve tension or affective arousal, or to experience instant gratification (American Psychiatric Association, 2013). Reported prevalence rates of pyromania range between zero (Geller & Bertsch, 1985; O’Sullivan & Kelleher, 1987) and 10% (American Psychiatric Association, 2013; Lindberg et al., 2003; Richie & Huff, 1999). Consequently, the term ‘fire setting’ has been widely adopted within the literature and will be used throughout this review to include all acts of intentionally setting fire to property, land, other people and individuals themselves (Barnoux et al., 2015; Dickens & Sugrman, 2012; Gannon & Pina, 2010), inclusive of pyromania.

Characteristics and treatment need of adults who set fires

Research into the sociodemographic features of adults without intellectual disabilities and/or autism who set fires suggests they are white, poorly educated, unskilled, single males of low economic status (Barrowcliffe & Gannon, 2015; Barnett et al., 1997; Blanco et al., 2010; Gannon & Barrowcliffe, 2011; Gannon & Pina, 2010; Lewis & Yarnell, 1951; Soothill & Pope, 1973; Soothill et al., 2004; Vaughn et al., 2010). This population is more likely to come from large families, single parent households, characterised by unstable or poor parenting styles (i.e., absent parents, abusive experiences, conflictual family environment) compared to population comparison groups (Anwar et al., 2011) and other offender comparison groups (Bradford, 1982; O’Sullivan & Kelleher, 1987). Other background factors include a family history of antisocial behaviour (Vaughn et al., 2010), experiences of violence, neglect, abuse and trauma (Barnoux et al., 2015; Tyler et al., 2014).

Although not well supported by empirical evidence, biological features associated with fire setting among adults without intellectual disabilities and autism, include a central monoamine

(particularly serotonin) deficit and glucose metabolism abnormalities (Roy et al., 1986; Virkkunen, 1984; Virkkunen et al., 1989), frontal lobe dysfunction (Bosshart & Capek, 2011; Calev, 1995; Friedman & Clayton, 1996; Kanehisa et al., 2012), electroencephalographic abnormalities (Meinhard et al., 1988), epilepsy (Carpenter & King, 1989; Mende, 1960), and Klinefelter's or XYY syndrome (Eytan et al., 2002; Stochholm et al., 2012).

Furthermore, a number of psychological and personality traits have been associated with fire setting perpetrated by adults without intellectual disabilities and/or autism, including an external locus of control, social competency problems (Gannon et al., 2013), emotional or self-regulation problems, a lack of assertiveness skills, and limited communication skills (Jackson et al., 1987; Rice & Chaplin, 1979; Rice & Harris, 2008; Rix, 1994; Stewart, 1993). Furthermore, adults who set fires have been found to have dysfunctional attachment styles, difficulties forming and maintaining healthy relationships, and low self-esteem (Barnoux et al., 2015; Bell et al., 2013; Duggan & Shine, 2001; Gannon & Pina, 2010; Noblett & Nelson, 2001; Saunders & Aviad, 1991). Maladaptive coping strategies, aggression, impulsivity, a low threshold for frustration tolerance and loneliness are also reported in the literature as risk factors for fire setting (e.g. Barnoux et al., 2015; Gannon & Pina, 2010; Gannon et al., 2013; Inciardi, 1970; Rice & Chaplin, 1979).

In addition, early positive or negative experiences of fire during childhood may impact on the presence of psychological vulnerabilities and risk factors for fire setting behaviour during adulthood (Barnoux et al., 2015; Tyler et al., 2014). Factors include having normalised the criminal use of fire, an interest in serious fires or everyday fires, either positive or negative affect about fire, or reduced fire safety awareness. (Gannon et al., 2015). Offence supportive norms and schemas may develop and are common, which predispose adults to engage in fire setting behaviour (Barrowcliffe & Gannon, 2016; Barrowcliffe et al., 2019; Gannon et al., 2013; Tyler et al., 2014).

When reviewing offence-specific characteristics for adults without intellectual disabilities and/or autism who set fires a criminally versatile offending history is common with evidence suggesting behavioural problems start in childhood (e.g., Doley et al., 2011; Ducat et al., 2013; Gannon et al., 2013; Hagenauw et al., 2015; Hill et al., 1982; O'Sullivan & Kelleher, 1987; Ritchie & Huff, 1999; Sapsford et al., 1978; Soothill et al., 2004). Research comparing different types of offenders has suggested that those who set fires are often younger compared to other types of offenders, and most comparable to property offenders (Gannon & Pina, 2010).

Motivations for fire setting among adults without intellectual disabilities and/or autism include revenge (Gannon et al., 2012; Koson & Dvoskin, 1982; Lewis & Yarnell, 1951; O'Sullivan & Kelleher, 1987; Rix, 1994), peer influence (Barnoux et al., 2015; Molnar et al., 1984), vandalism, excitement (Gannon & Pina, 2010; Icové & Estépp, 1987; Inciardi, 1970), to conceal another crime (Barnoux et al., 2015; Dennet, 1980), self-protection (Tyler et al., 2014), political motivation (e.g., terrorist attacks, riots; Prins, 1994), financial gain (Dennett, 1980; Prins, 1994; Nanayakkara et al., 2020) and self-injury or suicide (Barnoux et al., 2015; Gannon et al., 2012; Jayaraman & Frazer,

2006; Noblett & Nelson, 2001).

Mental illness is also common amongst adults without intellectual disabilities and/or autism who set fires (Barnoux et al., 2015; Bell et al., 2018; Jayaraman & Frazer, 2006; Räsänen et al., 1995; Tyler & Gannon, 2012; Tyler et al., 2014). Common diagnoses associated with adults who set fires are personality disorder (i.e. anti-social and borderline personality disorders; Blanco et al., 2010; Dickens & Sugarman, 2012; Ducat et al., 2013; Lindberg et al., 2005; MacKay et al., 2006; Martin et al., 2004), schizophrenia (Anwar et al., 2011), substance dependence (Ducat et al., 2013; Enayati et al., 2008), affective disorders (Ducat et al., 2013; Tyler et al., 2014), and anxiety disorders (Barnoux et al., 2015).

The current evidence base also suggests lower general intellectual functioning, with intellectual disabilities and other developmental disorders common among adults who set fires (Devapriam et al., 2007; Hall et al., 2005; Murphy & Clare, 1996; Lees-Warley & Rose, 2015; Simpson & Hogg, 2001). Prevalence studies suggests around 1 to 22% of fire setters may have lower general intellectual functioning or intellectual disabilities depending upon the population sampled (i.e. inpatient, community, prison samples; Alexander et al., 2011; Devapriam et al., 2007; Hall et al., 2005; Murphy & Clare, 1996; Lees-Warley & Rose, 2015; Simpson & Hogg, 2001). However, the aetiology of fire setting by people with intellectual disabilities and/or autism is not well understood and little evidence is available to support professionals when considering assessment and formulation for this population (Taylor & Thorne, 2019). Therefore, further research is required in order to better understand these behaviours within this population.

Recent research is beginning to investigate the differences in the aetiology and pathways to fire setting for different groups of individuals. For example, self-protection was highlighted as a motive for fire setting among adults with a mental disorder (Tyler et al., 2014). Nanayakkara et al. (2020) concluded firesetting among females frequently occurs within the context of personality disorder, self-harm, and mood dysregulation, and was associated with the motive to relieve or express frustration. Conversely, males were more likely than females to set fires for financial profit and as an act of revenge within context of intimate partner violence (Nanayakkara et al., 2020).

Nevertheless, current knowledge on the characteristics and treatment needs of people who set fires comes from research conducted primarily with adults who do not have intellectual disabilities and/or autism, which may not adequately capture some factors that may be more relevant to those with intellectual disabilities and/or autism (e.g. increasing social exclusion). Other areas of research have demonstrated the characteristics and treatment needs of adults with intellectual disabilities and/or autism who offend are different to adults without developmental disabilities who have an offending history (e.g., sexual offending; Gleaser & Deane, 1999), which warrants an in-depth examination of existing knowledge pertaining to fire setting perpetrated by adults with intellectual disabilities and/or autism more specifically. Whilst there is a body of research on this topic, there has to date been no comprehensive systematic review of the literature, with existing reviews being limited

in terms of sample population and methodological rigour (e.g., Allely, 2019; Campbell et al., 2016; Lees Warley & Rose, 2015). This review therefore seeks to answer the following research question, ‘What does the evidence tell us about adults with intellectual and other developmental disabilities who set fires?’

Aims

The aim of this project was to complete a systematic literature review of unpublished/published articles about adults with intellectual disabilities and autism who have set fires. The specific aims were:

- To identify the prevalence of adults with intellectual disabilities and autism who set fires.
- To highlight the characteristics and treatment needs of adults with intellectual disabilities and autism who set fires.
- To highlight offence related characteristics of adults with intellectual disabilities and autism who set fires.
- To evaluate the assessment tools and interventions available to clinicians working with adults with intellectual disabilities and autism who set fires.

Method

Design

A systematic review of the research on adults with intellectual disabilities and autism who set fires was conducted, published/unpublished articles, incorporating quantitative and qualitative data. Database and ancestry searches resulted in 100 articles that met the specific inclusion criteria. Data was extracted and a quality assessment was conducted using the Mixed Methods Appraisal Tool (Hong et al., 2018). There are five criteria for appraising studies and rating vary from 0* (none of the criteria are met) to 5* (all criteria are met).

A data extraction template was used to record relevant information under the following heading: Title, author, year of publication, sample, study design, data collection method, number of firesetters with intellectual disabilities and autism, gender, age, ethnicity, diagnosis, general intellectual functioning, socioeconomic status, treatment and treatment outcomes, sociodemographic characteristics, offending characteristics, developmental features, associated traits, psychopathology, and biological features. The quantitative and qualitative findings are then summarised based on existing reviews of the fire setting literature pertaining to adults and children without intellectual disabilities and autism (Gannon & Pina, 2010; Lambie & Randell, 2011; Lees-Warley & Rose, 2015), under the following headings:

- Study characteristics.
- Prevalence

- Characteristics of adults with intellectual disabilities and autism.
- Offence related characteristics of adults with intellectual disabilities and autism who set fires.
- Assessment and Interventions for adults with intellectual disabilities and autism who set fires.

Search Strategy

A systematic search of the literature was conducted by the first author on 1st March 2019 and 21st February 2020 using electronic databases (PsychINFO, PsychARTICLES, Medline, CINAHL Plus with Full Text, Criminal Justice Abstracts, SCOPUS, Open Grey), the University of Kent arson library, and ancestry searching (see Appendix A). No limits were applied to year of publication. The search terms are provided in Table 1.

Eligibility Criteria

The current review aimed to consolidate and evaluate the current research on fire setting within an adult population of offenders with intellectual disabilities and autism. Articles were reviewed to ensure they met the following inclusion criteria:

- Empirical research (i.e. published and unpublished articles that make reference to primary or secondary data that is based on direct observations, assessment, interview, file notes or experience in the field).
- Written in English.
- Sample includes participants aged 18 and above.
- Participants with intellectual disabilities and/or autism and fire setting behaviour.

Articles were excluded if:

- They were a book, book chapter, magazine, abstract only, letter, or review.
- Researchers were unable to differentiate a sub-sample of adults with intellectual disabilities and/or autism who had set a fire from other cohorts in the method, analyses, or reporting of outcomes.

Identification of studies

The initial search resulted in 2795 papers, and after filters were applied to age, type of publication, and language, 555 publications were excluded. After duplicates were removed, database and ancestry searches 2,083 articles were included in the initial review of titles and abstracts. After the review of titles and abstracts, 1,925 articles were excluded, and 158 articles were identified by the first author for full text review; however, 7 articles could not be located. Following a further review of 151 full text articles against the eligibility criteria, 100 were included in the review. Full text screening was checked by the second author and this resulted in an inter-rater reliability of 97% agreement. Disagreements were resolved upon discussions between the first and second author.

[Insert Figure 1 here]

Figure 1: PRISMA chart of search results.

Data extraction

Table 3 (see Appendix B) provides a summary of the key characteristics of the 100 studies included in the review. One study was a randomised controlled trial. A total of 59 publications were either cohort studies, cross-sectional studies, or case control studies. A further 23 studies were prevalence studies without a comparison group, surveys, or case series studies. A total of 12 studies use qualitative designs and included: grounded theory, case studies, or descriptive methodologies. Five studies used a mixed methods design.

Quality Appraisal

Each study underwent a standard critical appraisal process using the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018). The first author rated the methodological quality of all included articles and 20% were rated by the second author (inter-rater reliability: 90%) whereby disagreement was resolved through discussion. Studies were appraised based on four areas relating to the appropriateness of methodology, data analysis techniques and data collection techniques, the representativeness of the sample, reliability of outcome data, and the researchers' interpretation of research findings. Studies were categorised by design (i.e., quantitative, qualitative or mixed methods) and ranked in order of quality from good to poor quality (see Appendix B).

Results

Study Characteristics

Countries. Fifty-nine of the 100 included studies were conducted in the United Kingdom, 14 in North America, 16 in Europe, 8 in Australia, 2 in Asia, and 1 in South America.

Sample. A total sample of 1,181 adults with intellectual disabilities and/or autism who set fires were recruited to 100 studies. Adults who set fires were sampled from psychiatric services (n=80), the prison service (n=4), psychiatric services and the prison service (n=1), community services (n=4), court (n=2) and database records (e.g. The Royal Ministry of Social Affairs and Health archives, National Criminal Registers, records from the Sentencing Advisory Council of Victoria, court databases; n=12). One additional study reported one adult with borderline intellectual disability and autism who set fires was recruited from 'forensic contexts' (Murrie et al., 2002). Regarding overlapping samples, Taylor et al. (2005) reported on 10 out of 14 participants also recruited to Taylor et al. (2002). Alexander et al. (2015) reported on the same 30 adults with intellectual disabilities and/or autism who set fires as Alexander et al. (2011). Geller et al. (1992) used the same sample of three adults with intellectual disabilities who set fires reported in Geller & Bertsch (1985). Lastly,

Lindsay et al. (2012) used the same sample of 105 adults with intellectual disabilities who set fires reported in Lindsay et al. (2010b). Papers which made use of a previously reported sample were not included when calculating the total number of participants across studies to avoid inflating the sample size.

Data collected. Authors across 96 of the 100 studies reported their data collection strategy. Primary data were collected by the authors in 15 studies (n=82), while 66 studies were regarding secondary data (n=1,066), and 14 used a mixed methods approach, collecting both primary and secondary data (n=70). Holst et al. (2019) collected secondary data for all participants (n=83) and primary data for 8.4% of the sample (n=7). The authors of four studies reported on individual cases from their own practice as clinicians, without reference to a formal data collection strategy (n=4).

Methodology. The dataset consisted of 59 non-randomised comparison studies, 23 quantitative descriptive designs, 12 qualitative designs, five mixed methods designs and one randomised controlled trial. Using the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018), 15% of studies were rated 0*-1*, 56% were rated 2*-3*, and 29% were rated 4-5*.

Prevalence of intellectual disabilities and autism in populations of adults who set fires

Authors of 43 of the 100 studies reported the number of adults with intellectual disabilities and/or autism within an overall sample of adults who set fires, inclusive of those who did not have intellectual disabilities and/or autism (n = 5,811). The prevalence rate of intellectual disabilities and autism among a sample of adults who set fires was 7.9% (n=460). However, the prevalence rates reported showed a great deal of variation from 0.4% in a sample of detained adults with a conviction for Arson (e.g. Richie & Huff, 1999) up to 50% for mild or borderline 'mental retardation' among a sample of forensic inpatients with a history of firesetting (Rice & Chaplin, 1979).

Authors of 56 of the 100 studies included adults with intellectual disabilities and/or autism who set fires within an overall sample of adults with intellectual disabilities and/or autism, some of whom had not set fires (n=5,293). The prevalence rate of fire setting in adults with intellectual disabilities and autism was 10.1% (n=638). However, the prevalence rates reported showed a great deal of variation from 1.4% among a sample of adults recruited from a psychiatric in-patient and community learning disability service (e.g. Devapriam et al., 2007) to up to 66.6% in a sample of three in-patients with mild learning disabilities (Burns et al., 2003). However, and overall, it must be noted that these estimates are inherently biased as authors tended to make use of samples who had an offending history and were known to services, including inpatient secure services.

Authors of eighteen of the 100 studies recruited males and authors of 12 studies recruited females with intellectual disabilities and/or autism. The percentage of women with intellectual disabilities and/or autism who set fires was higher than that reported for men. Data suggested 17.4% of the women who set fires also had intellectual disabilities and/or autism (n=86). In comparison 11.2% of men who set fires had intellectual disabilities and autism (n=182). Although again,

recruitment and sampling strategies bias these findings.

Variations in prevalence are likely due to differing definitions of intellectual disabilities and autism (i.e., pervasive developmental disorder, Asperger's syndrome, intellectual disability, mental retardation), differing inclusion and exclusion criteria for participants (e.g., inclusive or exclusive of individuals with borderline intellectual disability), and poor study methodology (e.g., lack of matched comparison samples, varying sample sizes). Poor methods to recognise intellectual disabilities or autism is common with the majority of studies reporting diagnosis only without reference to any standardised assessment tool (e.g., Almeida et al., 2010). Incomparable samples from different populations (e.g., prison, community, psychiatric inpatient services) have also led to variations in prevalence. To date, no authors have not explored the prevalence of intellectual disabilities, autism and firesetting among a representative population sample.

Characteristics of adults with intellectual disabilities and autism who set fires

Sociodemographic features

Age. Rather than report actual age, authors of 23 of the 100 studies reported an age range of adults with intellectual disabilities and/or autism who set fires ranging from 17 to 77 years (n=260). However, seven of the 23 studies reported the actual age of adults with intellectual disabilities and/or autism who set fires (n=9), which ranged from 23-40 years ($M_{age}=31.3$, $SD=8.39$).

Gender. The number of males and females recruited to the overall sample for most studies was reported, however, only authors of 52 of the 100 studies reported the gender of participants with intellectual disabilities and/or autism who set fires. Thirty-four studies recruited males only, eight recruited females only, and 10 recruited a sample of both males and females. More males with intellectual disabilities and/or autism who set fires were recruited (n=415), compared to females (n=120).

Ethnicity. Authors of four of the 100 studies reported on the ethnicity of adults with intellectual disabilities and/or autism who set fires (n=121). Ethnicities included White-British (n=7), Caucasian (n=111), Black African (n=1) and South Asian (n=2).

The majority of researchers have recruited adults with intellectual disabilities and/or autism together with other types of offenders. Therefore, the sociodemographic features of adults with intellectual disabilities and/or autism are rarely reported, meaning for the majority of studies we do not know their age, gender or ethnicity. Consequently, we are unable to conclude with any certainty whether they are more or less likely to be of a certain age, gender or ethnicity.

Socio-economic status and employment. Authors of seven of the 100 studies commented on the socioeconomic or employment status of adults with intellectual disabilities and/or autism who set fires (n=207). They had a history of unemployment and homelessness (Bradford, 1982; Campbell et al., 2016; Dickens et al., 2008; Hill et al., 1982; Murrie et al., 2002). Devapriam et al. (2007) reported that of 15 adults with intellectual disabilities and/or autism who set fires, 4 adults (26.7%) had a history of homelessness and 11 adults (73.3%) had a history of unemployment. Further, the parents of adults

with intellectual disabilities who set fires were most frequently unskilled workers and less likely to have jobs that require a higher education qualification (Holst et al., 2019). However, adults with intellectual disabilities and/or autism are overrepresented in homeless and unemployed population generally, and this is therefore unlikely to be specific to those who set fires (e.g. Oakes and Davies, 2008). Without a well-matched comparison sample these study findings are limited in their reliability and validity.

Developmental features and cognitive functioning. Authors of 17 of the 100 studies reported on the developmental features of adults with intellectual disabilities and/or autism who set fires (n=255). They had histories of early traumatic experiences, childhood abuse (including physical, emotional, and sexual abuse), and neglect (e.g. Alexander et al., 2015; Dickens et al., 2009; Rose et al., 2015). Further, an unstable family environment, separation from significant others, family dysfunction, and a history of poor parental health (including mental illness and substance misuse) were highlighted as features (e.g. Campbell et al., 2016; Devapriam et al., 2007; Holst et al., 2019; Palermo, 2004). Consequently, feelings of perceived abandonment or rejection were common, as well as difficulties forming and maintaining healthy relationships (e.g. Ashworth et al., 2017; Clare et al., 1992; Dickens et al., 2008; Murrie et al., 2002; Rose et al., 2015). Holst et al. (2019) found 55.4% of their sample (n=83) had problems at school. Such problems may have arisen due to a delay in achieving developmental milestones and difficulties communicating with others from a young age (Barry-Walsh & Mullen, 2004; Borja-Santos et al., 2010; Radey & Shaherbano, 2011; Scragg & Shah, 1994).

To conclude with confidence that adults with intellectual disabilities and/or autism have unique developmental features, studies should have unbiased samples of people with intellectual disabilities and/or autism who have set a fire, which is difficult to achieve. Studies should also include a matched comparison sample comprising of either, a) adults without intellectual disabilities and/or autism who have set a fire, or b) adults with intellectual disabilities and/or autism who have no history of firesetting. Only Alexander et al. (2015) made comparisons between groups, reporting experiences of abuse were significantly more common among a sample of adults with intellectual disabilities who set fires compared to adults with intellectual disabilities who did not have a history of firesetting.

Of the 100 studies included within the review, 16 authors referred to a formal assessment of intelligence for adults including the Wechsler Adult Intelligence Scale- Third Edition (Wechsler, 1997), the Wechsler Adult Intelligence Scale-Revised (Wechsler, 1981), the Wechsler Adult Intelligence Scale- Fourth Edition (Wechsler, 2008), Wechsler Abbreviated Scale of Intelligence (WASI; The Psychological Corporation, 1999), the Raven Coloured Matrices (Raven, 1981), the Swedish Synonyms, Reasoning and Block Design tests, (SRB; Dureman & Säide, 1971), and the Individual Mental Ability Scale (Chevrier, 1989, 1993). Only five of the 100 studies reported IQ scores of individual participants with intellectual disabilities and autism who set fires (n=7), ranging from 42-98 ($M_{IQ}=66.7$, $SD=7.6$).

Of the 100 studies, only five authors referred to an assessment of ASC, including the Autism

Diagnostic Interview-Revised (ADI-R; Lord et al., 1994), the Psychiatric Assessment Schedule for adults with developmental disabilities-Shortened Version (Moss et al., 1993), the Nylander screening questionnaire (Nylander, 1996), a modified version of the Handicaps, Behaviours and Skills Schedule (Wing & Gould, 1978), and Gillberg and Gillberg's (1989) criteria for Asperger's Syndrome. Ten studies referred to the use of the ICD-10 or equivalent (e.g., the Diagnostic and Statistical Manual or the Danish Classification System) to make a diagnosis of either intellectual disability or autism. Across all 100 studies ($n=1,163$), 1,101 adults who set fires were reported to have intellectual disabilities (94.7%), 58 adults who set fires had autism (5%), and 4 adults who set fires were diagnosed with both an intellectual disability and autism (0.3%).

Poor assessment and reporting of general intellectual functioning and autism among participants with a history of firesetting has led to unreliable and ungeneralizable research findings. Consequently, our understanding of the unique developmental and cognitive features of adults with intellectual disabilities and/or autism and a history of firesetting behaviours is inadequate.

Biological features. Authors of two of the 100 studies reported on the biological features of adults with intellectual disabilities and autism who set fires ($n=2$). Borja-Santos et al. (2010) reported on a male fire setter with XYY syndrome who was reported to have discrete reduction of the heads of hippocampal formations. Scragg & Shah (1994) reported on a male fire setter with Asperger syndrome and neurological deficits, which included visuo-spatial deficits, interpreted as problems of the right temporal lobe. Neither of these studies allows for the conclusion that these abnormalities caused fire setting.

Psychological and personality traits. Authors of 11 of the 100 studies reported on the psychological and personality traits of adults with intellectual disabilities and/or autism who set fires ($n=210$). They were found to exhibit behavioural difficulties including self-harm, suicide, aggression, and impulsivity (e.g. Ashworth et al., 2017; Campbell et al., 2016; Curtis et al., 2019; Dickens et al., 2008; Radley & Shaherbano, 2011; Rose et al., 2015). The results also suggested they are likely to demonstrate maladaptive coping techniques (Ashworth et al., 2017; Curtis et al., 2019), due in part to their limited social and problem-solving skills (Campbell et al., 2016; Clare et al., 1992), and their difficulties regulating emotions (Ashworth et al., 2017). Other associated traits exhibited included limited assertiveness skills, low self-esteem (Campbell et al., 2016), social difficulties (Ashworth et al., 2017; Campbell et al., 2016, Scragg & Shah, 1994), poor housekeeping and poor self-care (Curtis et al., 2019).

However, studies exploring the psychological and personality traits have predominantly used a case study design or been largely descriptive (e.g., Ashworth et al., 2017; Borja-Santos et al., 2010; Campbell et al., 2016). With the exception of Kelly et al. (2009), who compared adults with mild intellectual disabilities who set fires to a comparison sample of adults without a history of firesetting behaviour, none of the included studies used a comparison sample to explore the psychological and personality traits of adults with intellectual disabilities and/or autism who set fires. Kelly et al. (2009)

found a significant association between an index offence of pathological arson and a perceived inability to effect social change. Nevertheless, the lack of comparison studies limits our ability to understand whether the psychological and personality traits of adults with intellectual disabilities and/or autism who set fires are comparable to other types of offender, or adults without intellectual disabilities and/or autism who set fires.

Psychopathology. Authors of 30 of the 100 studies commented on the psychopathology of adults with intellectual disabilities and/or autism who set fires, although some studies provided limited detail (e.g. Bradford, 1982; Crossland et al., 2005). Devapriam et al. (2007) reported previous engagement with psychiatric services as high as 100% for adults with intellectual disabilities and/or autism who set fires. However, it is common amongst this population to have some previous contact with psychiatric services (e.g. for the purposes of diagnosis) regardless of whether they have a history of setting fires.

Holst et al., (2019) reported that 49.4% of the total sample of adults with intellectual disabilities who set fires had co-occurring conditions including attention deficit hyperactivity disorder, disruptive behavioural disorders, developmental disorders, and personality disorders (n=83). Further, 43% had a history of drug and/or alcohol misuse and 6% had Klinefelter's Syndrome (Holst et al., 2019). However, specific comorbid diagnoses of adults with intellectual disabilities and/or autism who set fires was reported by authors in only 19 of the 100 studies (n= 233 adults with intellectual disabilities and autism who set fires). Diagnoses included personality disorder (i.e. emotionally unstable, borderline, antisocial, impulsive types; n=65), psychosis (i.e. including schizophrenia, paranoid schizophrenia, schizoaffective disorder; n=29), depression (n=11), bipolar affective disorder (n=2), mental illness, unspecified (n=2), psychopathic disorder (n=1), pyromania (n=1), epilepsy (n=1), attention deficit hyperactivity disorder (n=1), intermittent explosive disorder (n=1), and a harmful use of alcohol or drugs (n=15).

Alexander et al. (2015) compared adults with intellectual disabilities and other developmental disorders who set fires to those who had not set a fire and found no significant differences between prevalence of pervasive developmental disorders in the firesetting and non firesetting group. However, a diagnosis of personality disorder was significantly more common in the firesetting group (Alexander et al., 2015). However, the majority of samples were recruited from psychiatric services and it is therefore unsurprising that rates of comorbid psychiatric diagnosis was high across studies.

Offence related characteristics

Offending History. Authors of 18 of the 100 studies reported on the offending history of adults with intellectual disabilities and/or autism who set fires (n=418). Except for Ashworth et al. (2017) who described one adult with intellectual disabilities charged with two counts of Arson who had 14 convictions for 26 offences that were mainly against the person and property, participants' previous offences or convictions were not reported. Nevertheless, findings suggest most adults with intellectual disabilities and/or autism who set fires were likely to have lengthy and varied offending histories

(Ashworth et al., 2017; Campbell et al., 2016; Devapriam et al., 2017; Holst et al., 2019; Patterson & Thomas, 2014). Previous offences included criminal damage or property offences, violence, cruelty to animals, sexual offending, road traffic offences, fraud, and making hoax calls to the fire brigade (Alexander et al., 2015; Borja-Santos et al., 2010; Clare et al., 1992; Curtis et al., 2015; Curtis et al., 2019; Dickens et al., 2008; Holst et al., 2019; Patterson & Thomas, 2014; Rayner et al., 2015). Alexander et al. (2015) concluded offenders with intellectual disability who set fires were more likely than adults with intellectual disabilities and no history of firesetting to have a past conviction for violence. In contrast, Mourisden et al. (2008) identified three adults who set fires with Asperger syndrome who had no prior history of offending.

Further, findings indicated adults with intellectual disabilities and/or autism who set fires were likely to have set more than one fire (e.g., Bell et al., 2008; Holst et al., 2019; Murphy & Clare, 1996; Murrie et al., 2002). The mean number of fires set varied between 4.1 ($n=88$) and 5.17 ($n=18$; Curtis et al., 2019; Dickens et al., 2008). Holst et al. (2019) found that 48.2% of their sample had set between two and four fires ($n=40$). Three studies reported the mean age at which participants set their first known fire, ranging from 7 to 31 years (Dickens et al., 2009; Holst et al., 2019; Murrie et al., 2002; Taylor et al., 2006). Findings from two studies suggested violent offenders set fires significantly more than sex offenders (Alexander et al., 2015; Lindsay et al., 2012). Prior planning was evident in 42.2% of a sample of adults with intellectual disabilities who set fires in Denmark, with 79.5% having some affiliation to the crime scene ($n=83$, Holst et al., 2019). Further, some adults with intellectual disabilities and autism who set fires had a positive or negative experience of fire during childhood, as evidenced by the presence of fire play, personal experience of fire, symbolic significance of fire or indirect experience of fire (Campbell et al., 2016; Kelly et al., 2009). However, findings predominantly relied on retrospective file review data. Where primary data had been collected, authors relied on the ability of participants with intellectual disabilities and/or autism to recall previous offending behaviour accurately and reliably.

Antecedents for fire setting. Within 10 of the 100 studies, the authors reported the antecedents and risk factors for adults with intellectual disabilities and/or autism who set fires ($n=230$). These included, withdrawal or a lack of support, an increase in discussions about the future (i.e. discharge from hospital), and experiencing a traumatic event (Campbell et al., 2016; Clare et al., 1992; Dickens et al., 2008; Rose et al., 2015). Further risk factors include a relationship breakdown and others doing something that was perceived as negative (Campbell et al., 2016; Palermo, 2004).

Common feelings prior to fire setting behaviour experienced included anger, injustice, sadness, boredom, jealousy, feeling overwhelmed, mistreated, not listened to, unable to cope, loss, fear, frustration, loneliness, desperation and disempowerment (Campbell et al., 2016; Clare et al., 1992; Curtis et al., 2019; Holst et al., 2019; Murphy & Clare, 1996; Rayner et al., 2015; Rose et al., 2015). The feeling of disempowerment and not being listened to led to a perceived inability to effect social change (Campbell et al., 2016; Kelly et al., 2009). Fire setting was used by some as a coping

strategy and rationalised as the only option (Campbell et al., 2016; Rose et al., 2015).

However, with the exception of Holst et al. (2019) who used a mixed methods design, findings are drawn from qualitative studies with limited samples (e.g., Clare et al., 1992; Palermo, 2004) or secondary data sources (Curtis et al., 2015; Dickens et al., 2008) rather than primary data. The lack of standardised assessment tools used within research to collect data limits the reliability and validity of findings.

Offence characteristics. The authors of 13 of the 100 studies reported offence characteristics of adults with intellectual disabilities and/or autism who set fires (n=218). The most frequent motivation for starting a deliberate fire amongst adults with intellectual disabilities and autism was revenge (Devapriam et al., 2007; Koson & Dvoskin, 1982; Leong & Silva, 1999; Murrie et al., 2002). Other motives included attempted suicide, to enforce change (i.e. move to a different accommodation facility), to gain support from others, to gain respect, to gain attention from others, to please others, and to feel listened to and understood (Barry-Walsh & Mullen, 2004; Dickens et al., 2008; Holst et al., 2019; Taylor et al., 2006). Some participants, particularly those with autism, were motivated by circumscribed interest or fascination with fire and fire paraphernalia (Barry-Walsh & Mullen, 2004; Hare et al., 1999; Holst et al., 2019; Murrie et al., 2002; Palermo, 2004; Radley & Shaherbano, 2011). However, these findings rely predominantly on retrospective file review data.

More recent qualitative research conducted, focused on the experiences of adults with intellectual disabilities and/or autism who set fires, and reported motives for fire setting behaviour included emotional expression, reducing emotional and physiological arousal (e.g. distress), enabling positive emotional experiences (e.g. intense sensory stimulation, feeling in control, excitement), experiencing a connection to others, communicating with others and enforcing change (Campbell et al., 2016; Holst et al., 2019; Rose et al., 2015). However, these findings are based on a relatively small number of adults who set fires (n=22). Consequently, the difference in motivation between individuals with intellectual disabilities and/or autism and other offenders are not well understood.

Assessment and interventions for adults with intellectual disabilities and autism who set fires

The authors of four of the 100 studies used fire specific tools to assess adults with intellectual disabilities and/or autism who set fires (n=25), i.e. the Fire Assessment Interview (Murphy, 1990), the Firesetting Assessment Schedule (Muckley, 1997), the Fire Interest Rating Scale (Mouridsen et al., 2008), and the St Andrew's Fire and Arson Risk Instrument (Long et al., 2014). However, none of these tools have been validated for use with adults with intellectual disabilities and/or autism. Within 21 of the 100 studies, generalised assessment tools were used to measure treatment need (e.g. impulsivity, self-esteem, aggression, mental health) or risk (e.g. future risk of violence or firesetting). These are summarised in Table 2 below.

The authors of 11 of the 100 studies reported on either offence focused interventions (i.e. targeting firesetting) or non-specialist interventions (i.e. addressing general treatment needs) of adults with intellectual disabilities and/or autism who set fires (n=45 intellectual disabilities, n=1 ASC).

Three non-specialist individual treatment approaches that were evaluated were medical treatment (Thalayasingam et al., 2004), cognitive behavioural treatment for anger problems (Taylor & Novaco, 2005), and a combination of progressive muscle relaxation, social skills training, coping skills training, assertiveness training, and assisted covert sensitisation (Clare et al., 1992). Although individualised, none of the treatments provided specifically address the risk factors associated with firesetting behaviour. Further, no follow-up of participants was conducted to assess the long-term impact of treatment on firesetting behaviour.

Evaluations of 5 non-specialist group interventions delivered to adults with intellectual disabilities and/or autism who set fires included a structured cognitive behavioural anger management training package developed by Williams and Barlow (1998), an adapted dialectical behaviour therapy program developed by Ingamells and Morrissey (2014), a cognitive behavioural life skills group treatment programme (Patterson & Thomas, 2014), and social skill training (Rice & Chaplin, 1979). A socialisation-based treatment programme based on token economy strategies included training in personal and domestic skills, occupational experience, education, activities to assist participants with integrating into the community following discharge, counselling, psychotherapy and drug treatment (Day, 1988). As with the individualised treatments, these did not focus on the risk factors for firesetting specifically, small samples of adults with intellectual disabilities were included within the evaluations and no long-term follow up was conducted. For those participants followed up for a short time by Day (1988), one adult who set fires showed a poor response to treatment, reportedly reoffending upon discharge into the community.

Recognising the need for specialised interventions for offenders with deliberate fire setting behaviour, Taylor et al. (2002; 2006) implemented a group-based fire setting intervention with male (n=8) and female (n=6) adults with intellectual disabilities who set fires within a forensic mental health low secure unit. The programme was run weekly over a period of 40 weeks and adopted Jackson et al.'s (1987) functional analysis framework to treatment with modules covering fire education, offending behaviour, coping strategies, family relationships, and relapse prevention. However, the research was limited to a small sample of adults with a diagnosed mental disorder who set fires. Findings may not be generalisable to other adults with intellectual disabilities and/or autism, or those living in the community. Psychometric assessments were completed on measures pertaining to fire interest and attitudes using the Fire Interest Rating Scale (Murphy & Clare, 1996), and the Fire Attitude Scale, Muckley (1997). However, these have not been standardised or validated with a sample of adults with intellectual disabilities and/or autism making the treatment gains reported unreliable.

Treatment Outcomes

Psychosocial outcomes. Within eight of the 11 intervention studies, the authors reported on the psychosocial outcomes of interventions delivered to adults with intellectual disabilities and/or autism who set fires (n=37). Positive psychosocial outcomes included: (i) an increase in readiness to change,

emotional understanding, confidence, and motivation following completion of a life skills treatment programme (Patterson & Thomas, 2014); (ii) an increase in the use of mindfulness techniques and adaptive coping strategies following an adapted dialectical behavioural therapy program (Ashworth et al., 2017), (iii) improvement in social skills (Rice & Chaplin, 1979), and (iv) a reduction in anger intensity (Burns et al., 2003). Taylor et al. (2002; 2006) reported significant treatment gains for fire interest, fire attitudes, goal attainment, anger, self-esteem, but not for depression. However, findings are limited in their comparability to other generic treatment interventions as no control treatment groups were included.

Recidivism

The authors of two of the 11 intervention studies reported on recidivism of adults with intellectual disabilities and/or autism who set fires who had engaged in non-specialist interventions (n=3). Day (1988) delivered a socialisation-based treatment programme to a group of 20 men with intellectual disabilities, including 2 men who had a history of setting fires, 1 of whom was discharged and committed several further offences, including Arson. Secondly, Clare et al. (1992) delivered an individualised package of treatment to a male firesetter with intellectual disabilities, which included facial surgery, progressive muscle relaxation (Bernstein & Borkovec, 1973), social skills training (Fox & McMorro, 1983), coping skills training, assertiveness training, and assisted covert sensitisation (Maletsky, 1974). The participant showed no evidence of setting further fires or making hoax calls to the fire brigade 48 months after moving to an environment, which was not secure (Clare et al., 1992). However, sample sizes are small and assessment of recidivism is limited as authors relied on self-report data collection strategies.

Length of Stay

The authors of five of the 100 studies reported on the length of stay in hospital for adults with intellectual disabilities and/or autism who set fires (n=51). Taylor et al (2002) reported on 14 adults with a conviction for Arson (M=1725 days, SD=985.5). Rice and Chaplin (1979) reported that the average length of stay in hospital for a sample of five adults with intellectual disabilities and a history of firesetting was 1247.1 days. Alexander et al. (2015) reported that patients with a history of fire setting who had been discharged had a shorter length of stay (M=950.4 days, SD= 534.8), than patients without a history of fire setting who had been discharged (M=1451.6 days, SD=1051.9). However, there were no significant difference between the length of stay for participants with a history of fire setting (M=950.4 days, SD= 534.8), and those without a history of fire setting who had not been discharged (M=1451.6 days, SD=1051.9). There are many confounding variables (e.g. mental health, treatment completed, previous offending history) not accounted for within the limited data on length of stay available.

Discussion

Within this review, we aimed to firstly identify the prevalence of adults with intellectual disabilities and/or autism who set fires. Findings indicated that exact prevalence data varies widely

according to study designs and recruitment strategies. Secondly, we aimed to highlight the characteristics and treatment needs of adults with intellectual disabilities and/or autism who set fires. Characteristics and treatment need of the population were explored revealing some unique features (e.g. poor parental health, feelings of perceived abandonment or rejection, and difficulties forming and maintaining healthy relationships) and some characteristics similar to adults without intellectual disabilities and/or autism who set fires (e.g. socioeconomic status). We also aimed to highlight offence related characteristics of adults with intellectual disabilities and/or autism who set fires, revealing some unique factors (e.g. emotional and physiological arousal as a motivation for setting a fire) and some characteristics observed in adults without intellectual disabilities and/or autism (revenge as a motivation for setting a fire). Lastly, we aimed to evaluate the assessment tools and interventions available to clinicians working with adults with intellectual disabilities and/or autism who set fire. Findings revealed a lack of standardised assessment and treatment tools and a lack of unbiased, empirical research in this area.

The current review of the literature highlighted that although researchers recruit adults with intellectual disabilities and, to a lesser extent autism, participants are often not effectively differentiated from adults without these differences in the analysis or reporting of findings. Consequently, our understanding of the unique characteristics and treatment need of this population is limited. Current empirical evidence about adults with intellectual disabilities and/or autism who set fires is inadequate, biased towards adults in prisons or psychiatric hospitals, and generated from studies of poor methodological quality (i.e., dated, no comparison groups, small samples, inadequate follow-up, lack of structured risk assessment tools used, reliance on secondary data). This impacted upon the validity and reliability of conclusions that can be drawn from the included studies.

Studies of the prevalence of intellectual disabilities and/or autism and fire setting should entail unbiased samples (either total population samples or random samples). However, current figures are drawn from predominantly small, biased samples (i.e. males, prison or psychiatric inpatients, offenders with a conviction of Arson), which is likely to adversely impact the accuracy of research outcomes (i.e. decrease generalisability, over or under-estimation of prevalence). For example, findings suggested that within samples of men and women who set fires, there appeared to be more women with intellectual disabilities and/or autism may be overrepresented, while the opposite tends to be the case for those without intellectual disabilities and/or autism (Anwar et al., 2011; Blanco et al., 2010; Lewis & Yarnell, 1951; Soothill et al., 2004; Vaughn et al., 2010). A greater number of males compared to females being recruited to studies and the use of purposive rather than random sampling techniques are likely to bias research findings. Similarly, findings suggested adults with intellectual disabilities are more likely to set a fire compared to those with autism. However, identification of adults with intellectual disabilities and/or autism should entail a reliable and valid assessment of cognitive functioning (i.e. the Wechsler Adult Intelligence Scale, 2008), autism screening tools (e.g. Autism Diagnostic Observation Schedule; Lord et al., 1989) and a

developmental interview (e.g. Autism Diagnostic Interview; Rutter et al., 2003). However, few studies used a formal, reliable and valid assessment of intellectual disabilities and autism. In addition, 25% of included research was conducted in the 1990's, when the diagnostic criteria used to define intellectual disabilities and/or autism were not well defined and symptoms went unrecognised (Bristol-Power & Spinella, 1999). Consequently, the data collected across studies were sparse and inconsistent in terms of characteristics, psychological traits, psychopathology, offence related information, assessment and treatment. For example, only Borja-Santos et al. (2010) and Scragg & Shah (1994) reported on the biological features (n=31) of adults with intellectual disabilities and/or autism who set fires. Similarly, authors of only five studies reported on the length of stay in hospital for adults with intellectual disabilities and/or autism, of which two studies used duplicate samples. Therefore, our ability to make reliably, definitive conclusions about this group is extremely limited.

Nevertheless, the characteristics of adults with intellectual disabilities and/or autism who set fires do appear similar to adults without intellectual disabilities and/or autism who set fires across certain domains (e.g. demographic features, developmental features: traumatic experiences and childhood abuse, socio-economic status, psychological traits: aggression and impulsivity, presence of maladaptive coping strategies, and relationship/behavioural difficulties).

More importantly, there is tentative evidence to suggest that adults with intellectual disabilities and/or autism face additional challenges which may have implications for treatment (e.g. poor self-care, difficulties communicating with others, lack of appropriate support, significantly lower self-esteem, difficulties with assertiveness skills). The evidence reviewed suggested that this group are more likely to be known to mental health services (e.g. Barron et al., 2004; Devapriam et al., 2007; Leong & Silva, 1999). In addition, feeling overwhelmed or unable to cope, desperation, disempowerment, feeling mistreated and not listened to appear common. Evidence suggested that fire setting may be motivated by: (i) a desire to express emotions, (ii) a desire to reduce emotional and physiological arousal (e.g. distress), (iii) a desire to connect with others, (iv) a desire to communicate with others, (v) a desire to enforce change, and (vi) a desire to enable positive emotional experiences (i.e. intense sensory stimulation, feeling in control or excitement).

Further, a sub-sample of adults with intellectual disabilities and/or autism who set fires actually have no offending history, particularly amongst those with autism and average or above average IQ (Mouridsen et al., 2008), and instead appear motivated by a circumscribed interest in fire (Barry-Walsh & Mullen, 2004; Hare et al., 1999; Murrie et al., 2002; Palermo, 2004; Radley & Shaherbano, 2011). For example, a participant with Asperger Syndrome was reported to have shown a special interest in the pilot flame of a gas heater for long periods of time prior to his fire setting offence (Barry-Walsh & Mullen, 2004).

Authors who have conducted studies with adults detained in prison reported that those who set fires have general intellectual functioning within the average range (Hurley & Monaghan, 1969). However, findings from this review suggested some adults with intellectual disabilities and/or autism

do of course set fires. Furthermore, the background factors and variables that precipitate or perpetuate fire setting behaviour are likely to be very different for those with intellectual disabilities and/or autism compared to adults without these differences. High rates of comorbidity among this group are likely to contribute towards their unique characteristics and treatment need.

In some areas, adults with intellectual disabilities and/or autism appear similar to adults with a mental disorder who set fires (e.g. background factors, relationship difficulties and psychopathology). For example, adults with intellectual disabilities and/or autism were found to frequently have unstable family environments with evidence of parental separation or separation from significant others, which is arguably similar to the negative caregiver relationships observed among adults with a mental disorder who set fires (Tyler et al., 2014). However, no studies have been conducted to compare firesetting with intellectual disabilities and/or autism to those experiencing a mental disorder.

Current practice regarding the assessment and treatment of adults with intellectual disabilities and/or autism who set fires appears to be grounded on a literature that is fraught with methodological problems. At present, there is no standardised intervention for adults with intellectual disabilities and/or autism who set fires, while there are related or common elements across interventions (e.g., psychoeducation about fire, problem-solving components). Only one RCT has been completed, and the authors did not make use of masked assessors (Taylor et al., 2005), while the findings showed the self-reported anger scores significantly reduced for the treatment group compared to the control group. However, limited evidence for the effectiveness of treatment was provided by staff ratings of patient behaviour post-treatment. The only specialised interventions for adults with intellectual disabilities and/or autism convicted of arson was evaluated by Taylor et al. (2006) who implemented a group-based fire setting programme. Significant treatment gains were reported on measures of fire interest and attitudes, but not depression, bearing in mind that these studies did not have a comparison sample, or control group, nor was randomisation, masking, independent data management or allocation concealment used. There are associated issues with the reliability and validity of outcome measures within intervention studies for fire setting, as these constructs have not been robustly investigated. Overall, many of the intervention studies have been completed using small samples of participants. Further research is needed to ensure the unique characteristics and risk factors associated with fire setting among adults with intellectual disabilities and/or autism are included within both the assessment and treatment of this group of offenders.

Implications for policy and clinical practice

There is tentative evidence to suggest adults with intellectual disabilities and/or autism face additional challenges compared to adults without intellectual disabilities and/or autism who set fires, which have implications for assessment, formulation and treatment. There are no robust and evidence-based treatment programmes designed specifically for adults with intellectual disabilities and/or autism who set fires, and considering the additional challenges faced by this population, caution should be exercised when adapting programmes for use with this population. Existing interventions

that target fire setting behaviour include the Firesetting Intervention Programme for Prisoners (FIPP; Gannon et al., 2012), Firesetting Intervention Programme for Mentally Disordered Offenders (FIP-MO; Gannon & Lockerbie, 2014), a cognitive-behavioural group based intervention (Taylor et al., 2002) and an adapted version of the Fire Awareness Child Education UP (Broadhurst, 1991). However, current programmes are based on theory (e.g. Functional Analysis Theory: Jackson et al., 1987; Dynamic-Behaviour Theory: Fineman, 1980, 1995; Multi-Trajectory Theory of Adult Firesetting: Gannon et al., 2012) and research that has not been validated with samples of adults with intellectual disabilities and/or autism who set fires.

Future research

As with other problematic behaviours (e.g., violence or sexual offending), offence process theories pertaining to adults with intellectual disabilities and/or autism who set fires, along with specialised assessment tools and treatment require further development. However, there is a paucity of studies that have specifically focused upon our understanding of fire setting behaviour amongst adults with intellectual disabilities. There are even fewer studies about those with autism to set fires. Future research is needed to better understand the clinical and forensic risk factors associated with fire setting amongst adults with intellectual disabilities and/or autism, inclusive of longitudinal studies, matched comparison groups and a larger, more diverse sample of participants. Further qualitative research focusing on understanding the experience of adults with intellectual disabilities and/or autism who set fires leading up to and surrounding an act of fire setting behaviour may lead to a better understanding of why some adults with intellectual disabilities and/or autism engage in fire setting behaviour. A particular focus is needed upon the offence process for this population in order to understand the impact of other factors identified in more recent research on adults without intellectual disabilities and/or autism who set fires (e.g. fire knowledge, fire safety, offence supportive cognitions). Future research in the area should lead to the development of robust theory to explain the offence pathway of adults with intellectual disabilities and/or autism who set fires, along with the creation of validated and reliable assessment tools and interventions that have been empirically tested, both of which would directly inform treatment.

Strengths and limitations of review

There are several limitations pertaining to the current review which merit consideration. All studies identified were included within this review despite their quality; this decision was made due to a lack of completed controlled studies. Although efforts were made to source all relevant articles, seven publications thought to be relevant were not reviewed. Despite searching the grey literature, most papers included were from published journals and although this increases the methodological quality of studies included, it may lead to publication bias with only positive results being reported within the literature. Further, filters applied during initial searches are likely to further bias research findings (i.e., age, type of publication and language). Nevertheless, this review provides a comprehensive overview of evidence pertaining to adults with intellectual and other developmental

disabilities who have set a fire.

To date, the current review is the largest conducted to understand the unique characteristics of adults with intellectual disabilities and/or autism, containing all known empirical research, whereby authors have included an adult with intellectual disabilities and/or autism within their sample. Focusing research findings on individuals with intellectual disabilities and/or autism allows for similarities and differences between these service-users to be highlighted (e.g. difference in offending history, motivations for setting a fire). Further, exploring both qualitative and quantitative data led to a more comprehensive and deeper understanding of adults with intellectual disabilities and/or autism who set fires. Lastly, the use of a standard critical appraisal tool to evaluate each study included in the review increases the objectivity of the review process, allowing researchers to identify potential bias within the data leading to more accurate research findings.

Conclusion

To date, limited empirical research has focused upon understanding fire setting behaviour amongst adults with intellectual disabilities and autism. The research that has been conducted has predominantly concentrated on offending behaviour more generally and is of poor methodological quality with a high chance of methodological bias affecting study outcomes. Particular concerns include the small sample sizes of adults with intellectual disabilities and/or autism who set fires being investigated amongst other types of offenders, the lack of well-defined and validated measurements, the over-reliance on file review data collection methods, and the lack of comparison groups. In addition, the lack of standardised treatment programmes warrants increased attention, particularly given the devastating impact of such offending behaviour on the wider community. Nevertheless, evidence suggests fire setting is an issue for a minority of adults with intellectual disabilities and/or autism and they appear to share some characteristics with those without developmental disabilities who set fires. There is also tentative evidence that they face additional challenges which has implications for assessment, formulation and treatment, inclusive of risk assessment.

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Table 1: Search Terms

Autism terms	Intellectual disability terms	Firesetting terms
autis*	learning dis*	arson
ASC	mental retardation	fireset*
Autism Spectrum Dis*	intellectual dis*	fire?set*
ASD	ID	deliberate fire*
Autism Spectrum Condition*	LD	fire rais*
asperg*	intellectually dis*	fire start*
developmental dis*	intellectual and developmental disorder	criminal damage
attention deficit*	IDD	
ADHD		
hyperkinetic		
PDD		

Pervasive developmental disorder		
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Table 2: Assessment tools used to measure treatment needs and risk for adults with intellectual disabilities and autism who set fires.

Assessment tools used to measure treatment need of adults with IDD who set fires	
Self-esteem/self-efficacy	<ul style="list-style-type: none"> • Culture-Free Self Esteem Inventory - 2nd edn, Form AD (CFSEI-2; Battle, 1992) • Evaluative Beliefs Scale-Adapted (Chadwick et al. 1999) • Generalised Self-Efficacy Scale (GSES; Jerusalem & Schwarzer, 1992) • Rosenberg Self-Esteem Scale-Adapted (Dagnan & Sandhu, 1999; Rosenberg 1965) • The Self Attitude Questionnaire (Belmont, Sorensen & Forshay, 1971)
Emotional factors	<ul style="list-style-type: none"> • Emotional Control Questionnaire (ECQ; Roger & Najarian, 1989) • Emotional Problems Scale-Behaviour Report Scale (EPS-BRS; Prout and Strohmer, 1991) • Internal/External Scale (Levenson, 1973) • Locus of Control (Nowicki 1976) • Barratt Impulsiveness Scale; BIS-11; Patton, Stanford & Barratt, 1995) • IM Questionnaire (Eysenck & Eysenck, 1978) • Aberrant Behaviour Checklist (Aman & Singh, 1986) • Modified Overt Aggression Scale (MOAS; Kay et al., 1988) • Novaco Anger Scale (NAS; Novaco 1991, 2003) • Spielberger State-Trait Anger Expression Inventory 2 (Staxi-2; Spielberger 1996) • Ward Anger Rating Scale (WARS; Novaco, 1994)
Social factors	<ul style="list-style-type: none"> • Interpersonal Reactivity Index (IRI) (Davis, 1980) • Social Problem-Solving Inventory-Revised (SPSI-R; D’Zurilla et al., 1999) • The Awareness of Social Inference Test (TASIT), Part One (McDonald et al., 2002) • The Rathus Assertive Schedule (Rathus, 1973)
Psychopathology	<ul style="list-style-type: none"> • Brief Rating Scale, Expanded [BPRS-E; Lukoff, Nuechterlein, & Ventura, 1986) • The Psychiatric Assessment Schedule for Adults with Developmental Disabilities, shortened version (Mini PAS-ADD; Moss et al., 1993) • The Psychopathology Instrument for Mentally Retarded Adults (PIMRA; Senatore, Matson, & Kazdin, 1985) • Psychopathology Checklist Revised (PCL-R; Hare, 1991, 2003) • Zung self-rating depression scale (ZDS; Zung, 1965)
Other	<ul style="list-style-type: none"> • Camberwell Assessment of Need, Forensic Version (CANFOR; Thomas et al., 2003)

	<ul style="list-style-type: none"> • Camberwell Assessment of Need Developmental & Intellectual Disabilities-Short (CANDID-S; Xenitidis et al., 2000) • Cognitive and Affective Mindfulness Scale–Revised (CAMS-R; Feldman et al., 2007) • Security Dependency and Treatment Needs Scale (SDTP; Shaw et al, 2001) • University of Rhode Island Change Assessment (URICA; McConnaughy et al., 1983)
Assessment tools used to measure risk of adults with IDD who set fires	
Firesetting	<ul style="list-style-type: none"> • St Andrew’s Fire and Arson Risk Instrument (SAFARI; Long et al., 2014)
Violence	<ul style="list-style-type: none"> • Historical Clinical Risk Management-20 (HCR-20; Webster, Douglas, Eaves, & Hart, 1997) • HCR-20 FAM (de Vogel, de Vries Robbe, Van Kalmthout & Place, 2012) • Short Dynamic Risk Scale (SDRS) • Structured Assessment of Violence Risk in Youth (SAVRY; Borum, Bartel, & Forth, 2002) • The VRAG (Quinsey et al., 1993; Quinsey, Harris, Rice, and Cormier 2006) • Static-99 (Hanson & Thornton 1999)
Recidivism	<ul style="list-style-type: none"> • Level of Service Inventory -Revised (LSI-R; Andrews & Bonta, 2000)

Appendix A.

Table 3: Example search string.

Intellectual disability and fire
TX (“learning dis*” OR “mental retardation” OR “intellectual dis*” OR ID OR LD OR “intellectually dis*” OR “intellectual and developmental disorder*” OR IDD) AND (arson OR fireset* OR “fire?set*” OR “deliberate fire*” OR “fire rais*” OR “fire start*” OR “fire-set*” OR “criminal damage”)
Autism and fire
TX (autis* OR ASD OR “Autism Spectrum Dis*” ASC OR “Autism Spectrum Condition*” asperg* OR “developmental dis*” OR “attention deficit*” OR ADHD OR hyperkinetic OR PDD OR “pervasive developmental disorder”) AND (arson OR fireset* OR “fire?set*” OR “deliberate fire*” OR “fire rais*” OR “fire start*” OR “fire-set*” OR “criminal damage”)

Appendix B.

Table 4: Table of included studies.

R a n k	Author, Year, Country, Title	Tot al sam ple/ sam ple stra tegy	No. of adults with intellectual disabilities and/or autism and a history of fire setting	Diagnosis	IQ score	Study Design	M M A T rat ing
Quantitative Studies							

1	Taylor et al. (2005), England, Individual cognitive-behavioural treatment for people with mild-borderline Intellectual Disabilities.	16 Detained service users with a history of serious aggression at the inpatient forensic service of a specialist UK National Health Service Disability Trust.	10 males (also recruited to Taylor et al, 2002)	Mild/ borderline intellectual disability	M=67.1, SD=4.5 (n=16)	Quantitative randomized controlled trials	4
2	Long, Dickens & Dolley (2014), England, Features and motivators of emotionally expressive firesetters: the assessment of women in secure psychiatric settings.	25 Females with a history of repeated firesetting who were assessed on admission to St Andrew's Healthcare and medium secure services	0 females	Mild learning disability	60-69	Quantitative Non-randomized	5
3	Lund (1990), Denmark, Mentally retarded criminal offenders in Denmark.	274 People with	58	Mental retardation	NR	Quantitative non-randomized	5

		mental retardation receiving care orders in Denmark				zed	
4	Mouridsen et al. (2008), Denmark, Pervasive developmental disorders and criminal behaviour: a case control study.	313 Former child psychiatric inpatients with pervasive developmental disorders consecutively seen at the University Clinics of Child Psychiatry of Copenhagen and Aarhus during between 1960 - 1984	7	Atypical autism (n=2), Asperger's syndrome (n=5)	NR	Quantitative non-randomized Case control study	5
5	Thomas et al. (2004), England, Defining the needs of patients with intellectual disabilities in the high security psychiatric hospitals in England.	102 Service-users at high security psychiatric services detained under one	15	Intellectual disabilities	M=65 .75 (47-80, n=48)	Quantitative non-randomized Cross-sectional survey	5

		or more legal classifications that included mental impairment or severe mental impairment on specific census dates in October or December 1999					
6	Alexander et al. (2011), England, Evaluation of treatment outcomes from a medium secure unit for people with intellectual disability.	138 Service-users admitted over the period of the study. Medium secure unit for people with intellectual disabilities	22 males & 8 females	Mild intellectual disability & pervasive developmental disorder	NR	Quantitative non-randomized Retrospective case file review	4
7	Ducat, Ogloff & McEwan (2013), Australia, Mental illness and psychiatric treatment amongst firesetters, other offenders and the general community.	1328 People with a conviction for Arson in Victoria, Australia between 2000 -	20	Intellectual disability	NR	Quantitative non-randomized Data-linkage	4

		2009					
8	Geller & Bertsch (1985), USA, Fire-setting behaviour in the histories of a state hospital population.	191 Service users below the age of 65 with fire setting behaviour on the census of Northampton State Hospital	3	Mental retardation	NR	Quantitative Non-randomized Retrospective file review study	4
9	Geller, Fisher & Bertsch (1992), USA, Who repeats? A follow up study of state hospital patients' firesetting behaviour.	Same sample of 50 adults who set fires included in Geller & Bertsch (1985)				As above	4
10	Harris & Rice (1984), Canada, Mentally disordered firesetters: Psychodynamic versus empirical approaches.	13 Service-users sent to the maximum security division of the Mental Health Centre at Penetanguishene, Ontario for treatment after the commission of at least one documented incident	2 males	Mental retardation	NR	Quantitative Non-randomized	4

		ent of fires setting					
1 1	Johnson (2012), England, The prevalence of low self-esteem in an intellectually disabled forensic population.	44 Service-users from a low and medium secure forensic hospital for people with intellectual disabilities in the north-west of England.	9 males	Mild/borderline intellectual disability	60-77	Quantitative non-randomized	4
1 2	Long, Fitzgerald & Hollin (2015), England, Women Firesetters Admitted to Secure Psychiatric Services: Characteristics and Treatment Needs.	49 service-users with a conviction for Arson obtained from case records of 90 consecutive admissions to a secure service for women between 2002 -	14 females	Learning disability	NR	Quantitative Non-randomized Survey	4

		2010					
1 3	Wachi et al. (2007), Japan, Female serial arsonists in Japan.	83 People with at least five incidents of Arson prior to arrest on the national police register in Japan between 1982 and 2005	15 females	Mental retardation	NR	Quantitative Non-randomized Retrospective file review	4
1 4	Alexander et al. (2006), England, Long-term outcome from a medium secure service for people with intellectual disability.	27 Service-users discharged from medium secure unit for people with intellectual disabilities & those who had received at least one year's treatment	5	Mild/moderate ID	NR	Quantitative non-randomized Cohort study	3
1 5	Barron, Hassiotis & Banes (2004), England, Offenders with Intellectual Disabilities: A prospective comparative study.	61 Participants were identified	13	Intellectual disability	NR	Quantitative non-randomized Prospective	3

		ified from contact with either specialist health and social services for people with intellectual disability or non-specialist services in the criminal justice or (forensic) mental health/social service systems				comparative study	
16	Bradford (1982), Canada, Arson: a clinical study.	34 Individuals charged with Arson and referred to the department of forensic psychiatry at the Royal Ottawa wa	5	Mental retardation	NR	Quantitative Non-randomized Retrospective file review	3

		Hospital for pre-trial examination					
17	Burns et al. (2003), England, Anger management training: the effects of a structured programme on the self-reported anger experience of forensic inpatients with learning disability.	3 Deemed suitable for anger management training by their responsible medical officer at the weekly clinical team meeting at the Learning Disability Unit by service of a Regional Medium Secure Forensic Psychiatric Hospital.	2 males	Mild learning disability	NR	Quantitative non-randomized Adapted ABA design	3
18	Cockram (2005), Australia, Justice or differential treatment? Sentencing of offenders with an intellectual disability.	843 Persons with an intellectual disability on the Disability	41	Intellectual disability	79 and below	Quantitative non-randomized Longitudinal study	3

		y Serv ices Com miss ion regis ter as at 31 Dece mber 1994 and the West ern Aust ralia n Polic e Serv ices appre hen sion recor ds.					
1 9	Ducat et al. (2017), Australia, A comparison of psychopathology and reoffending in female and male convicted firesetters.	105 2 Peop le conv icted of Arso n and fire - re lat ed off en ces betw een 2000 and 2009 in Vict oria, Aust ralia	12 males & 5 females	Intellectual disability	NR	Quantita tive non- randomi zed Longitud inal study & data- linkage	3
2 0	Enayati et al. (2008), Sweden, Psychiatric morbidity in arsonists referred for forensic psychiatric assessment in Sweden.	214 Peop le with a conv ictio n for Arso n refer red for a fore nsic psyc hiatr ic exa mina tion	29 males & 7 females	2 Autism spectrum disorder, 13 Asperger's, 21 Learning disability/mental retardation	NR	Quantita tive Non- randomi zed Database analysis	3

		in Sweden over a five-year period from 1997 - 2001					
2 1	Hickman et al (2017), UK, Sixteen years of the Brooklands Thinking Skills Offender Programme.	38 Service-users with intellectual disabilities detained in conditions of medium and low security who attended the Brooklands Thinking Skills group	1 male	Intellectual disability	53-69	Quantitative non-randomized	3
2 2	Hill et al (1982), Canada, Is arson an aggressive act or a property offence? A controlled study of psychiatric referrals.	38 Service-users being assessed at the Forensic Inpatient Service of the Clarke Institute of Psychiatry	7 males	Mental retardation	NR	Quantitative Non-randomized	3

<p>2 3</p>	<p>Hogue et al (2006), England & Wales, A comparison of offenders with intellectual disability across three levels of security.</p>	<p>212 Convicted adults with intellectual disabilities in a high security, medium/low security, and a community service</p>	<p>35 males</p>	<p>Intellectual disability</p>	<p>M=66, SD=8.61, (n=212)</p>	<p>Quantitative non-randomized Clinical record-based comparison study</p>	<p>3</p>
<p>2 4</p>	<p>Kelly (2014), England, The development and preliminary evaluation of a thinking skills programme for adults with learning disabilities at risk of offending.</p>	<p>20 Service users with either a recorded offence or previous contact with the criminal justice system, from the learning disability service referred to the Good Thinking group program</p>	<p>3</p>	<p>Mild/borderline learning disability</p>	<p>NR</p>	<p>Quantitative non-randomized Repeated measures</p>	<p>3</p>

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2 5	Labtree et al. (2010), Netherlands, Background and characteristics of arsonists.	25 Sentenced to treatment at a maximum-security hospital following repeated Arson	2 males	Mental retardation	NR	Quantitative Non-randomized Between-subjects design	3
2 6	Lindsay et al. (2006), UK, A community forensic intellectual disability service: Twelve year follow up of referrals, analysis of referral patterns and assessment of harm reduction.	247 Service-users with an offence history referred to a community forensic intellectual disability service	4 males	Intellectual disability	M=65 (n=226)	Quantitative non-randomized	3
2 7	Lindsay et al. (2010), UK, The relationship between assessed risk and service security level for offenders with intellectual disability.	197 Service-users with intellectual disabilities and an offence history accepted into forensic services.	12	Intellectual disability	Less than 75 (n=197)	Quantitative non-randomized	3
2 8	Lindsay et al. (2010), England, Pathways into services for offenders with intellectual disabilities: Childhood	477 Adults	105	Intellectual disabilities	NR	Quantitative non-randomized	3

	experiences, diagnostic information, and offense variables.	referred in the year 2001/2002 due to antisocial / offending behavior				zed	
29	Lindsay et al. (2012), England, A comparison of sex offenders and other types of offenders referred to intellectual disability forensic services.	Same sample as Lindsay et al. (2010)				Quantitative non-randomized	3
30	Murphy & Clare (1996), UK, Analysis of motivation in people with mild learning disabilities who set fires.	10 People who had all set fires and admitted to a hospital facility for people with challenging behaviors	7 males & 3 females	Learning disability	M=68.4, SD=5.7 (60-78)	Quantitative non-randomized	3
31	Nøttestad & Linaker (2005) Norway, People with ID sentenced to preventive supervision-mandatory care outside jails and institutions.	27 People with intellectual disabilities assigned to preventive supervision during 2002	6	Intellectual disability	Below 55	Quantitative non-randomized Survey	3

3 2	Taylor et al (1998), UK, Mental disorder and violence: A special high security hospital study.	264 Serv ice-users in the special hospitals from January-June 1993	33	Learning disability	NR	Quantitative non-randomized Record survey	3
3 3	Taylor, Novaco & Brown (2016), UK, Reductions in aggression and violence following cognitive behavioural anger treatment for detained patients with intellectual disabilities.	5 Serv ice-users who had completed an individually delivered anger treatment and had been in a long-term or long-term rehabilitation for forensic service of a National Health Service Foundation Trust hospital in England for a minimum of 12 months pre	16	Mild/Borderline learning disability	M=68.6, SD=6.7 (n=50)	Quantitative non-randomized	3

		and post treatment					
34	Tyler et al. (2015), UK, Characteristics that predict firesetting in male and female mentally disordered offenders.	43 Adults with a criminal offence and mental disorder identified as suitable to participate by clinical teams from six secure psychiatric hospitals (low, medium, and high security, and rehabilitation) in the UK	1 female	Learning disability	NR	Quantitative Non-randomized	3
35	Wilpert, Van Horn & Eisenberg (2017), Netherlands, Arsonists and violent offenders compared: two peas in a pod?	55 Males with a conviction for Arson or violence on the client registration system	9 males	Mental retardation	NR	Quantitative Non-randomized Retrospective cross-sectional study	3

		and accepted for treatment at De Waag forensic outpatient treatment centre between 1992 - 2003					
36	Woodbury-Smith et al. (2006), UK, High functioning autistic spectrum disorders, offending and other law-breaking: Findings from a community sample.	25 People with autism living in one Health District through primary care services, mental health services, specialist learning disability services, and local media	1	High functioning autism spectrum disorder	70 or above, M=104.7 (n=25)	Quantitative non-randomized	3
37	Alexander et al. (2002), England, Referrals to a forensic service in the psychiatry of learning disability.	79 Referrals to a medium secure unit for people	16	Learning disability & pervasive developmental disorder	NR	Quantitative non-randomized Retrospective case file-based survey	2

		with learning disabilities					
38	Almeida et al. (2010), Portugal, Characteristics of offenders deemed not guilty by reason of insanity in Portugal.	274 Service-users deemed not guilty by reason of insanity and detained in the specialised Psychiatric Forensic units in Portugal	10	Mental retardation	NR	Quantitative non-randomized Retrospective and descriptive cross-sectional study	2
39	Bell, Doley & Dawson (2018), Australia, Developmental characteristics of firesetters: Are recidivist offenders distinctive?	354 All adults convicted of either 'Arson', 'Criminal Damage by Fire', 'Setting an Unlawful Fire' or 'Setting Fire to Bushland or Wilderness' or 'Lighting	25	Learning disability	NR	Quantitative Non-randomized Retrospective file review	2

		to Northgate Hospital between 1974 and 1982					
42	Dickens et al. (2008), England, Characteristics of low IQ firesetters at psychiatric assessment.	202 Service-users convicted of Arson and referred for psychiatric assessment to the West Midlands regional forensic psychiatric service over a 24-year period	68 males & 20 females	Low IQ	85 or less	Quantitative non-randomized Retrospective study	2
43	Dickens et al. (2009), England Recidivism and dangerousness in arsonists.	167 A random sample of adults convicted of Arson and referred for psychiatric assessment to the West Midlands	19	Learning disability	NR	Quantitative non-randomized Retrospective study	2

		ands regio nal fore nsic psyc hiatr y servi ce over a 24- year perio d					
4 4	Ducat, McEwan & Ogloff (2013), Australia, Comparing the characteristics of firesetting and non firesetting offenders: are firesetters a special case?	207 Peop le conv icted of fires ettin g betw een 2004 - 2009 by high er court s in the State of Vict oria, Aust ralia	12	Learning disability	NR	Quantita tive non- randomi zed Database analysis	2
4 5	Esan et al (2015), England, The clinical, forensic and treatment outcome factors of patients with autism spectrum disorder treated in a forensic intellectual disability service	96 Sev erely users treat ed with in a speci alise d fore nsic inpat ient intell ectu al disa bilit y servi ce over a 6- year perio d	2	ASD	NR	Quantita tive non- randomi zed Retrospe ctive file review study	2
4 6	Kelly et al. (2009), England, A retrospective study of historical risk factors for pathological arson in adults with mild learning disabilities.	20 Serv ice- users with capa	10 males	Mild learning disability	NR	Quantita tive non- randomi zed Retrospe	2

		city to consent and detained under the Mental Health Act (1983, 2007) in secure services				ctive study	
47	Koson & Dvoskin (1982), USA, Arson-A diagnostic study.	36 Consecutive pre-trial adults charged for Arson & referred by the court to the State Maximum Security Hospital	7 males	Mental retardation	M=66.8 (n=4)	Quantitative descriptive Incidence/prevalence study without comparison group	2
48	Lindberg et al. (2005), Finland, Looking for pyromania: characteristics of a consecutive sample of Finnish male criminals with histories of recidivist firesetting between 1973-1993.	90 Recidivists convicted of Arson and referred for pre-trial psychiatric assessment in Helsinki	16 males	Mental retardation	Below 70	Quantitative Non-randomized	2

		University Hospital Department of Forensic Psychiatry between 1973 - 1993					
49	Lindsay et al. (2004), UK, Women with intellectual disability who have offended: characteristics and outcome.	18 Individuals referred between 1990 - 2001 for offences or offence-related behaviours for multi-agency service for offenders with intellectual disabilities	1 female	Intellectual disability	M=67.1 (n=18)	Quantitative non-randomized	2
50	Mannysalo (2009), Finland, Forensic psychiatric perspective on criminality associated with Intellectual Disabilities: A nationwide register-based study	44 Forensic psychiatric examination reports of individuals with intellectual disability	12	Mild intellectual disability, moderate intellectual disability, severe intellectual disability	21-51 (n=44)	Quantitative non-randomized	2

		disability who underwent a pre-trial forensic psychiatric evaluation in Finland during an 11-year period (1996–2006).					
51	O'Sullivan & Kelleher (1987), Ireland, A study of firesetters in the South-West Ireland	54 People identified from a list of service users who were previously known to have set fire collected by contact with senior medical and nursing staff at the two major long-stay psychiatric	4 males	Mental handicap	NR	Quantitative Non-randomized Survey	2

		ic hospitals and four acute adult psychiatric units within the Southern Health Board of Ireland.					
52	Rasanen, Hakko & Vaisanen (1995), Finland, The mental state of arsonists as determined by forensic psychiatric examinations.	98 People charged with Arson who had been given a forensic psychiatric examination at the University Hospital of Oulu, Finland between 1975 - 1993	10	Mental retardation	NR	Quantitative Non-randomized	2
53	Rice & Chaplin (1979), Canada, Social skills training for hospitalised male arsonists.	10 Adults with a history of firesetting detained at a maximum	5 males	Mild/borderline mental retardation	NR	Quantitative Non-randomized	2

		- security psychiatric facility					
5 4	Stewart (1993), UK, Profile of female firesetters: Implications for treatment	28 All females with a conviction of Arson admitted to Holloway Prison over 4 months	12 females	Low IQ	M=83.9 SD=18.0 (n=28)	Quantitative Non-randomized	2
5 5	Taylor et al (2002), England, Evaluation of a group intervention for convicted arsonists with mild and borderline Intellectual Disabilities.	14 Service-users detained in a local security centre who were offered and completed a broadly cognitive behavioural group based intervention	14	Mild/Borderline ID	M=72.9 SD=5.8 (64-84)	Quantitative non-randomized	2
5 6	Taylor et al. (2006), England, Responses of female firesetters with mild and borderline ID to a group intervention.	6 Women convicted of Arson and detained	2 females	Mild intellectual disability	55-70	Quantitative Non-randomized	2

		ned under the Mental Health Act (1983, 2007) in a low secure forensic service of a specialist intellectual disabilities NHS Trust in north-east England and selected for the treatment.					
57	Alexander et al. (2015), England, Arson or firesetting in offenders with intellectual disability: Clinical characteristics, forensic histories and treatment outcomes.		Same sample as Alexander et al. (2011)			Quantitative non-randomized Retrospective case file review	1
58	Bourget & Bradford (1989), USA, Female arsonists: A clinical study	15 Consecutive females charged with Arson and referred to the department of forensic psychiatry at	1 female	Mild mental retardation	NR	Quantitative Non-randomized Retrospective file review	1

		the Royal Ottawa Hospital for pre-trial examination					
59	Curtis et al. (2019), UK, Characteristics & treatment needs of firesetters with Intellectual Disability: Descriptive data and comparisons between offence type.	134 Service-users of low, medium, and high security ID facilities in the United Kingdom who have an index offence of Arson, a violent offence of sexual offence	18 males	Intellectual disability	NR	Quantitative non-randomized Retrospective file review & database analysis	1
60	Siponmaa et al. (2001), Sweden, Juvenile and young adult mentally disordered offenders: The role of child neuropsychiatric disorders	130 Patients at the forensic psychiatric department in Stockholm from 1990 - 1995	12	Pervasive developmental disorder (n=10) & mental retardation (n=2)	70 or below (n=2)	Quantitative non-randomized Retrospective study	1

6 1	Browning, Gray & Tomlins (2016), England, A community forensic team for people with intellectual disabilities.	70 Service users open to the community forensic team during June 2013.	10	Learning disability and autism spectrum disorder	NR	Quantitative descriptive Retrospective file review	5
6 2	Gibbens & Robertson (1983), UK, A survey of the criminal careers of restriction order patients.	146 People convicted to local hospitals in 1962 and 1964 under a hospital order with restriction or hospital order with restriction for psychiatric patients.	9 males	8 subnormal, 1 severely subnormal	NR	Quantitative descriptive Retrospective study	5
6 3	Leong & Silva (1999), USA, Revisiting arson from an outpatient forensic perspective.	32 Consecutive court-ordered psychiatric evaluations of pre-trial criminal defendants charged with either Arson/Aggravated Arson	2 males & 3 females	Mental retardation	NR	Quantitative Descriptive Incidence/prevalence study without comparison group	5

		n from the central Ohio area over five years					
64	Curtis, McVilly & Day (2015), Australia, Looking for a needle in a haystack: Arsonists with intellectual disability in Australia.	50 Individual cases identified from public case law databases Aust LII, West Law AU and Lexis Nexis AU and search of the police crime statistics from each State's police website	4 males & 2 females	Intellectual disability	NR	Quantitative Descriptive Database analysis	4
65	Ellis-Smith et al. (2019), Australia, Australian arsonists: an analysis of trends between 1990 and 2015.	309 Sentencing transcripts of Arson cases obtained across all Australian jurisdictions	9	Intellectual disability	NR	Quantitative-Descriptive Retrospective file review	4

		dicti ons betw een 1990 and 2015					
6 6	Hare, Gould, Mills & Wing (1999), England, A preliminary study of individuals with Autistic Spectrum Disorders in Three Special Hospitals in England.	130 5 Serv ice users of three Spec ial Hos pital s in Engl and.	5	4 Asperger's syndrome, 1 Autism spectrum disorder	50 or above	Quantita tive descripti ve Prevalen ce study	4
6 7	Leonard et al. (2016), Ireland, A national survey of offending behaviour amongst intellectually disabled users of mental health services in Ireland.	431 Serv ice- users repo rted by lead clini cians of all Intel lectu al Disa bilit y Psc hiatr y, Gen eral Adult t Psc hiatr y and Fore nsic Psc hiatr y Serv ices in the Rep ublic of Irela nd.	22	Severe, moderate, mid intellectual disability	NR	Quantita tive descripti ve Survey	4
6 8	Rix (1994), England, A psychiatric study of adult arsonists.	153 Refe rred to the auth or for pre- trial psyc hiatr	16	Mental handicap	NR	Quantita tive Descripti ve	4

		ic reports and subsequently convicted of arson between 1983 and 1993.					
69	Rose et al. (2008), UK, Individuals with an intellectual disability who offend.	47 Service-users in the district who were over the age of 16, were known to services for people with intellectual disabilities, and who had had contact with the criminal justice system (CJS) in relation to offending/behaviour	6	Intellectual disability	79 (n=2)	Quantitative descriptive Service audit	4

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70	Thalayasingam, Alexander & Singh (2004), England, The use of clozapine in adults with intellectual disability	24 Service-users treated in a medium secure unit, a low secure assessment and treatment service and a community team in the London region during March–June 2002	6	Intellectual disability and pervasive developmental disorder	NR	Quantitative descriptive Retrospective file review	4
71	Crocker et al. (2007), Canada, Race and characteristics of men with an intellectual disability in pre-trial detention.	53 Men based in a Montreal pre-trial holding centre and a pre-trial unit of the Montreal gaol who could	2 males	Probable intellectual disability	Below 70	Quantitative descriptive Incidence/prevalence study	3

		spea k Fren ch and who had not been fully asses sed in a previ ous dete ntion .					
7 2	Rasanen et al. (1994), Finland, Cognitive functioning ability of arsonists	72 Peop le char ged with Arso n and exa mine d befo re re trial at the Univ ersit y Hos pital of Jyvis ky Fors enic Psyc hiatr ic Dep artm ent	6	Mental retardation	Below 68	Quantita tive Descripti ve	3
7 3	Richie & Huff (1999), USA, Psychiatric aspects of arsonists.	283 Case files of adult s with a conv ictio n of Arso n at the Beha viou ral Scie nce Unit of the FBI, the centr	1	Pervasive developmental disorder	NR	Quantita tive Descripti ve Retrospe ctive file review	3

		alised military confinement facility, and records over 5 years at the State of Maryland's forensic hospital					
74	Smith, White & Walker (2008), Scotland, Offending in the learning-disabled population: a retrospective audit of Tayside learning disability service court reports.	93 Court reports of service users at the Tayside learning disability inpatient service	6	Intellectual disability	M=64.9 (50-75)	Quantitative descriptive Retrospective file review	3
75	Su et al. (2000), Taiwan, Characteristics of mentally retarded criminal offenders in Northern Taiwan.	32 Referred by the courts for pretrial forensic evaluation during the period from 1981 - 1997 at Taipei City Psych	7	Mental retardation	NR	Quantitative descriptive Retrospective file review	3

		hiat ic Cent er					
7 6	Anckarsater et al. (2008), Sweden, Autism spectrum disorders in institutionalized subjects.	22 Serv ice- users admi tted to a speci al hosp ital for fore nsic psyc hiatr y in Swe den, and a stud y popu latio n of viole nt/ sexu al offe nder s unde r goi ng re- trial investi gation at the Dep artm ent of Fore nsic Psyc hiatr y in Goth enbu rg	5	Autism spectrum disorder	NR	Quanta tive Descripti ve Case series study	2
7 7	Crossland et al. (2005), England, Needs assessment in forensic learning disability.	60 Fore nsic servi ce- users from two Strat egic Heal th Auth	6	Learning disability	NR	Quanta tive descripti ve Database analysis	2

		<p>riority areas in the north of England and identified as being suitable for inclusion in the study through liaison with the regional forensic case managers and individual services.</p>					
78	<p>Devapriam et al (2007), England, Arson: characteristics and predisposing factors in offenders with intellectual disabilities.</p>	<p>120 Sex offenders with a history of Arson and contact with psychiatric services for people with intellectual disabilities at Leicester Frith Hospital</p>	<p>7 males & 8 females</p>	<p>12 mild LD, 2 moderate LD, 1 borderline LD, 1 PDD</p>	<p>NR</p>	<p>Quantitative descriptive Retrospective study</p>	<p>2</p>

		over a 20-year period					
79	Jayaraman & Frazer (2006), UK, Arson: A Growing Inferno	54 Pre-trial court reports of persons charged for arson or persons who previously had a history of arson.	2	Mild mental retardation (n=1), Asperger's Syndrome (n=1)	NR	Quantitative descriptive Survey	2
80	Puri, Baxter & Cordess (1995), England, Characteristics of firesetters: A study and proposed multi-axial psychiatric classification.	36 Adults for whom fire setting was identified. One reference referred to the North West Thames Forensic Psychiatry Service over a 4-year period	1	Learning disability	NR	Quantitative Descriptive Retrospective file review	2
81	Ashworth, Mooney & Tully (2017), England, A case study demonstrating the effectiveness of an adapted DBT program upon increasing adaptive emotion management skills, with an individual diagnosed with mild learning disability and emotionally unstable personality disorder.	1 Clinical case study at a medium	1 male	Learning disability	69	Quantitative Clinical case study	1

		secure learning disability unit					
82	Inciardi (1970), USA, The adult firesetters.	138 All sentenced offenders convicted of Arson who were released on parole from the New York State prisons from 1961 through 1966 inclusive	26	Defective range	70 and below	Quantitative descriptive	1
83	Borja-Santos et al (2010), Portugal, 48,XXYY in a general adult psychiatry department.	1 fire-setter being treated in a general psychiatric department	1 male	Mild intellectual disability	NR	Quantitative descriptive Case study	0
Qualitative Studies							
1	Barnoux, Gannon & O Ciardha (2015), England & Wales, A descriptive model of the offence chain for imprisoned adult male firesetters.	38 People with at least one recorded fire setting incident	2 males	Learning disability	NR	Qualitative Grounded Theory-Interviews	5

		ent were identified from the prison records of seven establishments in England and Wales and individually approached					
2	Campbell et al. (2016), UK, A qualitative exploration of firesetting conducted by adults with ID: A grounded theory approach.	8 Service users at a low secure inpatient and community-based NHS forensic learning disability service and a private low secure learning disability service	8 males	1 participant with mild/borderline intellectual disability & autism spectrum disorder traits, 7 participants with mild intellectual disability.	M=70.4, SD=4.6 (57-75)	Qualitative Grounded Theory-Interviews	5
3	Rose, Lees-Warley & Thrift (2015), UK, The subjective experience of firesetting of men with mild ID detained in secure hospitals.	7 Service-users detained under	7 males	Intellectual disability	56-70	Qualitative- Interpretative Phenomenologic	5

		<p>r the Men tal Heal th Act (198 3, 2007) at medi um and low secu re units base d withi n one fore nsic intell ectu al disa bilit y hosp ital ident ified by the Mult i- Disc iplin ary Per mis sions regu lating delib erate ly set a fire, and who were unde rtaki ng/h ad com plete d the servi ces' indiv idual or grou p treat ment for fires ettin g beha viou</p>			<p>al Analysis - Intervie ws</p>	
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4	Tyler et al. (2014), UK, A firesetting offence chain for mentally disordered offenders	23 Service-users with at least at least one recorded incident of firesetting in their offence history from two medium secure psychiatric hospitals and four prisons in establishments in England	2	Borderline intellectual disability	NR	Qualitative- Grounded Theory Interviews	5
5	Scragg & Shah (1994), England Prevalence of Asperger's syndrome in a secure hospital	392 Identified through case note screening of the total male population of Broadmoor Hospital for autistic type behaviour	1 male	Asperger's syndrome	98	Qualitative- Interviews	2

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6	Barry-Walsh & Mullen (2004), Australia, Forensic aspects of Asperger's syndrome.	5 Cases heard in open court and assessed by one or both authors	2 males	Asperger's syndrome	NR	Qualitative descriptive Case histories	1
7	Hurley & Sovner (1995), USA, Six cases of patients with mental retardation who have antisocial personality disorder.	6 Service-users who underwent psychological and psychiatric assessments following their arrest for criminal acts	2 males	Mental retardation	42 & 68 (M=55, SD=18.4)	Qualitative descriptive Case histories	1
8	Murrie et al. (2002), UK, Asperger's Syndrome in forensic settings	6 Individuals with Asperger's syndrome encountered in forensic contexts	1 male	Borderline-low average IQ, Asperger's syndrome	NR	Qualitative Case histories	1
9	Radley & Shaherbano (2011), UK, Asperger Syndrome and arson: A case study.	1 Admitted to hospital after he was convicted of	1 male	Asperger's syndrome	NR	Qualitative Single case study	1

		Arson					
10	Rayner, Wood & Beail (2015), UK, The 'double-bind of dependency': early relationships in men with learning disabilities in secure settings.	10 Detained under the Mental Health Act (1983, 2007) following convictions for arson or violent or sexual offences at a low and medium security unit for men with learning disabilities	4 males	Learning disability	M=68 SD=3.2 (65-71)	Qualitative-Interviews	1
11	Haskins & Silva (2006), USA Asperger's disorder and criminal behaviour: Forensic-Psychiatric considerations.	3 Case histories developed from clinical practice	1 male	Asperger's Syndrome	NR	Qualitative Case histories	0
12	Palermo (2004), Italy, Pervasive developmental disorders, psychiatric comorbidities, and the law	3 Adult service-users with Pervasive Developmental Disorder	1 male	Pervasive developmental disorder	Normal range	Qualitative Case summaries	0

		who se admission to hospital was precipitated by criminal behavior					
Mixed Methods Studies							
1	Chester et al. (2018), England, Long-stay patients with and without intellectual disability in forensic psychiatric settings: comparison of characteristics and needs.	401 Service-users within high and medium secure psychiatric services defined and identified as 'long stay'	18	Intellectual disability	NR	Mixed Methods (including a cross-sectional survey, file review & consultation questionnaire)	4
2	Holst, Lystrup & Taylor (2019), Denmark, Firesetters with intellectual disabilities in Denmark	83 Records held by the Danish Ministry of Justice concerning all adults with intellectual disabilities and a conv	72 males & 11 females	Mild intellectual disability (n=74), Moderate intellectual disability (n=5), severe intellectual disability (n=1), other (n=3)	70 or below	Mixed Methods	4

		iction for deliberate firesetting					
3	Patterson & Thomas (2014), UK, Life Skills Group: Increasing foundation knowledge and motivation in offenders with a learning disability.	1 Identified from a group of five male Life Skills group members within a forensic learning disability placement	1 male	Mild learning disability & Autism spectrum condition	NR	Mixed Methods Single case study	4
4	Clare et al. (1992), UK, Assessment & treatment of firesetting: a single case investigation using a cognitive behavioural model.	1 Service user referred to specialist inpatient service for people with learning disabilities and severe behavioural/psychiatric difficulties	1 male	Intellectual disability	65	Mixed methods Case study	3
5	Woodbury-Smith et al. (2010), UK, Circumscribed interests and 'offenders' with autism spectrum disorders: a case-control study.	21 People with a criminal	5	Autism spectrum disorder	71 or above, M=91.2 (n=21)	Mixed Methods	3

		<p>conviction/ caution or who had been diverted to forensic mental health services following arrest from local NHS /independent sector medium secure psychiatric hospitals, including the National Medium Secure Unit for people with an ASD, and a national diagnostic clinic for adults with suspected autism, or the local health</p>					
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Highlights

- Adults with intellectual disabilities and autism set fires. This remains rare.
- They share some of the same characteristics as other adults who set fires.
- There is evidence to suggest they have unique characteristics.
- The research that has been conducted is of poor methodological quality.
- More research is needed to improve our understanding of all adults who set fires.

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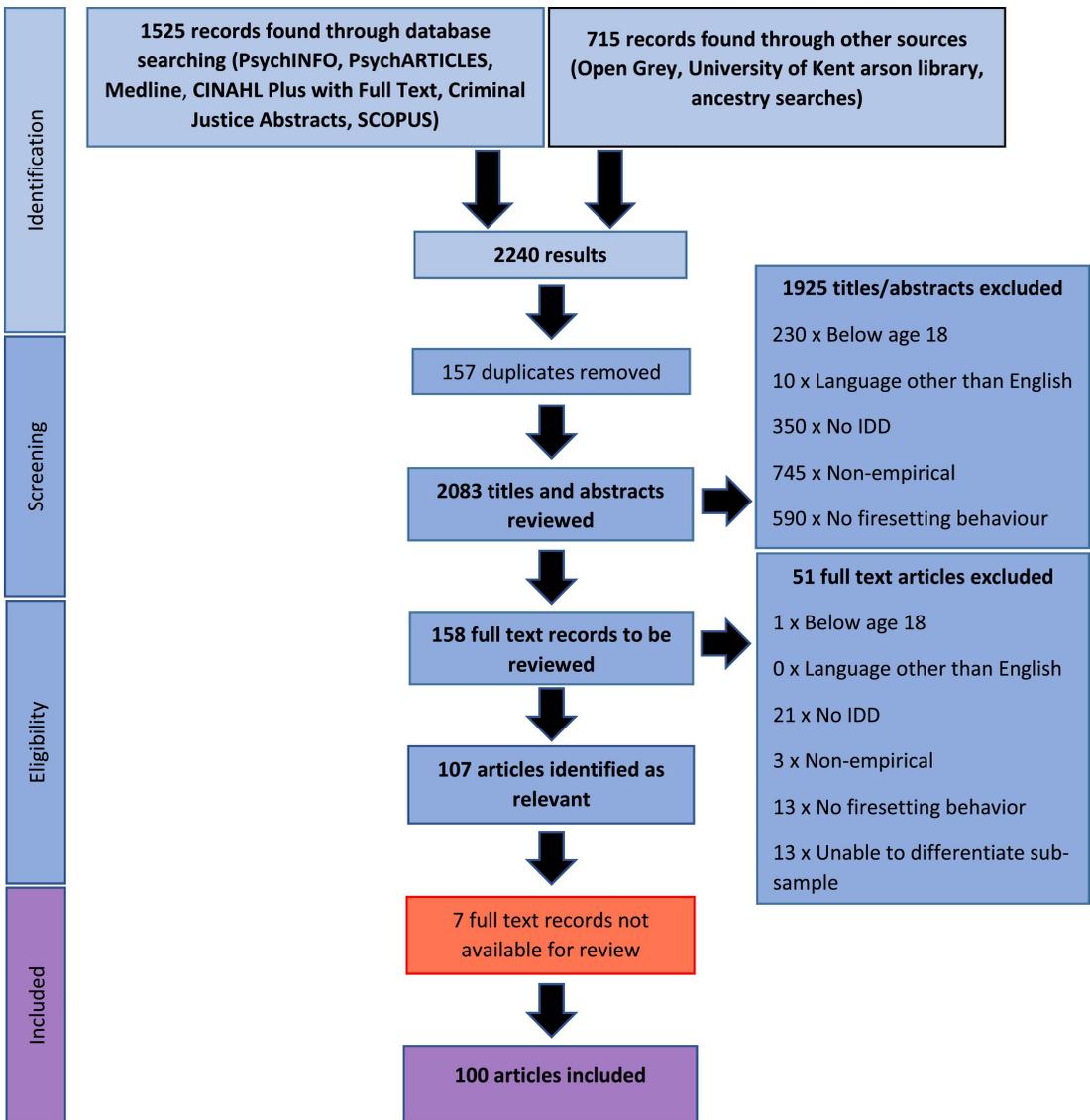


Figure 1