Examining the Relationship between Fire Interest and Firesetting: Contributions of Previous Experience with Fire and Self and Emotional Regulation

Rosalie E G Sherrell

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Abstract

Deliberate firesetting is an international problem with significant personal and economic cost. Interest in fire has previously been identified as a unique predictor of deliberate firesetting, however little is known about how fire interest interacts with other factors to produce firesetting. This research aimed to gain a deeper understanding of the role of fire interest by exploring how this construct interacts with previous exposure to fire and aspects of self and emotional regulation, and how this relates to firesetting behaviour. Two anonymous online studies were conducted among New Zealand adult community samples: Study 1 examined the relationship between fire interest, previous exposure to fire, emotional dysregulation, impulsivity, and sensation seeking (N = 146); Study 2 replicated the first study and explored the relationship between these factors and engagement in deliberate firesetting (N = 149). Results from both studies showed that only previous exposure to fire and sensation seeking were consistently positively correlated with fire interest, however, when other variables were controlled for via multiple regression analysis, the thrill/adventure seeking facet of sensation seeking was the only significant predictor of fire interest. In Study 2, logistic regression showed that only fire interest and impulsivity were significant predictors of deliberate firesetting. Moderation analyses indicated that thrill/adventure seeking moderates the relationship between fire interest and firesetting behaviour, while impulsivity does not. These findings extend previous research and theory by providing an initial understanding of how various factors may influence an individual's level of fire interest and their engagement in deliberate firesetting.

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Introduction

Humans and fire have co-existed for millennia, each interacting with and shaping the future of the other (Burton, 2009; Kershaw et al., 2002; Pyne, 2019). Prior to intervention by humans or other species, fire occurred by chance when available oxygen and suitable fuel were sparked by a natural ignition source, such as volcanic lava or lightning strike (Cochrane, 2010; Kershaw et al., 2002; Pyne 2019). Fires occurred regularly in many places during this prehistoric period, resulting in natural adaptations in landscapes, flora, and fauna, e.g., the development of fire-retardant properties in some organisms (Kershaw et al., 2002; Pyne, 2019). When humans learned to create and control fire, they were able to introduce fire into contexts previously untouched by flames across the Earth (Pyne, 2019). With the introduction of anthropogenic fire and the subsequent utilisation of industrialised fire, humans irrevocably changed the ecology of fire on Earth and such fire use continues to have hugely significant environmental impacts (e.g., the burning of fossil fuels; Pyne, 2019).

However, the relationship between fire and humankind is not unidirectional. The discovery of fire has delivered humans with warmth and light, a powerful tool to manipulate the natural environment, and the ability to create weapons or protect against threats (Murray et al., 2015). Cooking with fire allowed for improved nutritional intake by enabling the consumption of previously indigestible foods, leading to changes in human physiology such as larger brains and shorter guts (Wrangham, 2009). Burton (2009) argued that the proximity to fire altered early hominins' light/dark cycles, leading to irreparable changes in hormonal cycles dependent on light and darkness (e.g., changes in melatonin production). As well as this impact on physiology, Burton suggested that early human use of fire influenced social and cultural behaviours, with the additional light provided by evening fires increasing opportunities for communication of cultural norms and extending social interactions. Notably, use of fire is found universally and in religious rites and cultural practices across

cultures, both historically and in the present day (Winder, 2009). Nevertheless, despite this longstanding and beneficial relationship, human use of fire is not always positive. Fire has the potential to cause vast amounts of social and economic harm when left unattended or used in an irresponsible or malicious way, for example as a result of arson or deliberate firesetting.

Defining Firesetting

It is important to differentiate the term 'firesetting' from that of 'arson' and 'pyromania', which have often been used interchangeably in popular culture despite having conceptually different meanings. Internationally, arson is a narrow legal term which refers to the unlawful and intentional destruction of property using fire (Kolko, 2002; Williams, 2005). The charge of arson in New Zealand reflects this restrictive definition, where arson is a criminal offence involving the intentional or reckless destruction of property by fire or explosives (Crimes Act, 1961). However, a significant proportion of deliberately set fires do not involve the intentional or reckless destruction of property (e.g., fires set to another person, as an act of self-harm, or set to grassland), and therefore only a small number of deliberately set fires result in a charge of arson. Furthermore, difficulties in detecting perpetrators of deliberately set fires contribute to relatively low clearance rates for arson offences.

While arson is a legal term, pyromania refers to a psychiatric disorder with stringent diagnostic criteria outlined under the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V, American Psychiatric Association, 2013). Individuals who would meet a diagnosis of pyromania are considered those who repeatedly ignite deliberate fires as a means to relieve tension, for affective arousal, or to experience instant gratification (American Psychiatric Association, 2013). Under the DSM-V exclusion criteria for this disorder, individuals who set fires for revenge, crime concealment, monetary gain, political protest, to change living circumstances, or those who set fires under the influence of delusions, hallucinations, or substances, or who have an intellectual disability or

neurobiological disorder, cannot be diagnosed with pyromania (American Psychiatric Association, 2013). Due to the extremely strict diagnostic criteria, prevalence of pyromania is rare and such a diagnosis only represents a small number of individuals who have deliberately set fires. For example, in a 2005 study of 90 recidivist arsonists, only three (3.3%) met a pyromania diagnosis (Lindberg et al., 2005), while earlier studies found no individuals meeting the criteria among various samples of deliberate firesetters (Geller & Bertsch, 1985; Harmon et al., 1985; Prins et al., 1985; Soltys, 1992).

This thesis will therefore use the term 'firesetting', rather than 'arson' or 'pyromania' to describe all intentional acts of setting fire, regardless of whether this act resulted in criminal charges or whether property was damaged as a result of the fire. This broader definition is in line with those used in contemporary research conducted in the area of deliberate firesetting (Barrowcliffe & Gannon, 2015, 2016; Gannon et al., 2012; Gannon & Pina, 2010; Ó Ciardha & Gannon, 2012).

Prevalence and Harm of Deliberate Firesetting

Firesetting appears to be a pervasive behaviour that causes significant issues internationally. In New Zealand, Fire and Emergency NZ (2019) recorded 49,799 deliberately lit fire incidents between 01 January 2014 and 31 December 2018 (including fires set lawfully, unlawfully, and legality not determined or not classified). The National Arson Reduction Strategy (2011, p. 4) reported a "relatively stable" trend in arson incidents, with approximately 8% of fires being attributed to arson. In terms of criminal justice outcomes, between 2016 and 2020, 1021 charges were laid in New Zealand in relation to property damage by fire or explosion (Ministry of Justice, 2020). Of these charges, 564 resulted in a conviction, with non-convicted charges being withdrawn by the prosecuting agency, dismissed or acquitted by the Court, or discharged without conviction following a guilty plea (Ministry of Justice, 2020).

With regard to the financial impact of deliberate firesetting, the National Arson Reduction Strategy (2011) estimated the direct cost of arson fires in New Zealand between 2002 and 2009 as $223 million, based on the rebuild cost of the area and type of building construction damaged by fire. This figure does not take account of stock and other property loss, loss of earnings, and associated costs from business interruption, which contribute to the overall financial impact of damage caused by deliberately lit fires and represent the large financial burden of deliberate firesetting in New Zealand. In addition to this economic impact, a review of coronial, fire, and health records identified 13 New Zealanders aged 15-64 years who died between 1991 and 1997 in fires which were deliberately lit (Duncanson et al., 2001). These figures suggest deliberate firesetting is an enduring issue in New Zealand, resulting in substantial personal and economic harm. Furthermore, the charge clearance rates outlined above suggest that only a small proportion of deliberate firesetters in New Zealand are detected and apprehended by Police or other authorities, meaning a significant number of individuals who set fires remain un-apprehended in the community.

It is not just New Zealand who experiences large numbers of deliberate fires each year, with similarly high figures recorded internationally. For example, in the year ending March 2020, the United Kingdom Home Office (2020) recorded 69,8089 deliberate fires attended by fire and rescue services in England. Of these fires, 19,140 were identified as being of the most serious categorisation, i.e., those which involved fatalities, casualties, or rescues, and/or occurred in a non-derelict building, vehicle or outdoor structure, and/or were attended by five or more pumping appliances (Home Office, 2020). For the year ending September 2017, 47% of all fires attended by Fire and Rescue Services in England were classed as deliberate, significantly higher than the rate reported in New Zealand (Arson Prevention Forum, 2017). It is noted the New Zealand figure excludes reckless and other fires recorded as deliberate which may have been a result of arson, which may partially explain

this disparity in deliberate firesetting rates. Overall, 55 fire-related fatalities and 483 non-fatal casualties requiring hospital treatment were recorded in England in the year ending March 2020, with the estimated economic cost of deliberate fires in England estimated as £1.45 billion per annum (Arson Prevention Forum, 2017; Home Office, 2020). These figures reflect that the act of deliberate firesetting is a relevant issue in both New Zealand and internationally, begging the question of who is responsible for such firesetting.

Previous research shows firesetting is not uncommon among adolescents, with prevalence rates ranging from 4.5% to 33% among community samples (Bowling & Omar, 2014; Chen et al., 2003; Del Bove et al., 2008; MacKay et al., 2009; Martin et al., 2004). For example, Kafry (1980) found 21% of five to nine year old children had set a fire at some point in their life, while Martin et al. (2004) report that at age 13 at least 10.6% of boys and 3% of girls report "setting a fire in public for fun". Higher prevalence rates have been identified among clinical populations, with prevalence rates ranging from 14.3% to 34.6% in child and adolescent psychiatric inpatient samples (Kolko and Kazdin, 1988; Stewart & Culver, 1982) and from 2.3% to 19.4% (Kolko & Kazdin, 1988; Vandersall & Wiener, 1970) in outpatient psychiatric samples. Data on the prevalence of adult firesetting among community samples is rare, however one survey conducted in the USA found a lifetime self-reported firesetting prevalence rate of 1.13% among a representative adult sample (Blanco et al., 2010; Vaughn et al., 2010). Across three studies of UK adults, Barrowcliffe and Gannon (2012, 2015, 2016) found between 11% and 25% of participants reported having deliberately set a fire since the age of 10 years. Of those who self-identified as firesetters in the third study, 35% continued to set fires into adulthood (Barrowcliffe & Gannon, 2016). These existing community findings suggest firesetting remains a common behaviour among adults in the general population. However, no research has been published to date regarding the prevalence rate of firesetting among adult New Zealanders.

While these figures give a broad picture of the prevalence of deliberate firesetting, these statistics do not identify what may characterise those who engage in firesetting.

Characteristics of Deliberate Firesetters

Although a large number of deliberately set fires are started every year which result in a significant financial and human cost, there has been little focus in the psychological literature regarding who engages in such behaviour and why they do so. Across the existing youth and adult literature, the majority of empirical research has focused on apprehended populations, such as prisoners (e.g., Gannon et al., 2013; O'Sullivan & Kelleher, 1987; Sapsford et al., 1978), psychiatric inpatients (e.g., O'Sullivan & Kelleher, 1987; Räsänen et al., 1995; Tennent et al., 1971; Tyler & Gannon, 2012), youth convicted or arrested for firesetting (e.g., Hickle & Roe-Sepowitz, 2010; Icove & Estepp, 1987; Roe-Sepowitz & Hickle, 2011; Saunders & Awad, 1991; Swaffer & Hollin, 1995), and adolescent firesetters identified within residential care (e.g., Kazdin & Kolko, 1986; Sakheim et al., 1991; Shakeri et al., 2007). While it is recognised there have been some studies examining firesetting among community samples (e.g., Blanco et al., 2010; Vaughn et al., 2010; Barrowcliffe & Gannon, 2015, 2016; Gannon & Barrowcliffe, 2012), such community-based studies are far less common than research among apprehended populations. The extant literature has therefore mostly been conducted among firesetters who have come to the attention of authorities in some way, while less is known regarding those individuals who may engage in firesetting but have not been formally identified.

Despite this, existing research has shed some light on the background and demographic characteristics of adults who have set deliberate fires. Among apprehended populations, for both adult and adolescent populations, factors associated with firesetting include being male and Caucasian (Bradford 1982; Gannon, 2010; Koson & Dvoskin; 1982; Muller 2008; Pettiway, 1987; Rautaheimo, 1989; Roe-Sepowitz & Hickle, 2011; Root et al.,

2008), having disturbed childhoods characterised by poor attachment styles (Kolko & Kazdin, 1986; Hurley & Monahan, 1969; Jackson et al., 1987; Macht & Mack, 1968; Root et al., 2008; Sakheim & Osborn, 1999; Saunders & Awad, 1991; Tennent et al., 1971), and having poor interpersonal relationships (Ducat et al., 2013a; Hurley & Monahan, 1960; Lewis & Yarnell, 1951; Ó Ciardha et al., 2015; Sakheim et al., 1991). Research has also suggested that individuals who set fires may be more likely to come from families where there is a history of firesetting, or where interaction with fire is pervasive (Rice & Harris, 1991; Wolford, 1972). Relative to non-firesetting offenders, adult firesetters have been found to have lower levels of intelligence (Bradford, 1982), lower educational attainment (Räsänen et al., 1995), poorer occupational outcomes (Ducat et al., 2013a), and increased engagement with mental health services (Ducat et al., 2013b; Ó Ciardha et al., 2015). Among adolescent firesetters, rates of mental health diagnoses have been reported as 25.8% for females and 46.7% for males, with male adolescent firesetters more likely to have multiple mental health diagnoses (Roe-Sepowitz & Hickle, 2011). These results illustrate the wide range of demographic, developmental, and interpersonal factors which have been associated with deliberate firesetting among apprehended populations.

Although research on firesetting in the community has been scarce, some factors have been identified among un-apprehended samples of adults who self-report setting fires. As with apprehended populations, being male has been correlated with firesetting among un-apprehended samples, although these gender differences are less pronounced than among apprehended firesetters (Barrowcliffe & Gannon, 2015, 2016; Blanco et al., 2010; Chen et al., 2003; MacKay et al., 2009; Martin et al., 2004; Perrin-Wallqvist & Norlander, 2003; Vaughn et al., 2010). Being unmarried has also been found to be associated with un-apprehended firesetting (Blanco et al., 2010; Vaughn et al., 2010). Similar to apprehended adolescent firesetters, un-apprehended adolescent firesetters report limited parental supervision

(McCarty & McMahon, 2005). However, in contrast to apprehended firesetters, Gannon and Barrowcliffe (2012) found all un-apprehended firesetters were educated to at least GCSE level (comparable to NCEA level 2 in New Zealand), suggesting a disparity in education level among firesetters who are apprehended and those who are not (i.e., those who remain un-apprehended have higher levels of education than those who are apprehended for firesetting). Some contrasting findings have also been identified regarding mental health among un-apprehended populations, with Barrowcliffe and Gannon (2016), Blanco et al. (2010), and Martin et al. (2004) reporting an association between firesetting and psychopathological diagnoses, but no difference in this area identified by Gannon and Barrowcliffe (2012). As some of these factors indicate subtle differences between un-apprehended and apprehended firesetters, further research with un-apprehended samples is required to better understand this group, as apprehended firesetters only represent a minority of those who set fires.

Whilst the above demographic and historical factors provide us with some information about the characteristics of those who set fires, such demographic factors are not sufficient to provide a full understanding of the aetiology of firesetting. Examination of additional factors is therefore required.

Motivations

After demographic factors, the vast majority of literature on firesetting has focused on identifying motivations for the behaviour. Among apprehended firesetters, some report only a single motive; for example, Swaffer and Hollin (1995) report 94% of adolescents charged with a firesetting offence cited only one motivation. Other studies have found that both adolescents (Kolko & Kazdin, 1991) and adults (Barnoux et al., 2015; Koson & Dvoskin, 1982) describe multiple co-occurring motives for firesetting. Motivations for engaging in firesetting behaviour have included reasons such as revenge (Bourget & Bradford, 1989;

Gannon et al., 2012; Harmon et al., 1985; Icove & Estepp, 1987; Inciardi, 1970; Lewis & Yarnell, 1951; O'Sullivan & Kelleher, 1987; Rix, 1994; Stewart, 1993; Swaffer & Hollin, 1995; Tennent et al., 1971), excitement (Icove & Estepp, 1987; Inciardi, 1970; Rix, 1994), vandalism (Australian Government, 2005; Icove & Estepp, 1987; Inciardi, 1970; Rix, 1994), economic gain (Inciardi, 1970; Molnar et al., 1984), crime concealment (Icove & Estepp, 1987; Swaffer & Hollin, 1995), and communication (Dickens et al., 2009; Geller, 1992; Harmon et al., 1994; Root et al., 2008; Sakheim et al., 1991; Tyler et al., 2014). Self-harm and suicide have also been reported as motives for firesetting among apprehended samples, particularly by adolescent and adult females (Bourget & Bradford, 1989; O'Sullivan & Kelleher, 1987; Roe-Sepowitz & Hickle, 2011; Shakeri et al., 2007; Swaffer & Hollin, 1995). In addition, fascination with fire or pyromaniac tendencies have been associated with engagement in deliberate firesetting among apprehended populations (Quinsey et al., 2006; Tyler et al., 2015). Other motives have also been reported to a limited extent, specifically sexual gratification (Kocsis & Cooksey, 2002; Lewis & Yarnell, 1951; Rice & Harris, 1991), political/terrorist motivations (Prins, 1994), and self-protection (Tyler et al., 2014). Notably, some apprehended firesetters report no apparent motivation or reason for their firesetting (O'Sullivan & Kelleher, 1987).

Among un-apprehended populations, limited information is known regarding motives for deliberate firesetting due to most studies among community samples assessing firesetting with a single item (e.g., Chen et al., 2003; Del Bove et al., 2008; Martin et al., 2004). An exception to this is Gannon and Barrowcliffe's (2012) study, which found that most un-apprehended firesetters reported they ignited fires during adolescence due to boredom, peer pressure, to express feelings, or for excitement. In this study no participants reported revenge as a motive for their firesetting behaviour. One earlier study (Perrin-Wallqvist & Norlander, 2003) explored firesetting motives among an adolescent sample and found these firesetters

predominantly reported being motivated by curiosity and distraction. As with apprehended firesetters, an increased interest in fire has also been associated with firesetting among un-apprehended samples (Barrowcliffe & Gannon, 2015, 2016; Gannon & Barrowcliffe, 2012). These studies provide some insight into why un-apprehended populations set fires, however more research is required to further explore motivations for firesetting among community samples.

Psychological Factors Associated with Deliberate Firesetting

Although the previously described background factors and motivations provide a starting point to explore potential factors that may be associated with firesetting, they do not assist with understanding why some people choose to engage in firesetting and others do not. To develop such formulations, it is critical to examine what psychological factors may be associated with deliberate firesetting. Among both youth and adult apprehended populations, firesetting has previously been associated with psychological characteristics such as loneliness, social isolation, boredom, and lack of assertiveness (Hurley & Monahan, 1969; Inciardi, 1970; Jackson et al., 1987; Noblett & Nelson, 2001; Perrin-Wallqvist et al., 2004; Rice & Chaplin, 1979; Sapp et al., 1999).

In addition, emotional and self regulation issues such as anger (Rix, 1994), impulsivity (Hoerold & Tranah, 2014; Hurley & Monahan, 1969; Räsänan et al., 1996), and inability to tolerate frustration or provocation (Jackson, 1994) have also been identified as correlates of firesetting. Related to the characteristics of impulsivity and boredom proneness, a tendency towards sensation seeking has also been associated with firesetting behaviour among youth samples (MacKay et al., 2009; Dadds & Fraser, 2006), however there is a lack of research examining this trait among adult samples of firesetters.

Furthermore, comparing incarcerated firesetters to non-firesetting prisoners, Gannon et al. (2013) found that firesetters could be differentiated from non-firesetting prisoners on

self/emotional regulation factors and self-concept factors. Specifically, firesetters demonstrated more anger related cognitions, higher physiological arousal to anger, more susceptibility to provocation, and lower self-esteem.

Interestingly, firesetting has also been associated with Borderline Personality Disorder (BPD), a personality disorder which is characterised by problems with affect regulation and impulse control, among other factors (Lieb et al., 2004). Rix (1994) reported borderline personality traits as the second highest personality feature among male firesetters, while Lindberg et al. (2005) reported disproportionately high BPD diagnoses among their sample of recidivistic male firesetters. Similarly, both Ducat et al. (2013b) and Duggan and Shine (2001) found firesetting offenders had more historical diagnoses of BPD or displayed more borderline traits than non-firesetting offenders. Further, Ó Ciardha et al. (2015) identified the borderline personality scale of the Millon Clinical Multiaxial Inventory-III (MCMI-III) as the strongest discriminator between firesetting offenders and non-firesetting offenders. This prevalence of borderline personality features among apprehended firesetting populations supports other findings linking emotional regulation and impulse control difficulties with deliberate firesetting.

There has been limited research exploring psychological characteristics of firesetting among un-apprehended firesetters, however Barrowcliffe and Gannon (2016) found that self-reported firesetters in a community sample scored higher than non-firesetters on measures of anger, boredom proneness, and antisocial attitudes, consistent with psychological features of apprehended firesetters.

Fire Interest

Further to the psychological features described above, one factor has consistently been identified as a predictor of firesetting among both apprehended and un-apprehended samples: the presence of increased fire interest. Holding an interest in fire has previously

been conceptualised as a universal trait among humans, particularly among children (Fessler, 2006; Jackson, 1994; Kafry, 1980; Kennedy et al., 2006; Pinsonneault, 2002). Pinsonneault (2002) suggests that fire has the potential to attract and hold a child's interest at each stage of development, due to the visually appealing nature of flames for pre-schoolers, the intriguing process of fire for school children, and the potential for rebellion for adolescents. However, Pinsonneault (2002) takes care to point out that an interest in fire among children does not need to translate into firesetting behaviour, just as adult interest in an object and involvement with it are two very different things. This perspective on the relationship between fire interest and firesetting among children is supported by empirical research by McCarty and McMahon (2005). McCarty and McMahon's (2005) study of 361 American children found a firesetting prevalence rate of 17.17%, suggesting that although holding an interest in fire may be a pervasive and normative aspect of human development, such interest does not necessarily lead to deliberate firesetting in all children.

Although an interest in fire may not be a sole causal factor for firesetting, several empirical studies have supported a link between increased interest in fire and firesetting behaviour among young people. Both Kolko and Kazdin (1991, 1994) and MacKay et al. (2006) explored the relationship between firesetting and fire interest among samples of children and/or adolescents. Kolko and Kazdin (1991) identified that compared with children rated low in curiosity about fire, children rated high in curiosity showed higher ratings on a number of fire-specific dimensions (e.g., greater early experience and exposure to fire models), whilst MacKay et al. (2006) found increased fire interest was a significant predictor of both firesetting severity and recidivistic firesetting during an 18-month follow-up period. Similarly, Kolko and Kazdin (1994) reported that repeat child firesetters were rated by parents as higher in curiosity about fire. These findings suggest that a positive relationship

may exist between higher levels of fire interest and engagement in firesetting behaviour among children and adolescents.

A similar relationship has been identified in adult populations. For example, among a sample of adult males admitted to a maximum-security psychiatric institution for firesetting, Rice and Harris (1991) found that family reports of unusual interest in fire during childhood was the variable that best discriminated firesetting and non-firesetting offenders. In another sample of mentally disordered adult firesetters, Tyler et al. (2015) reported that firesetters were significantly more likely to have an expressed interest in fire/explosives than non-firesetters. Further, fire interest also differentiated between one-time and repeat firesetters in that it was the strongest unique predictor of multiple firesetting, with individuals who had expressed interest in fire/explosives being 15 times more likely to have set multiple fires than one fire. In addition to these studies, Gannon et al. (2013) examined whether a group of firesetting prisoners could be distinguished from a matched group of non-firesetting prisoners on a range of psychological constructs. Compared to non-firesetting prisoners, firesetting prisoners showed higher identification with fire, more interest in serious fires, less perceived fire safety awareness, more interest in everyday firesetting activities, and more acceptance of firesetting as a normal behaviour.

As well as this research among apprehended populations (i.e., psychiatric patients, prisoners), there have also been several studies examining fire interest among community samples. Gannon and Barrowcliffe (2012) identified that very little is known about firesetters who have not attracted professional attention and aimed to both investigate undetected firesetting among a community sample and develop two fire-related self-report measures (the Fire Setting Scale and Fire Proclivity Scale). The Fire Setting Scale (FSS) contained two 10-item subscales developed to measure antisocial behaviour and general fire interest, while the Fire Proclivity Scale (FPS) used vignettes to assess fascination with fire, behavioural

propensity, general arousal to fire, and general antisocialism. Gannon and Barrowcliffe found that there was a statistically significant difference between firesetters and non-firesetters on both the FSS and FPS, where firesetters scored higher on these measures than non-firesetters. However, when the antisocial and fire interest subscales of the FSS were examined separately, only the antisocial subscale produced a significant difference, where firesetters scored higher on this measure. The authors note that the difference between firesetters and non-firesetters on the fire interest subscale "just failed to reach significance" (p. 9) and suggest this lack of statistical significance may have been affected by impression management or by low levels of fire interest in the sample.

Expanding this literature base on un-apprehended firesetters, Barrowcliffe and Gannon (2015, 2016) recruited community participants via social media and hand delivered letters in two large UK based studies. Participants completed a number of measures including FSS and FPS (Gannon & Barrowcliffe, 2012), the Identification with Fire Scale (Gannon et al., 2011), the Fire Interest Rating Scale (Murphy & Clare, 1996) and the Fire Attitude Scale (FAS; Muckley, 1997), as well as self-reporting their own deliberate firesetting. Relative to non-firesetters, firesetters scored significantly higher on the FSS, the FPS, the Identification with Fire Scale, the Fire Interest Rating Scale, and the FAS. In other words, firesetters demonstrated higher levels of interest in fire, higher proclivity for firesetting behaviour, more identification with fire, and higher levels of normalisation of fire use. Overall, these findings support a positive relationship between interest in fire and engagement in deliberate firesetting.

Although fire interest has been found in a number of studies to be correlated with firesetting, empirical results have not always identified a clear positive correlation between increased levels of fire interest and firesetting behaviour. Hoerold and Tranah (2014) compared aspects of firesetting behaviour, fire interest, and fire-related attentional bias

among adolescent firesetters and non-firesetters. The firesetting group showed the highest levels of overall fire interest, however there was no statistically significant difference between groups. There was also no statistically significant difference between firesetters and non-firesetters on attentional bias towards fire-related stimuli. Further, fire interest did not significantly correlate with firesetting frequency across the sample. The authors note that this lack of relationship between fire interest and firesetting behaviour conflicts with previous research which has emphasised strong links between fire interest and firesetting, and refer to the self-report nature of the study and the relatively low levels of reported firesetting as possible explanations for the non-significant findings.

More recently, Butler and Gannon (2020) examined fire interest, attitudes, fire-related scripts and expertise among males who have engaged in deliberate firesetting and compared these to non-firesetting offender comparisons, fire service personnel, and community comparisons. Butler and Gannon (2020) found that firesetters and fire service personnel could not be differentiated on the number of fire-supportive scripts held, and fire service personnel held significantly more scripts than offender comparisons. Similarly, both firesetters and fire service personnel demonstrated greater fire-related expertise than offender and community comparisons, and fire service personnel reported higher levels of identification with fire than firesetters, offender comparisons and community comparisons. Furthermore, firesetters and fire service personnel reported similar levels of serious fire interest. These results are interesting as they indicate that both those who misuse fire and those who interact with it pro-socially (e.g., through work) hold similar scripts, expertise, and interests in fire, suggesting that having an interest in fire and holding fire-supportive scripts do not necessarily translate into deliberate firesetting behaviour. This begs the question as to what factors may interact with an interest in fire which lead some to use this antisocially or in problematic ways? Despite the lack of empirical investigation in this area, there have been

some attempts to develop multi-factor theories to explain how fire interest and other factors may lead to fire misuse in adults.

Theoretical Background

In comparison to other areas of forensic psychology (e.g., sexual offending), there have been relatively few theories developed to explain deliberate firesetting. Theories which have been proposed include single factor (e.g., psychoanalytical theory, biological disorder, social learning theory, Continuum of Fire Use Theory) and multi-factor theories (e.g., Functional Analysis Theory, Dynamic Behaviour Theory, Multi-Trajectory Theory of Adult Firesetting), and micro-theories (e.g., Descriptive Model of Adult Firesetting, Firesetting Offence Chain for Mentally Disordered Offenders). Many of these theories do not explain the role which fire interest plays in the facilitation of firesetting (e.g., biological theory, communicative arson, displaced aggression theory) or do not focus on how fire interest interacts with other factors (e.g., psychodynamic theory) due to concentrating on the influence of a single psychological construct. This section will therefore focus on explanations for firesetting that have hypothesised how fire interest influences behavioural outcomes with fire, including evolutionary theory, social learning theory, Functional Analysis Theory, Dynamic Behaviour Theory, the Multi-Trajectory Theory of Adult Firesetting, the Continuum of Fire Use Theory, the Descriptive Model of Adult Firesetting, and the Firesetting Offence Chain for Mentally Disordered Offenders.

Evolutionary Theory

In response to what he considered a lack of attention in the psychological literature to the role of fire in human evolution, Fessler (2006) proposed the existence of a dedicated information acquisition system for learning about fire. From ethnographic observations, Fessler noted that children in a semi-traditional Malay culture seemed to hold a similar level of interest in fire as children in Western cultures while they were young, however this interest

appeared to wane after the age of seven, to the point where fire was viewed by adults as an uninteresting tool rather than a source of any entertainment. Fessler contrasted this apparent diminished interest in fire with Western adult attitudes towards fire, where fire is used mostly as decoration, entertainment, or markers of special occasions, and interest in fire is pervasive. In exploring these cultural differences, Fessler observed that use of fire for day-to-day activities in the semi-traditional culture was pervasive and children had a high level of exposure to fire, while children in Western societies do not generally have such access to fire. To investigate these observations further, Fessler (2006) sent surveys to other anthropologists and ethnographic researchers asking for observations of fire interaction among cultures they had observed. Responses from these researchers accorded with Fessler's observations, namely, children in the observed cultures began interacting with fire early (from toddlerhood to six years old), and children generally did not play with fire as Western children tend to do. Additionally, fire did not appear to hold any entertainment value for adults and seemed to be viewed in strictly utilitarian terms. These observations led Fessler to propose an evolutionary theory of fire interest.

Fessler (2006) suggests that the control of fire is a learned behaviour which is dependent on experience with fire. Fessler notes that as humans live across a range of ecosystems, any evolutionary template for humans to produce and control fire would not translate across environments, and therefore information regarding how to use fire must be acquired via a learning mechanism. Fessler suggests this learning mechanism is likely to be specific to learning about fire, similar to domain-specific information acquisition systems for learning how to respond to threats posed by predatory animals. To explain the observed culture differences in attitudes towards fire, Fessler reasons that children in modern societies have limited opportunities to learn about fire through hands-on manipulation, and their ability to obtain realistic information about fire is constrained. This lack of exposure to fire may

result in an under-activated fire-learning mechanism, which leads to ongoing interest in fire and Western adult attitudes towards fire as an emotional symbol and source of entertainment.

Expanding on Fessler's (2006) evolutionary perspective, Murray et al. (2015) sought to explore Fessler's theory empirically, hypothesising that more exposure to fire in childhood would be associated with less interest in fire in adulthood. Terming this the "exposure hypothesis", Murray et al. (p. 206) conducted two studies to investigate the relationship between childhood fire exposure and adult interest in fire. While the first study returned no statistically significant relationship between childhood exposure to fire and the probability of participants reporting either positive or negative associations with fire, the second study returned a positive relationship between childhood fire exposure and positive affective reactions to fire. This finding is in contradiction to the exposure hypothesis, which predicts a negative relationship between previous exposure to fire and positive attitudes to fire. In reconciling these results with Fessler's observations, Murray et al. suggest a potential stimulus sensitisation/habituation effect, such that the levels of exposure to fire in the study samples may not have been high enough to activate Fessler's learning mechanism and reach habituation.

While Fessler's (2006) evolutionary theory expects that more exposure to fire in childhood leads to less interest in fire as an adult, due to under-activated fire learning mechanisms, Murray et al.'s (2015) empirical findings suggest the opposite relationship. A social learning theory perspective may explain why Murray et al. identified a positive correlation between previous exposure to fire and positive affective reactions to fire.

Social Learning Theory

Similar to the exposure hypothesis in evolutionary theory, social learning theory attempts to explain firesetting behaviour as a function of previous experiences with fire, whether directly or vicariously (Vreeland & Levin, 1980). However, while the exposure

hypothesis proposes a negative relationship between fire exposure and fire interest, social learning theory proposes the opposite relationship. Social learning theory argues that firesetting is the product of various learning principles, such as reinforcement contingencies (e.g., direct experiences with fire) and modelling (e.g., vicarious learning via parents or caregivers; Bandura, 1976; Kolko & Kazdin, 1986; Macht & Mack, 1968; Vreeland & Levin, 1980). In line with these principles, fire learning may occur vicariously through exposure to fire and models of firesetting behaviour, in that witnessing others engaging positively with fire increases the likelihood of an individual also engaging with fire in a similar manner (Vreeland & Levin, 1980). It is also expected that the more frequent positive experiences an individual has with fire, the more positively they will feel about fire and the more likely they will be to seek out opportunities to experience fire. Vreeland and Levin (1980) suggest that fire holds intrinsically reinforcing properties (e.g., sensory stimulation, tension release, excitement) and experiencing these properties is expected to increase an individual's positive attitude towards and interest in fire. Early and recent empirical findings support this perspective, as firesetters are more likely to have experienced early exposure to fire (Macht & Mack, 1968), have experimented with fire before age 10 (Barrowcliffe & Gannon, 2015), have a family history of firesetting (Barrowcliffe & Gannon, 2015; Rice & Harris, 1991), and be motivated by fire interest which may stem from early positive exposure to fire, such as having a firefighter father (Gannon & Pina, 2010). Social learning theory also suggests that the ability to self-regulate is influenced by environmental reinforcement contingencies (e.g., self-regulation reinforced via experiences of delayed gratification; Baumeister & Vohs, 2004). If such environmental contingencies are lacking, this may lead to socialisation issues such as poor role models and developmental difficulties, which is hypothesised to lead to experiences of perceived failure, aggression, poor coping, and low assertiveness (Vreeland & Levin, 1980). These experiences are in turn suggested to increase an individual's propensity

to engage in firesetting behaviour, in order to gain environmental control (Vreeland and Levin, 1980). Social learning theory therefore predicts that an interest in fire and propensity for firesetting are shaped by socially transmitted factors including previous exposure to fire, modelling of fire use, and learned delayed gratification. However, social learning theory is only a single factor theory and does not consider how other factors that have been indicated in the wider literature may play a role in the onset and maintenance of fire interest, and how these may interact with other factors to produce firesetting.

Functional Analysis Theory

Drawing together social learning theory with existing firesetting research and clinical experience, Jackson et al.'s (1987) Functional Analysis Theory argues that firesetting occurs as a result of interactions between antecedents (prior events and circumstances) and consequences (reinforcement principles associated with firesetting). Jackson et al. describe five key antecedents which underlie firesetting behaviour: psychosocial disadvantage (e.g., poor caregiver relationships), life dissatisfaction and self-loathing (e.g., self-esteem problems), social ineffectiveness (e.g., diminished conflict resolution skills), factors determining individual experiences of fire (e.g., pre-existing vicarious or individual fire experiences), and internal or external firesetting triggers (e.g., affective states or external contexts which trigger urges to set fires). Integrating these antecedents, Jackson et al. propose that three background/developmental factors are required for the development of recidivistic firesetting (psychosocial disadvantage, dissatisfaction with life or self, actual or perceived social ineffectiveness), while two factors direct the individual towards using fire specifically (previous experience with fire, particularly where fire was involved in a significant emotional event or where the social effects of fire were apparent, and the inhibition of alternative behaviour), and triggering conditions lead to the lighting of a fire (opportunity and/or the absence of an identifiable person target, an emotionally significant event which provokes

conflict between a desire to change a situation, and an inability to effect such change). Similar to social learning theory, Jackson et al. hypothesise that positive and negative reinforcement contingencies play important roles in the maintenance of repeat firesetting behaviour. For example, some children with social skills deficits may find fire provides positive reinforcement through acceptance from peers and increased attention from caregivers, while negative reinforcement contingencies may occur when the consequences of firesetting (e.g., rejection, punishment) strengthen the personal inadequacies already experienced by an individual (e.g., social ineffectiveness), supporting the maintenance of firesetting behaviour (Jackson et al., 1987).

Incorporating the role of fire interest, Jackson et al. (1987) describe how firesetting may lead to changes such as increased perceived effectiveness and self-esteem, changes in the environment (e.g., praise, attention, avoidance), or increased arousal, which reinforces an increased fascination with fire. In combination with other pre-existing antecedents (e.g., psychosocial disadvantage), this increased fire interest thereby contributes to a cycle of repeat firesetting behaviour. In a later iteration of the Functional Analysis model, Jackson (1994) further comments on the role of fire interest in recidivistic firesetting. Jackson notes that holding an interest in fire appears to be a near-universal trait in children, and contends that this interest generally continues into adulthood but becomes muted by social inhibition. Furthermore, Jackson suggests that those who set fires may be combating an interest in fire which is found in most people, pointing to clinical experience where firesetters have denied holding an interest in fire and displayed behaviour consistent with such denial (e.g., not looking out the window when a fire engine went past). However, Jackson does not explain how such a denial of fire interest may play into the Functional Analysis model and provides little elaboration on the implications of this concept.

Although providing a more comprehensive view of the factors which lead to firesetting, Functional Analysis Theory does not explain why some individuals who do not experience psychosocial disadvantage from childhood choose to engage in firesetting behaviour, or why others who do experience such disadvantage do not go on to become firesetters. Furthermore, there is little explanation of what is meant by the "muting" of fire interest in adulthood and how this might develop, why this may stay more pertinent for some, and what other factors may influence this.

Dynamic Behaviour Theory

Similar to Functional Analysis Theory, Fineman's (1980, 1995) Dynamic Behaviour Theory also hypothesises that firesetting results from an interaction of historical psychosocial influences and social learning experiences. Dynamic Behaviour Theory summarises the development and maintenance of deliberate firesetting as "FS = G1 + G2 + E" (Fineman, 1995, p. 43), where (G1) refers to dynamic historical factors which predispose maladaptive and antisocial actions (e.g., social disadvantage and ineffectiveness), (G2) refers to previous and existing environmental reinforcers associated with firesetting (e.g., childhood fire experiences and fire fascination), and (E) refers to instant environmental reinforcers associated with firesetting. In his 1995 paper, Fineman elaborates further on (E) and discusses the inclusion of impulsivity triggers, crime scene features, cognitions and affect around the time of firesetting, external reinforcers, and internal or sensory reinforcers in this factor. Fineman (1995) explains that the risk of a general psychological dysfunction can be determined by examining factor (G1), while (G2) is specific to at-risk fire behaviours, and (E) captures the likelihood of an individual continuing to set fires.

Factor (G2) provides some description of the role of fire interest in this formulation. At-risk fire behaviour is described as including features such as a lack of parental supervision relative to fire interest or fire play, lack of fire-safety knowledge, and a parent or other

significant other's previous response to a fire, which increase a person's risk of misusing fire. Fineman (1995) states that it is a combination of (G2) and salient aspects of (G1) which determine the risk of an individual using fire to express conscious or unconscious motives (e.g., anger expression), the propensity for which may be triggered by a crisis or trauma (e.g., incident of social rejection) prompting an impulsive action (i.e., firesetting). Fineman notes the importance of fire fascination among pathological firesetters and suggests that an early fixation on fire leads to a higher likelihood of firesetting in the future, compared to individuals who have not displayed such an early fire interest. Consistent with social learning theory, Fineman suggests that an interest in fire is developed through early experiences and reinforcement history, although such a predisposition towards fire use is just one of a variety of maladaptive behaviours present among pathological firesetters. Importantly, the Dynamic Behaviour Theory acknowledges that firesetting may occur in situations where a specific interest in fire is not prominent (e.g., opportunistic firesetting where alcohol use is a primary factor) and does not contend that a high level of fire interest must be present in all instances of firesetting.

While this model shares similarities with Jackson et al.'s (1987) Functional Analysis Theory, Dynamic Behaviour Theory provides more elaboration on the proximal factors associated with firesetting and is better able to explain firesetting in the absence of intense fire interest.

The Multi-Trajectory Theory of Adult Firesetting

While the above theories have each contributed to the understanding of firesetting behaviour, this theoretical base is somewhat limited and contemporary empirical findings have not been addressed. By generating a multi-factorial theory of firesetting, Gannon et al. (2012) sought to build upon existing theories to provide a comprehensive framework of the onset, maintenance, and desistance of deliberate firesetting behaviour. The Multi-Trajectory

Theory of Adult Firesetting (M-TTAF) proposes that developmental factors (e.g., caregiver environment, learning experiences, cultural forces) lead to the development of psychological vulnerabilities (e.g., self/emotional regulation issues), which interact with proximal triggers (e.g., life events, internal affect) and moderators (e.g., self-esteem, mental health), leading to critical risk factors (e.g., offence supportive attitudes) and engagement in deliberate firesetting. The authors outline four key groups of psychological vulnerabilities in the M-TTAF: inappropriate fire interest/scripts, offense-supportive cognitions, self/emotional regulation issues, and communication problems. Gannon et al. hypothesise that when other factors (e.g., negative life events) interact with these key vulnerabilities, particular vulnerabilities are primed and become critical risk factors prior to firesetting. For example, an individual who has vulnerabilities of inappropriate fire scripts and emotion regulation issues may experience distressing life events due to their dysfunctional coping approach (e.g., breakdown in an intimate relationship), which increases negative affect and triggers the pre-existing vulnerabilities into critical risk factors (e.g., emotion regulation issues), causing firesetting to be seen as the only viable response (e.g., setting fire to an ex-partner's property to express negative emotions).

Within the M-TTAF, Gannon et al. (2012) identify inappropriate fire interest/scripts as an important risk factor for firesetting, referring to both the reinforcing consequences of firesetting outlined by previous theories (i.e., Fineman, 1980, 1995; Jackson et al., 1987; Jackson, 1994; Vreeland & Levin, 1980) and the Western cultural focus on fire discussed by Fessler (2006). Expanding on Fessler's (2006) perspective, Gannon et al. suggest that an inappropriate interest in fire resulting from a lack of fire learning in childhood may become internalised among some individuals as a result of individual differences in childhood learning and fire-associated experiences. For example, an individual with a history of negative social experiences may encounter positive social interactions with their peers when

using fire. Fire may then be turned to in the future to resolve instances of negative affect, as the individual has previously experienced positive feelings in the context of such fire use. In line with reinforcement principles, fire interest thereby becomes entrenched and may lead to inappropriate scripts about how and when to use fire.

In addition to the model of how each factor interacts with one another leading to firesetting, Gannon et al. (2012) also propose five prototypical trajectories associated with firesetting: antisocial, grievance, fire interest, emotionally expressive/need for recognition, and multi-faceted. Each trajectory is associated with a prominent risk factor(s), other likely risk factors, potential clinical features, and potential motivators. Inappropriate fire interest/scripts are identified as a prominent risk factor for the fire interest trajectory. For these individuals, fire may hold arousal-reducing (e.g., tension releasing) or arousal-increasing (e.g., exhilarating) properties, and the authors suggest that impulsivity issues may also be present in this trajectory. Gannon et al. hypothesise that the firesetters in this trajectory are also likely to hold the critical risk factor of fire-supportive attitudes (e.g., "it's not harmful to anyone"), but not generally pro-criminal attitudes (e.g., use of violence to achieve goals). Inappropriate fire interest/scripts are also proposed to feature as a prominent risk factor for the multi-faceted trajectory. Unlike the fire interest trajectory, those who fall into the multi-faceted trajectory hold offense-supportive attitudes which interact with inappropriate fire interest/scripts, self/emotional regulation issues and communication problems, leading to complex issues across a range of factors linked with firesetting behaviours. Gannon et al. predict that for this group, developmental deficits (e.g., parental neglect, presence of antisocial peers) coincide with a childhood curiosity towards fire and increase the likelihood that early fire play will become reinforced as a coping mechanism and sensation-enhancing tool. The key difference between the multi-faceted and fire interest trajectories relates to the existence of fire interest in the service of antisocial goals and

cognitions and the presence of self regulation/communication deficits for those individuals falling into the multi-faceted trajectory (Gannon et al., 2012).

Though the M-TTAF provides a clear explanation of how developmental factors, psychological vulnerabilities, proximal factors, and moderators interact with one another, it does not discuss in detail how the identified psychological vulnerabilities interact with each other. For example, how do self/emotional regulation issues and communication problems influence an inappropriate interest in fire? Additionally, whilst the M-TTAF does not suggest that fire interest is necessary for firesetting, it does not explain why some individuals with higher levels of fire interest may not engage in firesetting and what other factors are necessary to make this a critical risk factor.

Continuum of Fire Use Theory

While the previously described theories offer explanation for the aetiology of deliberate firesetting, these theories specifically relate to illegal, antisocial, or socially unacceptable use of fire, rather than fire use in general. More recently, Horsley (2020) developed the Continuum of Fire Use Theory (CoFUT) to explain both criminalised and non-criminalised fire use, using a qualitative data-driven approach. Horsley argues that fire use is a heterogeneous concept which should be represented by a continuum, with criminalised fire use at one pole and non-criminalised fire use at the other. 'Non-criminalised fire use' refers to fire-related behaviour which is generally seen as socially and legally acceptable, whereas 'criminalised fire use' refers to fire-related behaviour which is generally considered to be illegal or socially unacceptable, e.g., arson (Horsley, 2020). Horsley observes that previous research has tended to take a dichotomous approach, where participants are generally categorised as firesetters or non-firesetters, and contends that this behaviour is better understood on a continuum rather than as a categorical framework, due to the great variation in how fire is used or misused.

Horsley (2020) developed a theory of fire use (the CoFUT) from analysis of interviews with 24 adults about their fire-related experiences, half of whom were predominantly criminalised fire users (all serving prison sentences) and half of whom were predominantly non-criminalised fire users. Using grounded theory to analyse these interviews, Horsley identified themes for each group of fire users before combining these themes into the overarching CoFUT. The CoFUT consists of three themes relating to the psychological impact of fire use, namely: transient emotional state, self-concept, and psychological well-being. 'Transient emotional state' refers to the short-term positive effects of fire use on participants' emotional states (e.g., physiological arousal, sensory stimulation); 'self-concept' captures the role of fire in the identity of fire users; and 'psychological well-being' refers to the long-term positive effects of fire use on mental well-being for non-criminalised users (e.g., hope, optimism) and the long-term negative effects of firesetting on the psychological well-being of criminalised fire users (e.g., threat to self-esteem, cognitive dissonance). Horsley suggests that the positive effects experienced in the transient emotional state reinforces fire use/misuse, leading to the long-term effects described in the psychological well-being theme, while the role of fire in individuals' self-concepts may motivate them to continue engaging in fire use to maintain a stable identity.

Interestingly, the CoFUT does not directly address the role of fire interest in fire use/misuse. While previous theories (e.g., M-TTAF, Dynamic Behaviour Theory, Functional Analysis Theory) have specifically incorporated fire interest to some degree, the CoFUT instead focuses on various reinforcement factors and reasons for ongoing fire use. In other words, the CoFUT explains *why* fire users might be interested in fire (e.g., positive reinforcement, maintenance of identity) rather than *how* fire interest itself may interact with other factors and lead to engagement in fire use or misuse.

Micro-Theories

Following a similar grounded theory approach to Horsley's (2020) Continuum of Fire Use Theory, two micro-theories have also been developed to explain deliberate firesetting among apprehended populations. The first pathway model for deliberate firesetting was developed by Tyler et al. (2014), based on interviews with 23 apprehended adult firesetters with a diagnosed mental illness. The Firesetting Offence Chain for Mentally Disordered Offenders (FOC-MD) highlights the significance of mental illness and early childhood fire experiences as precursors to firesetting among mentally disordered offenders, and identifies three common pathways to firesetting within this population: *fire interest-childhood mental health, no fire interest-adult mental health,* and *fire interest-adult mental health* (Tyler et al., 2014). Within the FOC-MD, childhood fire risk factors were identified as engagement in firesetting during childhood, evidence of fire interest as a child, and a strong positive or negative affective reaction to fire as a child. Tyler et al. observed that participants who followed either the *fire interest-childhood mental health* or the *fire interest-adult mental health* pathway developed at least two fire risk factors in childhood, while firesetters following the *no fire interest-adult mental health* generally did not display any fire risk factors as a child. Elaborating on these fire-related risk factors, the FOC-MD explains that among some mentally disordered firesetters, early experiences with fire may lead to strong affective reactions towards fire, which then impacts on other features of their firesetting behaviour (e.g., planning, ignition, watching the fire). Furthermore, positive affective reactions to fire may act as a motivator for firesetting by positively reinforcing any interactions with fire, while negative affective reactions may lead to an individual considering fire use as a weapon or to harm others.

Reflecting the development of the FOC-MD and the CoFUT, Barnoux et al. (2015) also utilised a grounded theory approach in the formulation of the Descriptive Model of Adult

Male Firesetting (DMAF). Based on interviews with 38 male imprisoned firesetters, two pathways to firesetting were identified: *approach* (firesetters who aggressively approached offending behaviour to achieve their goals) and *avoidance* (firesetters who passively approached offending behaviour to achieve their goals). In the DMAF, childhood fire-related vulnerability factors were identified as an excessive interest in fire typically associated with strong positive affect, the normalisation of unconventional uses of fire, early deliberate juvenile firesetting, and negative experiences involving fire and the family home. Barnoux et al. note that the majority of participants who followed the *approach* pathway displayed two or more fire-related risk factors during childhood, and nearly all engaged in firesetting as a child, while participants following the *avoidant* pathway showed one or zero childhood fire risk factors. Similar to the FOC-MD, the DMAF points to the relevance of fire-related risk factors emerging in childhood, including affective reactions to and interest in fire. However, neither the FOC-MD nor the DMAF discuss how fire interest may interact with other factors (e.g., self regulation) on the path to firesetting. Furthermore, the generalisability of these micro-theories may be limited to the specific populations in which they were developed.

What is the Gap in the Literature?

Overall, the above theories and previously described empirical research supports a link between increased fire interest and firesetting behaviour, however recent findings by Butler and Gannon (2020) indicate this relationship may not be as straightforward as previously thought. Moreover, while previous research has examined the relationship between fire interest and firesetting, fire interest has not previously been considered as an outcome variable. Little is known about what individual personality factors may be associated with increased interest in fire, particularly among un-apprehended populations. For example, what is the relationship between fire interest and psychological variables such as thrill seeking and emotional regulation? There also appears to be a conceptual gap between

interest in fire as a normative part of childhood and how this translates into criminalised firesetting behaviour as an adult. As Lambie and Randell (2011) observe, understanding of the aetiology behind firesetting behaviour and potential developmental trajectories remain theoretically rather than empirically based. Lambie and Randell (2011) argue there are myriad factors which appear to influence firesetting and existing theories do not take sufficient account of the complexities of firesetting behaviour. This observation also applies to the psychological construct of an interest in fire, in that little is known about the forms and functions of fire interest and in what situations such an interest in fire may lead to deliberate firesetting.

In addition to this lack of research on the construct of fire interest, there are limitations to the existing firesetting literature. While a large portion of research has been conducted involving populations of apprehended firesetters, little is known regarding firesetters who have not come to professional attention. Among apprehended populations, firesetting has been associated with numerous psychological characteristics, such as boredom, anger, impulsivity, poor emotional regulation, and borderline personality traits (Hoerold & Tranah, 2014; Hurley & Monahan, 1969; Inciardi, 1970; Jackson et al., 1987; Lieb et al., 2004; Lindberg et al., 2005; Perrin-Wallqvist et al., 2004; Räsänan et al., 1996; Rice & Chaplin, 1979; Rix, 1994). However, it is inappropriate to generalise these findings to all firesetting populations, due to the relative lack of information known about un-apprehended firesetters and the emergence of recent research suggesting subtle differences between apprehended and un-apprehended firesetters (e.g., Barrowcliffe & Gannon, 2015, 2016). While previous research has supported a link between fire interest and firesetting among apprehended populations, recent findings by Butler and Gannon (2020) question whether this relationship may differ between populations. To strengthen the wider firesetting literature and inform prevention efforts, more information is needed about how psychological factors such

as fire interest and self/emotional regulation may play a role in firesetting among un-apprehended populations.

This thesis aims to gain a deeper understanding of fire interest by exploring how this construct interacts with previous exposure to fire and aspects of self and emotional regulation. Two studies were conducted among community samples: Study 1 examined the relationship between fire interest, previous exposure to fire, emotional dysregulation, impulsivity, and sensation seeking; Study 2 aimed to see if the findings of the first study could be replicated in another independent community sample, and also explored the relationship between factors found to be associated with fire interest and self-reported firesetting. Although this research is exploratory, based on existing theory and previous empirical findings, it was hypothesised that a) higher levels of previous exposure to fire, b) poorer emotional regulation, c) higher levels of sensation seeking, and d) higher levels of impulsivity, would be associated with increased levels of fire interest.

Method – Study 1

Design

An exploratory correlational study was conducted to explore the relationship between levels of previous exposure to fire, impulsiveness, emotional dysregulation, and sensation seeking (independent variables) and fire interest (dependent variable). A measure of impression management was also included to assess the effect of socially desirable responding and was included as a covariate in analysis.

Participants

An a-priori power analysis was conducted using Green's (1991) formula in order to determine an appropriate sample size for multiple regression analyses. Based on 12 predictor variables (i.e., all independent variables including subscales but excluding the covariate of impression management), the power analysis indicated a minimum sample of 146 participants

would be required to detect a medium effect size (0.50; Cohen, 1988) with a significance value of .05.

A community sample of adults were recruited using the crowd sourcing website, Prolific Academic (www.prolific.co). Crowd sourcing has previously been found to result in high data quality and has the advantages of obtaining data efficiently while increasing participant comfort when disclosing personal or sensitive information (Shapiro et al., 2013). Previous research has also reported that crowdsourcing platforms (such as Mechanical Turk and Prolific Academic) show more representative samples than recruiting from student populations (Goodman & Paolacci, 2017), and that Prolific Academic in particular provides more honest and high-quality data when compared to other equivalent platforms (Peer, 2017).

The study was made available to adults (aged 18 years or older) who were registered with the Prolific Academic website and who had identified themselves as currently residing in New Zealand. One hundred and fifty-two participants self-selected and accessed the online survey with 151 participants subsequently completing the questionnaire. Five participants failed at least three out of five attention check questions and therefore their data was not included in further analysis. This resulted in a final sample of 146 participants.

Seventy-four participants identified as male (50.7%) and 68 as female (46.6%), with four participants identifying as “other” (1.4%) or choosing not to identify their gender (1.4%). The majority of participants identified as NZ European/Pākehā (58.9%) or Asian (28.1%), and more than half reported being currently employed. Over half of participants were aged between 18 and 34 years (65.1%), with only 4.7% of participants aged over 55 years (see Table 1 for full demographic characteristics). Participation was anonymous and confidential and participants were paid an average of $4 NZD for their time following completion of the study.

Table 1

Demographic Characteristics of Participants

Demographic Characteristic	*n*	*%*
Gender		
Male	74	50.7
Female	68	46.6
Other	2	1.4
Prefer not to say	1	0.7
Not specified	1	0.7
Age		
18-24 years old	31	21.2
25-34 years old	58	39.7
35-44 years old	33	22.6
45-54 years old	11	7.5
55-64 years old	9	6.2
65-74 years old	3	2.1
75 years or older	1	0.7
Ethnicity		
NZ European/Pākehā	86	58.9
Māori	5	3.4
Pasifika	3	2.1
Asian	41	28.1
European	14	9.6
Middle Eastern	1	0.7
African	1	0.7
Latin American	3	2.1
Other	5	3.4
Occupation		
Employed	93	63.7
Student	28	19.2
Unemployed	20	13.7
Retired	2	1.4
Not specified	3	2.1

Note. Total percentage for ethnicity adds up to more than 100%, as some participants identified as more than one ethnicity. Total percentage for gender and occupation adds to 100.1% due to rounding effects. Missing data in gender and occupation have been categorised as ‘not specified’. Occupation was collapsed into the above categories based on answers provided in free response format.

Measures

Participants completed an online survey that comprised a battery of six questionnaires which were selected based on their use in previous research and their psychometric properties (see Appendix F). All questionnaires were presented in a random order to participants following completion of demographic information, which was always completed first. Cronbach's alpha scores for the following measures are reported based on the criteria outlined by George and Mallery (2003), specifically α above .90 is 'excellent', α between .80 and .89 is 'good', α between .70 and .79 is 'acceptable', α between 0.60 and 0.69 is 'questionable', α between 0.50 and 0.59 is 'poor', and α less than .50 is 'unacceptable'.

The Fire Setting Scale

The Fire Setting Scale (FSS) was developed by Gannon and Barrowcliffe (2012) from literature reviews examining the factors associated with adolescent and adult firesetters. The FSS is a 20-item self-report scale comprised of two 10-item subscales measuring Antisocial Behaviour (e.g., "I have physically threatened another person", "I am a rule breaker") and Fire Interest (e.g., "I am fascinated by fire", "I like to watch and feel fire". The items are rated using a 7-point Likert scale (1 = not at all like me, 7 = very strongly like me). In a United Kingdom community sample, Gannon and Barrowcliffe reported good internal consistency (overall α = .86, Antisocial Behaviour α = 0.80, Fire Interest α = .85) and test-retest reliability over a two-week period (overall r = .86, Antisocial Behaviour r = .84, Fire Interest r = .83). Items in the FSS are summed to obtain a total FSS score (range 20 to 140), with higher scores indicating higher levels of fire interest and antisocial behaviour. As the current study was specifically interested in examining fire interest, only the Fire Interest subscale was included in the questionnaire. Excellent internal consistency was found for the Fire Interest subscale of the FSS in the present study (α = .94). As only the Fire Interest subscale was utilised in this study, the range of total scores in the present study was 10 to 70.

Exposure to Fire Questionnaire

Exposure to fire was measured using three items adapted from Murray et al.'s (2015) questionnaire assessing individuals' previous experience with fire. In a 2015 study, Murray et al. developed a short questionnaire to investigate the relationship between childhood fire exposure and adult interest in fire. Participants were asked to report interactions with small fires, specifically small wood fires such as campfires, cooking fires, and hearth fires, e.g., "Before you turned 10 years old, how often were you in the presence of small fires (such as campfires, cooking fires, or hearth fires)?". Participants were instructed not to include any fires produced by manufactured items, such as gas or propane stoves, lighters, or lit cigarettes. Participants were asked to separately report their interactions with fire before the age of 10, between the ages of 10 and 18 years old, and in the past year. Responses were assessed on a 6-point Likert scale (1 = almost daily or more, 6 = never). Each item was utilised as a separate independent variable rather than obtaining a total score for exposure to fire.

In order to include normative examples for the New Zealand context and avoid confusion for participants, the present study did not restrict fire exposure to small wood fires and no exclusion criteria were provided to participants. Three items were presented to assess exposure to fire before the age of 10, between 10 and 18 years of age, and since the age of 18 years old (e.g., "Between 10 and 18 years of age, how often were you in the presence of fire(s)? E.g., log fires, bonfires, campfires"). The same fire examples were included for each item (i.e., log fires, bonfires, campfires). Responses were measured on a 6-point Likert scale (1 = never, 6 = daily or almost daily), where a higher score reflects more exposure to fire. Each item was treated as a separate independent variable in order to differentiate between varying levels of exposure to fire at different life stages. As each timeframe was assessed by

a single item rather than calculating a total exposure to fire score, Cronbach's alphas could not be calculated for these single items.

The Barratt Impulsiveness Scale – Brief

The Barratt Impulsiveness Scale (BIS-11) is a 30-item scale designed to assess the personality/behavioural construct of impulsiveness (Patton et al., 1995). Following a factor analysis of the BIS-11, the Barratt Impulsiveness Scale-Brief (BIS-Brief) was developed as a unidimensional measure including eight of the original BIS-11 items (Steinberg et al., 2013; e.g., "I plan tasks carefully", "I act on the spur of the moment"). The items are rated on a 4-point Likert scale (1= rarely/never, 4 = almost always/always), with half of the items reverse scored before being summed to obtain a total BIS-Brief score. The BIS-Brief has a range of possible total scores of 8 to 32, with higher scores representing higher levels of impulsiveness. The BIS-Brief has been found to have acceptable internal consistency (average $\alpha = .78$ across multiple samples; Steinberg et al., 2012) and similar predictive validity to the BIS-11 (Fields et al., 2015), with test-retest reliability ranging between $r = .66$ and $r = .83$ for time intervals of between two weeks and six months (Vasconcelos et al., 2012). Good internal consistency was found for the BIS-Brief in the present study ($\alpha = .83$).

The Difficulties in Emotion Regulation Scale

The Difficulties in Emotion Regulation Scale (DERS) is a 36-item multidimensional scale designed to assess clinically relevant difficulties in emotion regulation (Gratz & Roemer, 2004). Items are presented as first-person statements relating to emotional regulation (e.g., "I am attentive to my feelings", "When I'm upset, I feel out of control") and participants indicate how often the statements apply to them on a 5-point Likert scale (1 = almost never [0-10%], 5 = almost always [91-100%]). Eleven items are reverse scored before being summed to obtain a total DERS score, with a possible range between 36 and 180 and higher scores suggestive of greater problems with emotion regulation. Gratz and Roemer

(2004) found excellent internal consistency for the total DERS scale (overall α = .93) based on a sample of undergraduate students, with a test-retest reliability coefficient of *r* = .88 over four to eight weeks for the total DERS scale. Similar internal consistency was found for the DERS in the present study (overall α = .94).

As a multidimensional scale, the DERS is comprised of six subscales assessing emotion regulation/dysregulation: '*Nonacceptance'* measures nonaccepting or negative secondary responses to distressing emotions (e.g., "When I'm upset, I become angry with myself for feeling that way"); '*goals'* measures difficulties engaging in goal-directed behaviours when distressed (e.g., "When I'm upset, I have difficulty getting work done"); '*impulse'* measures difficulties controlling impulsive behaviours when distressed (e.g., "I experience my emotions as overwhelming and out of control"); 'a*wareness'* measures a decreased tendency to attend to and acknowledge emotional responses (e.g., "I pay attention to how I feel", reverse scored); 's*trategies'* measures limited access to emotion regulation strategies perceived as effective (e.g., "When I'm upset, I believe that I will remain that way for a long time"); and 'c*larity'* measures lack of knowledge regarding the emotions an individual is experiencing (e.g., "I have no idea how I am feeling"). Gratz and Roemer reported good internal consistency for each subscale, with Cronbach's α > .80 for each subscale (*nonacceptance* α = .85, *goals* α = .89, *impulse* α = .86, *awareness* α = .80, *strategies* α = .88, *clarity* α = .84). Test-retest reliability over four to eight weeks was adequate for each subscale (*nonacceptance r* = .69, *goals r* = .69, *impulse r* = .57, *awareness r* = .68, *strategies r* = .89, *clarity r* = .80; all *p*s < .01). Similar internal consistency was found in the present study for each subscale (*nonacceptance* α = .90, *goals* α = .89, *impulse* α = .89, *awareness* α = .78, *strategies* α = .87, *clarity* α = .84).

The Zuckerman-Kuhlman-Aluja Personality Questionnaire – Shortened Form

The Zuckerman-Kuhlman Personality Questionnaire (ZKPQ; Zuckerman et al., 1988) is a psychometric instrument which was developed based on a biological/evolutionary five-factor model of personality. The ZKPQ comprises 99 true-false items and includes subscales of Impulsive Sensation Seeking, Neuroticism-Anxiety, Aggression-Hostility, Sociability, and Activity. Following factor analysis of the ZKPQ and further research regarding personality factors, the Zuckerman-Kuhlman-Aluja Personality Questionnaire (ZKA-PQ) was developed as a 200-item factor/facet version of the ZKPQ (Aluja et al., 2010). The ZKA-PQ includes five personality factors (Sensation Seeking, Neuroticism, Aggressiveness, Extraversion, and Activity) with four facets for each factor (e.g., Neuroticism further defined into facets of anxiety, depression, dependency, and low self-esteem). The ZKA-PQ utilises a Likert scale rather than the ZKPQ's true-false response format. A shortened version of the ZKA-PQ was then developed as an abbreviated form to decrease participant load and increase inclusion of the form in further studies (Aluja et al., 2018).

The Zuckerman-Kuhlman-Aluja Personality Questionnaire shortened form (ZKA-PQ/SF) is an 80-item questionnaire with a 4-point Likert scale response format (1 = disagree strongly, 4 = agree strongly). The questionnaire includes items such as "I like to keep busy all the time" and "I am usually in a good mood". The ZKA-PQ/SF includes the same five personality factors and four facets for each factor as the ZKA-PQ and has been found to have good or excellent internal consistency for each factor (Aggressiveness $\alpha = .90$, Activity $\alpha = .82$, Extraversion $\alpha = .86$, Neuroticism $\alpha = .86$, Sensation Seeking $\alpha = .88$; Aluja et al., 2018). Test-retest coefficients for a three-month period were $r = .83$, $r = .84$, $r = .80$, $r = .78$ and $r = .82$ for Neuroticism, Sensation Seeking, Extraversion, Activity and Aggressiveness, respectively (Aluja et al., 2018). The ZKA-PQ/SF was utilised in the current study due to its good psychometric properties and retainment of the original 20 facets of the ZKA-PQ. Only

items relating to the Sensation Seeking factor were included in the present study, as the remaining four factors were not relevant to the research question. The Sensation Seeking (SS) subscale includes facets of thrill and adventure seeking (SS1; e.g., "I like physical activities that are somewhat risky", experience seeking (SS2; e.g., "I would like travelling a lot, with lots of change and excitement"), disinhibition (SS3; e.g., "I like 'wild' uninhibited parties"), and boredom susceptibility/impulsivity (SS4; e.g., "I am bad at maintaining a routine"). One item is reverse scored and the items are summed to obtain a total SS score, with the items for each facet also summed individually to obtain facet scores. The total SS score can range from 16 to 64, with higher scores indicating higher levels of sensation seeking. Questionable to acceptable internal consistency has been found for each SS subscale (SS1 $\alpha = .78$, SS2 $\alpha = .73$, SS3 $\alpha = .77$, SS4 $\alpha = .66$; Aluja et al., 2018). In the present study, similar internal consistency was found for the total SS factor ($\alpha = .84$) and for each facet (SS1 $\alpha = .71$, SS2 $\alpha = .74$, SS3 $\alpha = .69$, SS4 $\alpha = .51$).

The Balanced Inventory of Desirable Responding

Paulhus' (1984, 1988) Balanced Inventory of Desirable Responding (BIDR; version 6) is a 40-item scale designed to assess socially desirable responding. The BIDR comprises two 20-item subscales measuring Self-Deceptive Enhancement (the tendency to give self-reports that are honest but positively biased; e.g., "My first impressions of people usually turn out to be right", "I always know why I like things") and Impression Management (deliberate positive self-presentation to an audience; e.g., "I sometimes tell lies if I have to", "I never swear"). The BIDR is rated on a 7-point Likert scale (1 = not true, 7 = very true), with half of the items reverse scored before adding one point for each extreme response (6 or 7) to obtain total scores for each subscale and the BIDR as a whole. Total scores for Self-Deceptive Enhancement (SDE) and Impression Management (IM) can each range from 0 to 20, with higher scores representing a greater tendency to provide socially desirable responses. Paulhus

(1988) reports questionable to good internal consistency for the SDE subscale (α range from .68 to .80), the IM subscale (α range from .75 to .86) and the BIDR total (α = .83). Test-retest reliability over a five-week period was found to be *r* = .69 for the SDE and *r* = .65 for the IM subscale (Paulhus, 1988). In the present study only the IM subscale was included due to the self-reporting nature of the study. Similar internal consistency was found for the BIDR-IM in the present study (α = .82).

Procedure

This research was approved by the Victoria University of Wellington Human Ethics Committee (ResearchMaster ID 0000028384). The survey was published on the Prolific Academic website in May 2020 and advertised to those individuals who were registered as a potential participant and who met the eligibility criteria for the study (i.e., over the age of 18 and currently residing in New Zealand). Participants who viewed the online study were presented with an information sheet followed by a consent form, where participants were required to tick a box to provide consent before proceeding with the study (see Appendices A and C). Demographic information was collected after consent was obtained. Participants were then asked to complete the battery of questionnaires which were presented in randomised blocks using the inbuilt function in Qualtrics. To confirm participants were paying attention to the measures, a total of five attention check items were interspersed among items of the FSS, the BIS-Brief, the ZKA-PQ/SF, and the DERS. An example attention check item is "Please respond almost always/always". Data from participants who responded incorrectly to three or more attention check items were excluded from analysis. A debrief sheet explaining the purpose of the research was presented at the end of the study (see Appendix D). Participants received payment directly into their Prolific Academic accounts within three weeks of completing the study.

Data Analysis Plan

Kruskall-Wallis H tests were conducted to determine whether any significant difference in fire interest existed between age groups or gender groups. Due to the small number of participants in the age groups of 55-64 years, 65-74 years, and 75+ years, these three categories were collapsed into one category (55+ years) prior to analysis. Kruskall-Wallis H tests showed there were no statistically significant differences in fire interest for age (p = .597) or gender (p = .122*).*

Bivariate correlations were conducted to examine the strength and direction of the relationships between the dependent variable of fire interest, the control variable of impression management, and each of the independent variables of exposure to fire, impulsiveness, emotional dysregulation, and sensation seeking. Two hierarchical multiple regressions were then conducted to explore which independent variables (and corresponding subscales) acted as significant predictors of fire interest, if any.

The assumptions of multiple regression were tested to confirm that there were no issues with multicollinearity, singularity, outliers, normality, linearity, homoscedascity and independence of residuals. A check of correlations showed a Pearson correlation coefficient of .81 between the variables measuring exposure to fire before age 10 (ETF before 10) and exposure to fire between ages 10 and 18 (ETF between 10 and 18), thereby violating the multicollinearity assumption. To resolve this multicollinearity issue, a new variable was computed to combine ETF before 10 and ETF between 10 and 18 (Frost, 2019; Pallant, 2020). The variables of ETF before 10 and ETF between 10 and 18 were collapsed into one variable by summing and dividing by two, in order to maintain the same 6-point scale as the remaining ETF since 18 item. The variable of ETF before 18 was utilised for all further analyses in lieu of ETF before 10 and ETF between 10 and 18.

One outlier was identified with a Mahalanobis distance which exceeded the critical chi-square value of 20.52 (critical value based on five independent variables). This outlier was not excluded from further analyses as it did not have a standardised residual of more than 3.3 and the maximum Cook's distance showed a value of 0.80, indicating no undue influence on the results caused by the outlier.

Multiple regression analyses were conducted to explore whether previous exposure to fire (independent variables of ETF before 18 and ETF since 18), impulsiveness, sensation seeking, and difficulties in emotion regulation (independent variables of BIS-Brief, SS factor of the ZKA-PQ/SF, and DERS) were predictive of increased levels of fire interest (dependent variable of Fire Interest subscale of the FSS). As this is exploratory research, two hierarchical multiple regressions were run; one with the total scores for each variable and one with the subscales of the DERS and the SS factor of the ZKA-PQ/SF (and total scores for all remaining variables). As the Impression Management subscale of the BIDR was significantly correlated with the Fire Interest subscale of the FSS, the BIDR-IM was controlled for in the analysis and entered as a covariate in block one of each regression model and the independent variables entered into block two.

Results – Study 1

Missing Data

With the exception of one attention check item (which had four missing data points), no item was missing more than two responses. Pro-rating was used to calculate the subscales and total scores for the independent variables, control variable and dependent variable where there were missing responses. Pro-rating was considered an appropriate technique to address missing data due to the small number of missing data points (total of 24 pro-rated responses). Pro-rating has previously been validated as an appropriate technique to address missing data

(Schretlen & Ivnik, 1996), particularly when missing data is less than 15% of total data (Marley & Barrett, 2001).

Descriptive Statistics

Means, standard deviations and ranges were calculated for all variables (including subscales) – refer to Table 2 for the descriptive statistics for all variables included in this study.

Table 2

Mean Scores and Ranges for All Variables

Measure	Mean (*SD*)	Scale range in current sample	Total possible scale range
Exposure to fire (until age 18)	3.34 (1.15)	1-6	1-6
Exposure to fire (since age 18)	3.00 (1.03)	1-6	1-6
FIS	33.34 (13.44)	10-68	10-70
BIS-Brief	16.63 (4.04)	8-29	8-32
DERS			
Nonacceptance	13.70 (5.57)	6-30	6-30
Goals	15.64 (4.56)	5-25	5-25
Impulse	11.70 (4.60)	6-28	6-30
Awareness	15.61 (4.17)	6-28	6-30
Strategies	17.77 (5.93)	8-40	8-40
Clarity	11.14 (3.60)	5-24	5-25
Total score	85.57 (20.40)	43-172	36-180
SS factor of ZKA-PQ/SF			
Thrill and adventure seeking	8.37 (2.71)	4-14	4-16
Experience seeking	11.15 (3.60)	4-16	4-16
Disinhibition	9.03 (2.47)	4-16	4-16
Boredom susceptibility and impulsivity	10.27 (2.01)	5-15	4-16
Total score	38.82 (7.49)	21-58	16-64
BIDR-IM	6.99 (3.89)	0-19	0-20

Bivariate Correlations

Bivariate correlations were conducted to examine the relationships between the dependent variable (FIS), the covariate (BIDR-IM), and each of the independent variables

(DERS including subscales of *nonacceptance, goals, impulse, awareness, strategies,* and *clarity;* Sensation Seeking subscale of ZKA-PQ/SF including facets of *thrill and adventure seeking, experience seeking, disinhibition,* and *boredom susceptibility and impulsivity*; BIS – Brief; exposure to fire before the age of 18; and exposure to fire since the age of 18) – refer to Table 3 for correlation matrix for all variables. All independent variables were significantly positively correlated with fire interest, with the exceptions of the BIS-Brief and the DERS subscales of *impulse* and *awareness*. Impression management was significantly negatively correlated with the dependent variable and with all independent variables, except for exposure to fire since the age of 18 and three of the four SS facets (*thrill and adventure seeking, experience seeking,* and *boredom susceptibility and impulsivity*), which were not significantly correlated. These significant negative correlations indicate that participants with higher scores on impression management responded with lower scores on certain measures including fire interest, and impression management was therefore controlled for in further analysis.

Table 3

Bivariate Correlations between All Variables

Measure	FIS	1	2	3	4	4a	4b	4c	4d	4e	4f	5	5a	5b	5c	5d
1. ETF before 18	.23**															
2. ETF since 18	.22**	.50**														
3. BIS-Brief	.15	.04	-.06													
4. DERS	.25**	.04	-.02	.54**												
4a. Nonacceptance	.23**	.00	.03	.28**	.72**											
4b. Goals	.25**	.02	-.06	.48**	.71**	.35**										
4c. Impulse	.16	.12	.03	.51**	.78**	.46**	.57**									
4d. Awareness	.03	-.07	-.11	.24**	.51**	.21**	.13	.20*								
4e. Strategies	.20*	.09	.02	.44**	.88**	.54**	.65**	.65**	.31**							
4f. Clarity	.20*	.01	-.01	.45**	.77**	.47**	.38**	.51**	.53**	.59**						
5. SS	.31**	.11	.16*	.29**	.04	.09	-.05	.15	-.10	-.02	.09					
5a. Thrill and adventure seeking	.26**	.22**	.15	.13	-.03	.01	-.12	.12	-.03	-.06	-.02	.74**				
5b. Experience seeking	.19*	-.05	.05	.13	-.11	.00	-.13	-.01	-.22**	-.10	.06	.79**	.39**			
5c. Disinhibition	.27**	.13	.13	.34**	.14	.17*	.04	.22**	-.08	.08	.17*	.83**	.49**	.57**		
5d. Boredom susceptibility and impulsivity	.22**	.03	.18*	.34**	.14	.10	.08	.14	.05	.04	.25**	.70**	.31**	.44**	.50**	
6. BIDR-IM	-.18*	-.20*	-.16	-.44**	-.41**	-.27**	-.35**	-.37**	-.20**	-.28**	-.35**	-.18*	-.05	-.04	-.36**	-.10

Note. * Correlation is significant at the .05 level (2-tailed). ** Correlation is significant at the .01 level (2-tailed).

Multiple Regression Examining Predictors of Fire Interest: Total Scores for all Measures

Since this research is exploratory in nature, a hierarchical multiple regression was first conducted using the total scores for all measures, with all factors entered simultaneously, to examine which of the independent variables were predictors of increased levels of fire interest, while controlling for the influence of impression management. Preliminary analyses were conducted to check if the assumptions of normality, linearity, multicollinearity and homoscedascity were met; none of the assumptions were violated. Impression management was entered at Step 1, explaining 3% of the variance in fire interest. After entry of the measures for previous exposure to fire, sensation seeking, impulsiveness and difficulties in emotion regulation at Step 2 (utilising total scale scores for DERS and SS), the total variance explained by the model as a whole was 20.0%, $F(6, 139) = 5.79$, $p < .001$. The overall model was significant, and the five predictor variables explained an additional 17% of the variance in fire interest, after controlling for impression management, *R* squared change = .17, *F* change (5, 139) = 5.86, $p < .001$. In the final model, only the predictor variables of the SS factor of the ZKA-PQ/SF and the DERS were statistically significant, with both factors contributing a similar amount of variance (SS: $\beta = .29$, $p = .001$; DERS: $\beta = .28$, $p = .004$). Refer to Table 4 for hierarchical multiple regression statistics for all independent variables, including total scores for DERS and SS.

Table 4

Hierarchical Multiple Regression Statistics for All Independent Variables, Not Including Subscales

Measure	*β*	*t*	*p*
ETF before 18	.14	1.54	.126
ETF since 18	.10	1.15	.253
BIS-Brief	-.08	-.84	.402
DERS	.28	2.93	.004
SS	.29	3.53	.001

Note. To control for the effects of impression management, the BIDR-IM was entered as Block 1 of the hierarchical multiple regression.

Multiple Regression Examining Predictors of Fire Interest: Subscale Scores for DERS and SS

Due to several of the independent variables representing multi-faceted constructs, we wanted to further understand if there were particular facets of these factors that were predictive of increased fire interest. Therefore, a second hierarchical multiple regression was conducted to examine whether any of the subscales of the independent variables predicted increased levels of fire interest better than the total scores for these scales. Again, impression management was entered at Step 1, explaining 3% of the variance in fire interest, and the measures for previous exposure to fire, impulsiveness, the individual facets of sensation seeking (*thrill and adventure seeking, experience seeking, disinhibition,* and *boredom susceptibility and impulsivity*) and the subscales of difficulties in emotion regulation (*nonacceptance, goals, impulse, awareness, strategies,* and *clarity*) were entered at Step 2. The final model, including the 13 predictor variables, was significant with the total variance explained as 25.9%, $F(14, 131) = 3.27$, $p < .001$. The 13 predictor variables explained an additional 23% of the variance in fire interest, after controlling for impression management,

R squared change = .23, *F* change (13, 131) = 3.10, $p < .001$. In the final model, only the predictor variables of the DERS *goals* subscale and the SS *thrill and adventure seeking* facet were statistically significant, with the *goals* subscale contributing more variance than the *thrill and adventure seeking* facet (*goals* subscale*:* $\beta = .35$, $p = .002$; *thrill and adventure seeking* facet: $\beta = .19$, $p = .044$). Refer to Table 5 for hierarchical multiple regression statistics for all independent variables, including subscales/facets for DERS and SS.

Table 5

Hierarchical Multiple Regression Statistics for All Independent Variables, Including Subscales

Measure	*β*	*t*	*p*
ETF before 18	.15	1.60	.112
ETF since 18	.12	1.32	.189
BIS-Brief	-.08	-.78	.436
DERS Nonacceptance	.15	1.59	.115
DERS Goals	.35	3.13	.002
DERS Impulse	-.17	-1.50	.137
DERS Awareness	.01	.08	.933
DERS Strategies	-.04	-.34	.734
DERS Clarity	.15	1.26	.210
SS1 Thrill and adventure seeking	.19	2.03	.044
SS2 Experience seeking	.14	1.33	.186
SS3 Disinhibition	.07	.62	.539
SS4 Boredom susceptibility and impulsivity	.01	.14	.889

Note. To control for the effects of impression management, the BIDR-IM was entered as Block 1 of the hierarchical multiple regression.

Comparisons between the Two Regression Models

When comparing the total amount of variance explained by each model, it appears that including the subscales led to a 5.9% better fit than when only including total scores for each scale. However, the larger number of predictor variables in the second model may have

contributed to this difference. To take into account the different number of predictor variables when comparing regression models, adjusted R squared values were compared between the two hierarchical multiple regressions. When the total scales for DERS and SS were included in the regression analysis, the adjusted R squared value of the model was .17. When the individual subscales and facets of the DERS and SS were included instead of the total scores, the adjusted R squared valued of the model was .18, indicating similar predictive value between the two models. It is noted that when comparing individual beta values between models, the *goals* subscale appears to be driving the effect for the total DERS scale while *thrill and adventure seeking* appears to be driving the effect for the total SS factor.

While these results provide us with an insight into some of the correlates of increased fire interest (e.g., difficulties in engaging in goal-directed behaviour when distressed, tendency for thrill and adventure seeking), this study does not provide us with information about how the relationship between these variables and fire interest may interact to produce the behaviour of deliberate firesetting. In order to examine the relationship between these variables further, we conducted a second study which aimed to (a) replicate the findings of the first study, and (b) investigate the relationship between exposure to fire, facets of emotional and self regulation, fire interest, and self-reported firesetting behaviour.

Method – Study 2

Design

A correlational study was conducted to a) replicate the findings of Study 1, and b) explore how the variables of exposure to fire, impulsiveness, emotional dysregulation, and sensation seeking interact with fire interest to predict firesetting behaviour. In the replication section of this study, fire interest remained the dependent variable with the same independent variables as Study 1 (i.e., ETF, BIS-Brief, SS factor of the ZKA-PQ/SF, DERS). The second section of this study examined engagement in firesetting behaviour as the dependent variable

and included the same independent variables as Study 1, with the addition of fire interest as an independent variable. Impression management was again included as a covariate to assess and control for the effect of socially desirable responding in both sections.

Participants

Participants were recruited via the Prolific Academic website using the same method described in Study 1. In order to ensure an independent sample was obtained and to avoid practice effects, a filter on the Prolific Academic website was used to exclude any participants who completed Study 1. One hundred and fifty New Zealand based adults completed the online questionnaire as part of study 2. While no participants failed more than three attention check questions, one participant failed three of these attention checks. Further examination of this participant's responses indicated a response pattern of consecutive extreme responses throughout the questionnaire, alternating between each measure (i.e., this participant responded '1 = not at all like me' to all items on the Fire Setting Scale, '6 = never' to all items assessing previous exposure to fire, '4 = almost always/always' to all items on the Barratt Impulsiveness Scale – Brief, and '1 = almost never [0-10%]' to all Difficulties in Emotion Regulation Scale items). As the attention check items required responses at the extreme ends of each measure, two of the attention check questions may have been passed as a result of the extreme response pattern of this participant. Previous research has suggested utilising a longstring technique for identifying such response patterns (where the maximum longstring number is the highest number of consecutive invariant responses provided by a participant) and screening on the basis of six to 14 invariant responses in a row (Costa & McCrae, 2008; Huang et al., 2012). This participant's responses reflected a maximum longstring of 36 and their data was therefore not included in further analysis. This resulted in a final sample of 149 participants.

Of the final sample, 64 participants identified as male (43.0%) and 82 as female (55.0%), with three participants identifying as “other” (0.7%) or choosing not to identify their gender (1.4%). The majority of participants identified as NZ European/Pākehā (57.0%) or Asian (24.2%), and more than half reported being currently employed. Over half of participants were aged between 18 and 34 years (65.1%), with only 4.7% of participants aged over 55 years (see Table 6 for full demographic characteristics).

Table 6

Demographic Characteristics of Participants

Demographic Characteristic	*n*	*%*
Gender		
Male	64	43.0
Female	82	55.0
Other	1	0.7
Prefer not to say	1	0.7
Not specified	1	0.7
Age		
18-24 years old	40	26.8
25-34 years old	57	38.3
35-44 years old	28	18.8
45-54 years old	17	11.4
55-64 years old	4	2.7
65-74 years old	2	1.3
75 years or older	0	0
Not specified	1	0.7
Ethnicity		
NZ European/Pākehā	85	57.0
Māori	8	5.4
Pasifika	1	0.7
Asian	36	24.2
European	15	10.1
Middle Eastern	4	2.7
African	4	2.7
Latin American	0	0
Other	14	9.4
Occupation		
Employed	88	59.1
Student	31	20.8
Unemployed	16	10.7
Retired	2	1.3
Not specified	12	8.1

Note. Total percentage for ethnicity adds up to more than 100%, as some participants identified as more than one ethnicity. Total percentage for gender adds to 100.1% due to rounding effects. Missing data in gender, age, and occupation have been categorised as 'not specified'. Occupation was collapsed into the above categories based on answers provided in free response format.

Measures and Procedure

The measures and procedure replicated those of the previous study and are described in detail in the method section of Study 1 (page 31). In line with the preceding study, participants answered a demographic section before completing measures assessing previous exposure to fire, fire interest, emotional dysregulation, sensation seeking, impulsivity, and impression management (see Appendices B, C and E). An additional question was also included in this study to investigate deliberate firesetting behaviour, more specifically an item adapted from Gannon and Barrowcliffe (2012; see Appendix G).

Gannon and Barrowcliffe (2012) designed a single response item to measure firesetting behaviours in the UK general population. This question asks participants to self-report how many fires they have set intentionally for a variety of reasons, including fires set to annoy other people, fires set as a result of boredom, fires set for revenge, fires set to create excitement, fires set for insurance purposes, fires set as a result of peer pressure, and fires set to destroy evidence. Participants are instructed to exclude any fires set before the age of 10 years, fires set accidentally, and fires set for organised or social events (e.g., barbecues). Participants respond on a 6-point scale indicating whether they have set zero, one, two, three, four, or five or more deliberate fires. This question has previously been used to assess fire misuse in the UK general population and has been found to identify acts of deliberate firesetting while excluding normative fire use (e.g., Barrowcliffe & Gannon, 2015, 2016; Barrowcliffe et al., 2019; Butler & Gannon, 2020; Gannon & Barrowcliffe, 2012). To adapt this question to a New Zealand context, a culturally appropriate example of hāngi was provided instead of "a hog roast" when asking participants to exclude fires set for social occasions. As the age of criminal responsibility for serious offences (including arson) is the same in New Zealand as it is in the UK (where this question was designed), the instruction asking participants to exclude fires set before the age of 10 was not changed.

As with Study 1, internal consistency for each scale is reported against George and Mallery's (2003) criteria. In this study, the Fire Interest subscale of the Fire Setting Scale demonstrated excellent internal consistency (α = .91), and acceptable internal consistency was found for both the Barratt Impulsiveness Scale – Brief and the Impression Management subscale of the Balanced Inventory of Desirable Responding (α = .79 for both scales). The Difficulties in Emotion Regulation Scale demonstrated excellent internal consistency (α = .95), with good to excellent consistency found for each subscale (*nonacceptance* α = .92, *goals* α = .90, *impulse* α = .88, *awareness* α = .82, *strategies* α = .90, *clarity* α = .89). Good internal consistency was found for the Sensation Seeking factor of the Zuckerman-Kuhlman-Aluja Personality Questionnaire – Shortened Form (α = .86), with the individual facets ranging from poor to acceptable (SS1 α = .76, SS2 α = .67, SS3 α = .70, SS4 α = .56). These results reflect similar internal consistencies found for each scale/subscale in Study 1.

Data Analysis Plan

Section 1: Replication of Study 1

Kruskall-Wallis H tests were conducted to determine whether any significant difference in fire interest existed between age groups or gender groups. Due to the small number of participants in the age groups of 55-64 years, 65-74 years, and 75+ years, these three categories were collapsed into one category (55+ years) prior to analysis. Kruskall-Wallis H tests showed there were no statistically significant differences in fire interest for age (p = .094) or gender (p = .325).

Bivariate correlations were conducted to examine the strength and direction of the relationships between the dependent variable of fire interest, the control variable of impression management, and each of the independent variables of exposure to fire, impulsiveness, emotional dysregulation, and sensation seeking, as well as the additional

dependent variable of intentional firesetting. A multiple regression was then conducted to explore which independent variables act as significant predictors of fire interest, if any.

The assumptions of multiple regression were tested to confirm no issues with multicollinearity, singularity, outliers, normality, linearity, homoscedascity and independence of residuals. A check of correlations showed a Pearson correlation coefficient of .76 between the variables measuring exposure to fire before age 10 (ETF before 10) and exposure to fire between ages 10 and 18 (ETF between 10 and 18), thereby violating the multicollinearity assumption. To resolve this multicollinearity issue, a new variable was computed to combine ETF before 10 and ETF between 10 and 18 (Frost, 2019; Pallant, 2020). The variables of ETF before 10 and ETF between 10 and 18 were collapsed into one variable by summing and dividing by two, in order to maintain the same 6-point scale as the remaining ETF since 18 item. The variable of ETF before 18 was utilised for all further analyses in lieu of ETF before 10 and ETF between 10 and 18.

One outlier was identified with a Mahalanobis distance which exceeded the critical chi-square value of 20.52 (critical value based on five independent variables). This outlier was not excluded from further analyses as it did not have a standardised residual of more than 3.3 and the maximum Cook's distance showed a value of 0.08, indicating no undue influence on the results caused by the outlier. Multiple regression analyses were conducted to explore whether previous exposure to fire (independent variables of ETF before 18 and ETF since 18) and measures of impulsiveness, sensation seeking, and difficulties in emotion regulation (independent variables of BIS-Brief, SS factor of the ZKA-PQ/SF, and DERS) are predictors of level of fire interest (dependent variable of Fire Interest subscale of the FSS). As with Study 1, two regressions were run; one with the total scores for each variable and one with the subscales of the DERS and the SS factor of the ZKA-PQ/SF (and total scores for all remaining variables). However, in this study these regression models were linear rather than

hierarchical, as there was no significant correlation found between impression management and fire interest.

Section 2: Engagement in Firesetting Behaviour and Relationship with Other Variables

In the second section of this study, analyses were conducted to examine which of the factors of fire interest, impulsiveness, emotional dysregulation, sensation seeking, and previous exposure to fire were associated with deliberate firesetting behaviour (e.g., able to distinguish between firesetters and non-firesetters). Intentional firesetting was recoded into a binary variable, where participants who reported setting zero fires were coded as 0 (i.e., non-firesetters) and participants who reported setting at least one fire were coded as 1 (i.e., firesetters).

Mean scale scores were calculated separately for firesetters and non-firesetters, and univariate analyses were performed to determine if there were any significant differences between firesetters and non-firesetters for the measures assessing fire interest, impulsiveness, emotional dysregulation (total score), sensation seeking (total score), previous exposure to fire, and impression management. Due to previous research identifying gender differences in firesetting status (e.g., Gannon, 2010), univariate analyses were also performed to determine if there were any significant differences between gender and firesetting status. Multivariate analyses were performed to determine if there were any differences between firesetters and non-firesetters across the subscales of the DERS and the facets of SS. To reduce the risk of Type 1 error, statistical significance was determined using a Bonferroni-corrected p-value ($p \leq .013$). The factors which were found to discriminate firesetting status based on the results of the MANOVA were then entered into a binary logistic regression to further explore which of these factors acted as significant predictors of firesetting status. Moderation analyses were then performed to explore the relationship between fire interest, firesetting status, and the other significant predictor variables.

Results – Study 2

Missing Data

No item was missing more than three responses. Pro-rating was again used to calculate the subscales and total scores for independent variables and dependent variable where responses were missing, resulting in a total of 22 pro-rated responses.

Descriptive Statistics

Means, standard deviations and ranges were calculated for all variables (including subscales) – refer to Table 7 for full descriptive statistics. These results were similar to those found in Study 1, however it is noted a higher level of fire interest was reported in this study (study 1 fire interest: M = 33.34, SD = 13.44; study 2 fire interest: M = 36.01, SD = 13.52). An independent samples t-test showed this difference was not statistically significant, $t(293) = -1.70$, $p = .090$, $d = 0.20$.

Table 7

Mean Scores and Ranges for All Variables

Measure	Mean (*SD)*	Scale range in current sample	Total possible scale range
Exposure to fire (until age 18)	3.28 (1.12)	1-6	1-6
Exposure to fire (since age 18)	2.89 (1.13)	1-6	1-6
FIS	36.01 (13.52)	10-70	10-70
BIS-Brief	16.51 (4.02)	8-27	8-32
DERS			
Nonacceptance	15.19 (6.23)	6-30	6-30
Goals	15.74 (4.82)	5-25	5-25
Impulse	12.99 (5.00)	6-30	6-30
Awareness	14.82 (4.56)	6-27	6-30
Strategies	19.70 (7.15)	8-40	8-40
Clarity	11.28 (4.16)	5-25	5-25
Total score	89.71 (23.62)	46-150	36-180
SS factor of ZKA-PQ/SF			
Thrill and adventure seeking	8.75 (3.02)	4-16	4-16
Experience seeking	11.18 (2.52)	5-16	4-16
Disinhibition	9.18 (2.52)	4-16	4-16
Boredom susceptibility and impulsivity	10.50 (2.33)	4-16	4-16
Total score	39.61 (8.22)	22-58	16-64
BIDR-IM	6.63 (3.89)	0-15	0-20
Intentional fires set	2.02 (1.71)	1-6	1-6

Section 1: Replication of Study 1

Bivariate Correlations

Correlational analysis was conducted to examine the relationships between the dependent variable (Fire Interest subscale of the FSS), the covariate (Impression Management subscale of the BIDR), and all independent variables (Difficulties in Emotion Regulation Scale including subscales of *nonacceptance, goals, impulse, awareness, strategies,* and *clarity;* Sensation Seeking subscale of ZKA-PQ/SF including facets of *thrill and adventure seeking, experience seeking, disinhibition,* and *boredom susceptibility and impulsivity*; Barratt Impulsiveness Scale – Brief; exposure to fire before the age of 18; and exposure to fire since the age of 18) – refer to Table 8 for correlation matrix of all variables. Both measures of

previous exposure to fire and the Sensation Seeking subscale (including all facets) were significantly positively correlated with fire interest. The BIS-Brief, total DERS score and all DERS subscales, and the BIDR-IM were not significantly correlated with fire interest. Impression management was significantly negatively correlated with the BIS-Brief, DERS total score and subscales of *impulse, awareness, strategies,* and *clarity,* and SS total score and facets of *thrill and adventure seeking* and *disinhibition.* In contrast to Study 1, impression management was not significantly correlated with fire interest. As impression management was not significantly correlated with fire interest in this study, this factor was not controlled for in subsequent analyses.

Table 8

Bivariate Correlations between All Variables

Measure	FIS	1	2	3	4	4a	4b	4c	4d	4e	4f	5	5a	5b	5c	5d
1. ETF before 18	.25**															
2. ETF since 18	.29**	.59**														
3. BIS-Brief	.16	-.01	.01													
4. DERS	.07	-.01	.04	.45**												
4a. Nonacceptance	.09	.03	.07	.29**	.76**											
4b. Goals	.04	-.04	.03	.33**	.70**	.41**										
4c. Impulse	.05	-.06	.00	.41**	.80**	.52**	.61**									
4d. Awareness	-.04	.01	-.01	.22**	.53**	.26**	.13	.21**								
4e. Strategies	.07	.00	.04	.34**	.87**	.59**	.60**	.67**	.31**							
4f. Clarity	.04	.03	.00	.40**	.70**	.41**	.31**	.45**	.58**	.47**						
5. SS	.40**	-.11	.07	.33**	.06	.07	-.03	.11	.00	.05	.08					
5a. Thrill and adventure seeking	.40**	.01	.17*	.16*	.06	.06	-.14	.02	.19*	.04	.09	.79**				
5b. Experience seeking	.22**	-.12	-.05	.20*	-.13	-.02	-.16*	-.11	-.08	-.10	-.09	.79**	.48**			
5c. Disinhibition	.35**	-.12	.07	.26**	.11	.08	.08	.21**	-.10	.07	.15	.81**	.50**	.50**		
5d. Boredom susceptibility and impulsivity	.29**	-.14	.01	.47**	.17*	.11	.16	.26**	-.06	.15	.10	.78**	.43**	.53**	.59**	
6. BIDR-IM	-.07	-.03	-.03	-.26**	-.33**	-.20*	-.10	-.35**	-.26**	-.23**	-.37**	-.22**	-.21**	-.06	-.31**	-.10

Note. * Correlation is significant at the .05 level (2-tailed). ** Correlation is significant at the .01 level (2-tailed)

Multiple Regression Examining Predictors of Fire Interest (Utilising Total Scores for all Measures)

A linear multiple regression was conducted to examine which of the independent variables (i.e., the factors of sensation seeking, emotional dysregulation, impulsivity, exposure to fire before the age of 18, and exposure to fire since the age of 18) were predictors of increased levels of fire interest. The overall model was significant, explaining 26.2% of the variance in fire interest, $F(5, 143) = 10.16$, $p < .001$. However, only exposure to fire before the age of 18 and sensation seeking were identified as being statistically significant predictors of fire interest, with sensation seeking explaining more of the variance than exposure to fire (sensation seeking: $\beta = .42$, $p < .001$; exposure to fire before the age of 18: $\beta = .23$, $p = .013$). There was no statistically significant correlation between the predictor variables of sensation seeking and exposure to fire before the age of 18, suggesting these two factors contribute independently towards fire interest. Refer to Table 9 for linear regression statistics for the total scores for all independent variables.

Table 9

Linear Multiple Regression Statistics for All Independent Variables, Not Including Subscales

Measure	*β*	*t*	*p*
ETF before 18	.23	2.50	.013
ETF since 18	.12	1.33	.185
BIS-Brief	.01	.07	.944
DERS	.03	.43	.671
SS	.42	5.32	<.001

Multiple Regression Examining Predictors of Fire Interest (Utilising Subscale Scores for DERS and SS)

Similar to Study 1, a second linear multiple regression analysis was conducted to further explore the role of the subscales/facets of the predictor variables in predicting fire

interest, to see if there was any particular facet driving the indicated effects. The measures for previous exposure to fire, impulsivity, the individual facets of sensation seeking (*thrill and adventure seeking, experience seeking, disinhibition,* and *boredom susceptibility and impulsivity*) and the subscales of difficulties in emotion regulation (*nonacceptance, goals, impulse, awareness, strategies,* and *clarity*) were entered into the model simultaneously. The overall model was significant and the total variance explained was 29.5%, $F(13, 135) = 4.34$, $p < .001$. Only the predictor variables of exposure to fire before the age of 18 and the SS *thrill and adventure seeking* facet were statistically significant, with the *thrill and adventure seeking* facet contributing slightly more variance than exposure to fire (exposure to fire before the age of 18*:* $\beta = .23$, $p = .013$; *thrill and adventure seeking* facet: $\beta = .30$, $p = .003$). Refer to Table 10 for linear multiple regression statistics for all independent variables, including subscales/facets for DERS and SS. There was no statistically significant correlation between the SS *thrill and adventure seeking* facet and exposure to fire before the age of 18 suggesting that these factors contribute independently to the regression model.

Table 10

Linear Multiple Regression Statistics for All Independent Variables, Including Subscales

Measure	*β*	*t*	*p*
ETF before 18	.23	2.52	.013
ETF since 18	.07	.78	.436
BIS-Brief	.05	.50	.621
DERS Nonacceptance	.06	.60	.550
DERS Goals	.06	.63	.533
DERS Impulse	-.09	-.75	.454
DERS Awareness	-.10	-1.01	.315
DERS Strategies	.03	.29	.770
DERS Clarity	-.01	-.09	.927
SS1 Thrill and adventure seeking	.30	2.99	.003
SS2 Experience seeking	-.04	-.43	.670
SS3 Disinhibition	.19	1.78	.077
SS4 Boredom susceptibility and impulsivity	.08	.75	.454

Comparisons between the Two Regression Models

Similar to Study 1, when comparing the total amount of variance explained by each model, including the SS and DERS subscales appears to improve the overall model – in this case, the regression model with subscales led to a 3.3% better fit than when only including total scores. However (as with Study 1), this difference may have been amplified by the larger number of predictor variables. In this study, the adjusted R squared value of the model using total scores was .24, while the model including individual subscales had an R squared value of .23. These adjusted values indicate similar predictive value between the two models. As in Study 1, the individual beta value for the *thrill and adventure seeking* facet of the SS scale suggests this facet may be driving the effect for the total SS scale in the first regression model. Both models in this study returned slightly better predictive values than the models in Study 1 (difference of .06 for each model).

Section 2: Engagement in Firesetting Behaviour and Relationship with Other Variables

Prevalence of Intentional Firesetting

Thirty five percent of participants reported setting at least one intentional fire since the age of 10 (n = 52), including 11.4% who reported setting five or more fires (n = 17). Refer to Table 11 for a breakdown of reported rates of intentional firesetting.

Table 11

Prevalence of Intentional Fires Set

Intentional fires set	Frequency	Percentage
Zero	97	65.1
One	16	10.7
Two	10	6.7
Three	5	3.4
Four	4	2.7
Five or more	17	11.4

Bivariate Correlations

Correlational analysis was conducted to examine the relationships between the dependent variable (firesetting status), the covariate (BIDR-IM), and all independent variables (FIS subscale of FSS, DERS including subscales, SS subscale of ZKA-PQ/SF including facets, BIS-Brief, ETF before 18, and ETF since 18; see Table 12). Firesetting status was significantly positively correlated with FIS, BIS-Brief, SS total score, and the *thrill/adventure seeking* facet of SS. There was no significant correlation between firesetting status and all remaining variables. As BIDR-IM was not significantly correlated with firesetting status, impression management was therefore not controlled for in subsequent analyses.

Table 12

Bivariate Correlations between Firesetting Status and All Other Variables

Measure	*r*	*p*
FIS	.44	<.001
ETF before 18	.16	.055
ETF since 18	.14	.079
BIS-Brief	.21	.012
DERS		
Nonacceptance	.04	.648
Goals	-.06	.481
Impulse	.04	.640
Awareness	.19	.180
Strategies	.09	.300
Clarity	.05	.517
Total score	.08	.339
SS factor of the ZKA-PQ/SF		
Thrill and adventure seeking	.26	.001
Experience seeking	.04	.629
Disinhibition	.12	.158
Boredom susceptibility and impulsivity	.12	.164
Total score	.18	.032
BIDR-IM	-.08	.361

Univariate Analyses

A Chi-square test of independence (with Yates Continuity Correction) indicated a significant difference between gender and firesetting status, χ^2 (1, n = 146) = 3.85, p = .050, φ = -.18. Among males, 56.3% were non-firesetters and 43.8% were firesetters. Among females, 73.2% were non-firesetters and 26.8% were firesetters. Due to the small number of participants who reported their gender as other (one participant), preferred not to say (one participant), or did not respond to this item (one participant), these three cases were not included in the Chi-square analysis as they violated the Chi-square assumption of requiring at least five participants for each case (Pallant, 2020).

Independent samples t-tests were conducted to examine if there were any differences between firesetters and non-firesetters on the FIS, BIS-Brief, DERS total score, SS total score, ETF before 18, ETF since 18, and BIDR-IM. Means and standard deviations were calculated for firesetters and non-firesetters for all dependent variables (refer Table 13). There was no significant difference between firesetters and non-firesetters for the variables of DERS total score (t(147) = -0.46, p = .648, d = 0.08), SS total score (t(147) = -1.97, p =.051, d = 0.34), ETF since 18 (t(147) = -1.36, p = .175, d = 0.24), and the BIDR-IM (t(147) = 0.94, p = .347, d = 0.16). On the FIS, firesetters (M = 43.38, SD = 11.69) reported significantly higher levels of fire interest than non-firesetters (M = 32.06, SD = 12.80); t(147) = -5.30, p < .001, d = 0.92. On the BIS-Brief, firesetters (M = 17.71, SD = 3.96) reported significantly higher levels of impulsivity than non-firesetters (M = 15.87, SD = 3.92); t(147) = -2.73, p = .007, d = 0.47. On ETF before 18, firesetters (M = 3.56, SD = 0.93) self-reported significantly more exposure to fire before the age of 18 years than non-firesetters (M = 3.13, SD = 1.18); t(147) = -2.27, p = .025, d = 0.39.

Table 13

Scale Scores for Firesetters and Non-Firesetters

	Firesetters (N = 52) Mean (*SD*)	Non-firesetters (N = 97) Mean (SD)
Exposure to fire (until age 18)*	3.56 (0.93)	3.13 (1.19)
Exposure to fire (since age 18)	3.06 (1.04)	2.79 (1.17)
FIS**	43.38 (11.69)	32.06 (12.80)
BIS-Brief**	17.71 (3.96)	15.87 (3.92)
DERS		
Nonacceptance	15.04 (6.72)	15.27 (6.03)
Goals	15.46 (5.07)	15.89 (4.70)
Impulse	13.02 (5.39)	12.97 (4.81)
Awareness	15.65 (4.56)	14.37 (4.52)
Strategies	20.21 (7.71)	19.43 (6.85)
Clarity	11.54 (4.19)	11.13 (4.15)
Total score	90.92 (25.91)	89.06 (22.41)
SS factor of ZKA-PQ/SF		
Thrill and adventure seeking**	9.69 (2.82)	8.24 (3.02)
Experience seeking	11.48 (2.67)	11.02 (2.43)
Disinhibition	9.35 (2.23)	9.08 (2.67)
Boredom susceptibility and impulsivity	10.88 (2.31)	10.30 (2.33)
Total score	41.40 (7.80)	38.65 (8.33)
BIDR-IM	6.22 (3.44)	6.85 (4.11)

Note. χ^2 with 95% confidence interval.

*$p \leq .05$, **$p \leq .01$

Multivariate Analyses

Two separate one-way between-groups multivariate analysis of variance (MANOVA) were performed to investigate differences between firesetters and non-firesetters on the facets of sensation seeking and emotional dysregulation. In the first MANOVA, four dependent variables were included: the SS facets of *thrill and adventure seeking, experience seeking, disinhibition,* and *boredom susceptibility and impulsivity.* In the second MANOVA, six dependent variables were included: the DERS subscales of *nonacceptance, goals, impulse, awareness, strategies,* and *clarity.* The independent variable in both MANOVAs was

firesetting status (firesetter vs. non-firesetter). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity, with no serious violations noted.

The first MANOVA examined if there were any differences between firesetters and non-firesetters scores on the facets of the SS scale. A non-significant trend was detected between firesetters and non-firesetters on the combined dependent variables, $F(4, 144) = 2.41$, $p = .052$; Wilks' $\Lambda = .94$; $\eta_p^2 = .05$. However, the subscale of *thrill and adventure seeking* subscale reached statistical significance (using a Bonferroni adjusted alpha level of .013), $F(1, 147) = 8.14$, $p = .005$, $\eta_p^2 = .05$, with firesetters reporting higher levels of thrill and adventure seeking ($M = 9.69$, $SD = 2.82$) than non-firesetters ($M = 8.24$, $SD = 3.02$). Scores on the other facets of the SS scale did not significantly differ between the two groups (p values ranging between .151 and .535).

The second MANOVA examined if there were any differences in the self-reported scores on the DERS for firesetters and non-firesetters. There was no statistically significant difference between firesetters and non-firesetters on the combined dependent variables for the DERS subscales ($F(6, 142) = .74$, $p = .620$; Wilks' $\Lambda = .97$; $\eta_p^2 = .03$) or individual subscales (p values ranging between .101 and .954).

As significant differences were found between firesetters and non-firesetters for the FIS, BIS-Brief, thrill/adventure seeking facet of the SS, ETF before 18, and gender, the ability of these factors to predict firesetting status were examined using logistic regression.

Forced entry binomial logistic regression, with all measures entered simultaneously, was conducted to assess which factors were associated with firesetting status (refer to Table 14). As gender was included as an independent variable for the regression, the previously noted three cases who did not report their gender as either male or female were excluded from the analysis in order to meet the regression assumption of sufficient case sizes (Pallant,

2020). The full model containing all predictors was statistically significant, χ^2 (5, N = 146) = 36.18, p < .001, indicating that the model was able to distinguish between those respondents who reported and did not report engaging in intentional firesetting. The model as a whole explained between 21.9% (Cox and Snell R^2) and 30.3% (Nagelkerke R^2) of the variance in firesetting status, and correctly classified 76.0% of cases. As shown in Table 14, only two of the independent variables made a unique statistically significant contribution to the model (fire interest and impulsiveness). The strongest predictor of firesetting was impulsiveness, recording an odds ratio of 1.12, while fire interest recorded a slightly lower odds ratio of 1.07. This indicated that for every unit increase in impulsiveness, participants were 1.12 times more likely to report setting deliberate fires, while for every unit increase in fire interest, participants were 1.07 times more likely to report deliberate firesetting.

Table 14

Logistic Regression Predicting Likelihood of Reporting Intentional Firesetting

							95% C.I.	
	B	*SE*	Wald	*df*	*p*	Odds Ratio	Lower	Upper
FIS	.07	.02	12.95	1	<.001	1.07	1.03	1.11
BIS-Brief	.11	.05	4.31	1	.038	1.12	1.01	1.24
SS1	.03	.08	0.16	1	.688	1.03	.89	1.20
ETF before 18	.29	.19	2.36	1	.125	1.34	.92	1.94
Gender	-.50	.43	1.39	1	.239	0.61	.26	1.40

Moderation Analyses Exploring the Relationship between Firesetting, Fire Interest, Impulsiveness, and Thrill/Adventure Seeking

The thrill and adventure seeking facet of sensation seeking was a consistent correlate and predictor of fire interest across studies, and also differentiated between firesetters and non-firesetters when tested via multivariate analysis. However, this factor was not a predictor

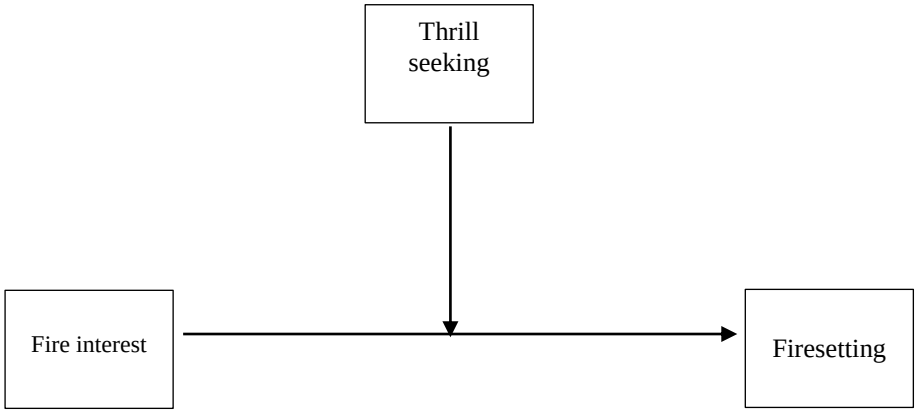
of firesetting when controlling for the contribution of other factors in the logistic regression model.

Contrastingly, impulsiveness was not correlated with or a predictor of fire interest, but did emerge as both a correlate and predictor of engagement in firesetting behaviour. Fire interest was both a significant correlate and predictor of firesetting. In order to further examine the nature of the relationship between these variables, two moderation analyses were conducted. Moderation was chosen to explore whether the relationship between fire interest and engagement in firesetting behaviour may change depending on an individual's level of impulsiveness or inclination for thrill seeking. The moderating effect of each variable was examined separately in order to assess the individual effect of each factor and to take into account the relatively small sample size (Hayes, 2013).

First, logistic regression was used to investigate whether thrill/adventure seeking might moderate the relationship between fire interest and firesetting behaviour. Firesetting behaviour was dummy coded (0 = zero fires set, 1 = one or more fires set) and all terms were entered into the model together, using Hayes (2013) PROCESS macro model 1 (see figure 1).

Figure 1

Hypothesised Moderating Relationship between Fire Interest, Thrill Seeking and Firesetting



Firesetting was entered as the dependent variable, fire interest as the independent variable, and thrill/adventure seeking as the moderating variable. The overall model was statistically significant, χ^2 (3, n = 146) = 32.27, $p < .001$, with the results indicating a significant interaction, $B = -.01$, $SE = .01$, $p = .046$. To probe the interaction further, simple effects coefficients were computed for three values of thrill/adventure seeking: one standard deviation below the mean, at the mean, and one standard deviation above the mean (refer Table 15). These show a significant main effect of thrill/adventure seeking on firesetting and fire interest.

Table 15

Simple Effects Coefficients for the Relationship between Fire Interest and Firesetting at Three Levels of Thrill/Adventure Seeking

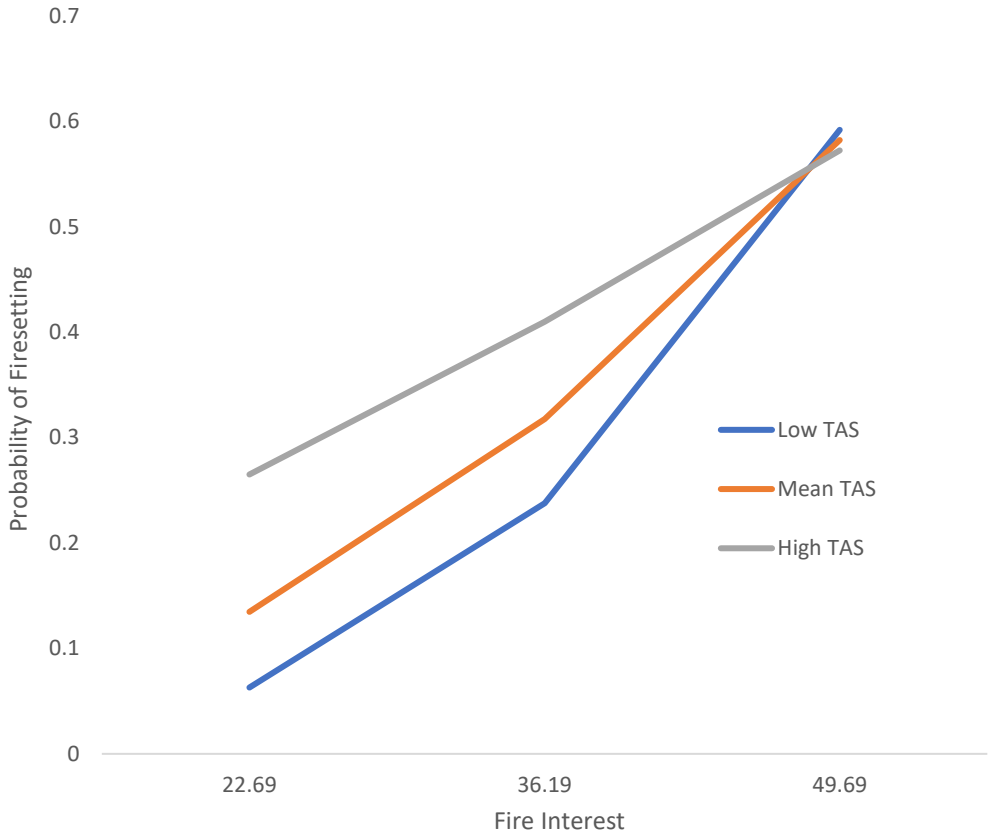
	B	*SE*	Odds Ratio	*p*
Low TAS	.11	-.03	1.12	<.001
Mean TAS	.08	-.02	1.08	<.001
High TAS	.05	.02	1.05	.014

Note. TAS = thrill and adventure seeking . Low TAS = 1 SD below the mean, High TAS = 1 SD above the mean.

While the odds ratios (OR) of these coefficients showed the highest OR at low thrill/adventure seeking, lower OR at mean thrill/adventure seeking, and lowest OR at high thrill/adventure seeking, these were very similar (ranging from 1.05 to 1.12) and significant at all levels. Figure 2 graphs the interaction between fire interest, thrill and adventure seeking, and firesetting; showing the change in the expected probability of firesetting by fire interest at -1 SD, Mean, and +1 SD of thrill/adventure seeking. These results indicate that across all levels of fire interest, higher levels of thrill/adventure seeking increased the probability of firesetting behaviour. This effect was strongest at low levels of fire interest.

Figure 2

Changes in Probability of Firesetting as a Function of Fire Interest and Thrill/Adventure Seeking

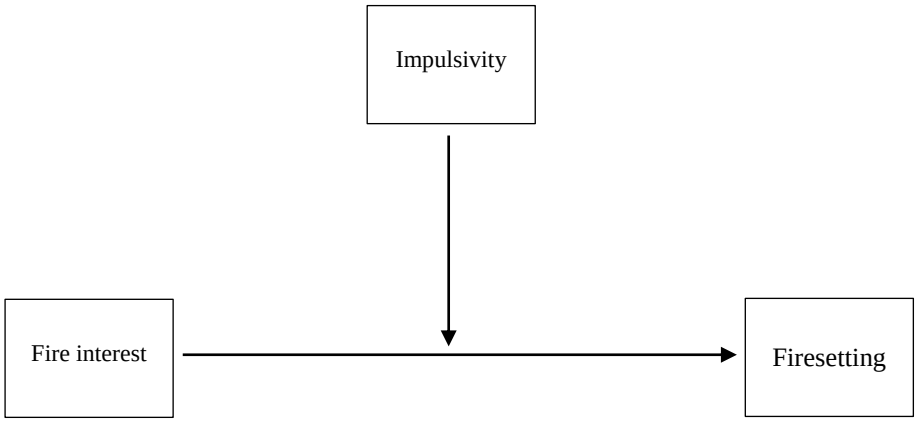


Note. TAS = thrill and adventure seeking. Low TAS = 1 SD below the mean, High TAS = 1 SD above the mean.

A second logistic regression was conducted to investigate whether impulsiveness moderates the relationship between fire interest and firesetting behaviour (refer Figure 3). Firesetting behaviour was again dummy coded (0 = zero fires set, 1 = one or more fires set) and all terms were entered into the model together, using Hayes (2013) PROCESS macro model 1.

Figure 3

Hypothesised Moderating Relationship between Fire Interest, Impulsivity and Firesetting



Firesetting was again entered as the dependent variable, fire interest as the independent variable, and then impulsiveness as the moderating variable. The overall model was again statistically significant, χ^2 (3, n = 146) = 31.84, $p < .001$, however this time there was no significant interaction between the three variables, $B = .00$, $SE = .00$, $p = .597$. Simple effects coefficients were again calculated for three values of impulsiveness (refer Table 16), the results of which indicate the relationship between fire interest and firesetting is not contingent on levels of impulsiveness.

Table 16

Simple Effects Coefficients for the Relationship between Fire Interest and Firesetting at Three Levels of Impulsiveness

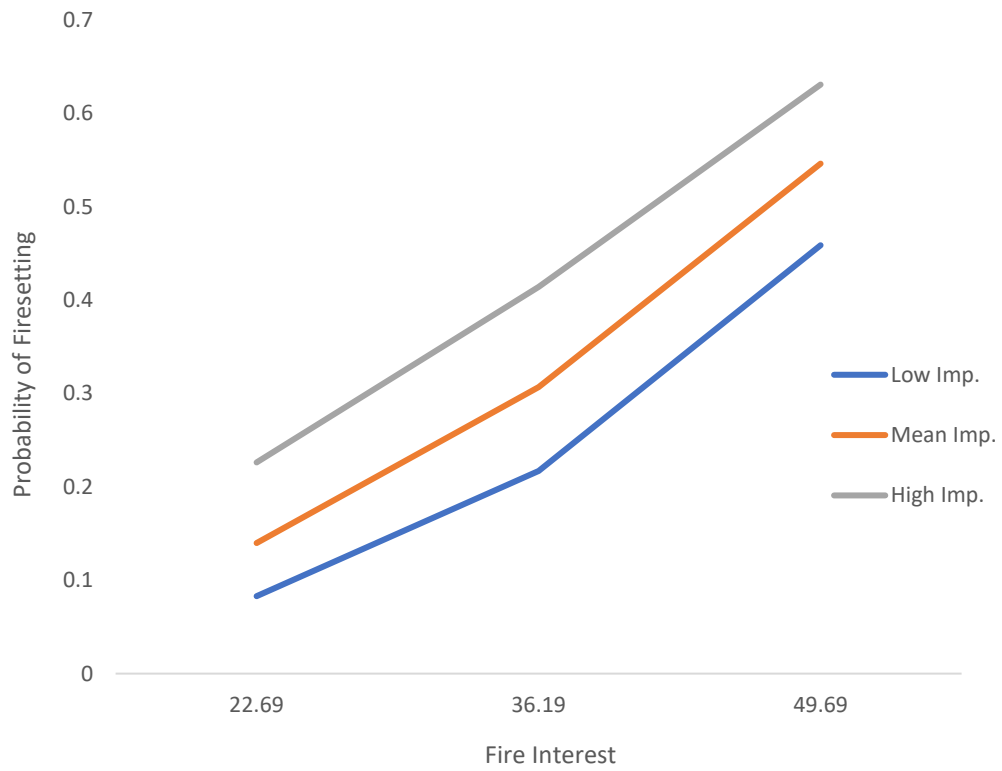
	B	*SE*	Odds Ratio	*p*
Low Imp.	.08	.03	1.09	.002
Mean Imp.	.07	.02	1.08	<.001
High Imp.	.07	.02	1.07	.002

Note. Imp. = impulsiveness. Low Imp. = 1 SD below the mean, High Imp. = 1 SD above the mean.

Figure 4 depicts the relatively parallel lines between fire interest and the probability of firesetting at one standard deviation below the mean for impulsiveness, at the mean of impulsiveness, and one standard deviation above the mean for impulsiveness. These results show that higher impulsiveness increases the probability of firesetting across all levels of fire interest, and the fire interest/firesetting relationship is consistent across levels of impulsiveness. Although these factors are both associated with an increased chance of being a firesetter, they appear to operate independently of one another.

Figure 4

Changes in Probability of Firesetting as a Function of Fire Interest and Impulsiveness



Note. Imp. = impulsiveness. Low Imp. = 1 SD below the mean, High Imp. = 1 SD above the mean

Discussion

This research represents the first direct study of fire interest and the first examination of deliberate firesetting in a community sample in New Zealand. Two studies were conducted to explore the relationship between fire interest, previous exposure to fire, aspects of self and emotional regulation, and engagement in deliberate firesetting, utilising two samples of New Zealand adults recruited via an online crowdsourcing platform. The first study aimed to examine whether previous exposure to fire and aspects of self and emotional regulation are predictive of increased levels of fire interest. Although this research was exploratory, some hypotheses were held based on the existing firesetting literature. Specifically, it was hypothesised that a) higher levels of previous exposure to fire, b) poorer emotion regulation, c) higher levels of sensation seeking, and d) higher levels of impulsivity, would be associated with increased levels of fire interest. The second study aimed to both replicate the findings of the first study and examine the relationship between these factors and deliberate firesetting behaviour. In this section, the findings of each study will be discussed, followed by a discussion of implications for theory and practice. The limitations of the current research will then be outlined and suggestions made for future research in this area.

Factors Associated with Increased Fire Interest and Engagement in Deliberate Firesetting

In both studies, initial correlational analyses were employed to identify the relationships between fire interest, previous exposure to fire, emotional dysregulation, sensation seeking, and impulsivity. Multiple regression analyses were then performed in both studies to identify the strongest predictors of fire interest. In the second study, additional correlational and regression analyses were performed to examine the relationships between engagement in deliberate firesetting, fire interest, and all other independent variables. Two moderation analyses were also conducted in Study 2 to explore whether thrill and adventure

seeking or impulsivity moderated the relationship between fire interest and firesetting status. In the following sections, each independent variable will be reviewed in turn. The findings for each factor and how these results fit within the existing literature will be discussed.

Previous Exposure to Fire

It was hypothesised that higher levels of previous exposure to fire would be associated with increased levels of fire interest. In both studies, previous exposure to fire before the age of 18 and exposure to fire since the age of 18 were significantly positively correlated with fire interest. However, when entered into a multiple regression model, exposure to fire since the age of 18 consistently returned a non-significant relationship with fire interest, while exposure to fire before the age of 18 returned conflicting results between studies – specifically, in the first study there was no significant relationship with fire interest, but in the second study exposure to fire before the age of 18 was identified as a significant positive predictor of fire interest. These correlational results indicate that a positive relationship appears to exist between previous exposure to fire and fire interest in adulthood, however the loss of statistical significance in subsequent regression analyses suggest this relationship may be better accounted for by other related variables. In the second study, both factors measuring previous exposure to fire returned a non-significant correlation with firesetting status, however subsequent t-tests showed firesetters scored higher on exposure to fire before the age of 18. Logistic regression indicated that exposure to fire before the age of 18 was not able to predict firesetting status when taking into account other predictor variables.

Overall, these results partially support the hypothesis. Small positive correlations between previous exposure to fire and fire interest indicate that the more exposure to fire an individual experiences as a child or adult, the more interested in fire they are likely to be. However, when controlling for other variables such as sensation seeking and emotional

dysregulation, previous exposure to fire appears to lose significance as a predictor of fire interest. Despite the mostly non-significant results identified for the exposure to fire variables in the regression analyses, it is noted that exposure to fire before the age of 18 returned as a significant predictor for fire interest in the second study. The positive association between previous exposure to fire and fire interest identified in the present study is in contradiction to Fessler's (2006) evolutionary perspective on the development of fire interest. According to Fessler's perspective, the level of exposure to fire experienced by children in Western societies is not high enough to activate the learning acquisition system for fire, leading to lack of habituation and ongoing interest in fire through to adulthood. Under this argument, increased exposure to fire in childhood should lead to *decreased* interest in fire in adulthood, rather than the opposite association identified in the current study. However, the positive correlation between previous exposure to fire and fire interest found in this study is consistent with the findings Murray et al.'s (2015) research which also found findings opposite to those hypothesised by Fessler; their findings indicated either no relationship between previous exposure to fire or a positive relationship between the two factors. Murray et al. suggested that their sample may not have experienced a high enough level of exposure to fire in order for habituation to take effect and this may have also have been the case with the sample in this study, as both studies found lower levels of exposure to fire compared to that experienced by the societies studied by Fessler. As repeated exposure to a stimulus initially increases the reinforcing properties of that stimulus (i.e., sensitisation) before the onset of habituation, it may be that the level of fire exposure in both Murray et al.'s samples and the present samples were reflective of sensitisation rather than habituation. If this is the case, the fire exposure experienced by these samples were below the threshold required for Fessler's learning mechanism to come into force. Furthermore, the type of exposure to fire which participants had experienced was not measured in either the present study or by Murray et al., a factor

which may influence how the proposed learning mechanism is activated (e.g., merely watching fire versus hands-on manipulation of fire).

However, linking Fessler's (2006) information acquisition system argument with a social learning theory perspective may help to explain why individuals who have experienced more exposure to fire during their lives have higher levels of interest in fire. According to Fessler, children are expected to be spontaneously interested in fire, possibly due to the evolutionary relationship between humans and fire. Social learning theory suggests that as children grow up, if they experience positive interactions with fire and/or witness modelling behaviour where fire has positive or interesting associations, this reinforces a positive attitude towards and interest in fire. This may occur via Fessler's domain-specific learning mechanism where fire-related information is more salient than other information received, thereby strengthening the learning experience. In line with this perspective, it is expected that the more positively reinforcing experiences with fire an individual has, the more interested in fire they are likely to be. Furthermore, the social learning theory concept of modelling may explain why the present study and Murray et al. (2015) found differing results to those reported by Fessler. Among the pre-industrialised societies observed by Fessler, fire is viewed as mundane and something which exists for practical purposes, whereas in modern Western societies fire is regularly used for entertainment and is often portrayed as exciting in the media. It may therefore be that a modelling effect occurs in both types of societies, where children in pre-industrialised societies are modelled a pragmatic and disinterested attitude towards fire, while children in Western societies are modelled an attitude which represents fire as fun and exciting.

Consistent with the present findings, Horsley (2020)'s qualitative analysis of 24 fire users identified an overarching theme of positive reinforcement obtained from engagement with fire. Horsley terms this theme 'Transient Emotional State' and describes how interacting

with fire provides a positive short-term impact on an individual's emotional state. This positive reinforcement can be obtained both directly (e.g., physiological arousal) and indirectly (e.g., emotional escapism). Horsley posits that the reinforcing effect of these positive emotional changes can be a perpetuating factor in ongoing fire use, where individuals repeatedly seek out the opportunity to experience positive feelings. Interestingly, this theme was found both for individuals who have used fire in antisocial ways (e.g., have arson convictions) and those who use fire extensively but have not been identified as using it in an antisocial way. This suggests that the reinforcing properties of fire are experienced universally, and as such the relationship between previous exposure to fire and fire interest is not expected to be limited to only those individuals who engage in deliberate firesetting.

A limitation of this study is that we did not assess whether participants' previous experiences with fire were positive or negative, which is likely to affect the relationship between previous exposure to fire and current fire interest. Should an individual have had unpleasant experiences with fire in the past, they would not have experienced fire as reinforcing and it is expected there would be either no correlation or a negative relationship between their previous exposure to fire and their current interest in fire. This may explain why previous exposure to fire was not a significant predictor of fire interest when all other variables were controlled for in the regression model. Furthermore, while the results for this research question have been interpreted as directional in that higher levels of previous exposure to fire are expected to be predictive of higher levels of fire interest, it is important to note that causality cannot be determined from the correlational result. It is possible that the direction of the relationship does not in fact exist as interpreted, and perhaps individuals who are more interested in fire seek out more opportunities to interact with fire. Alternatively, individuals who have higher levels of fire interest may have stronger memory recall for their

past interactions with fire than those who are less interested in fire, as these memories may be more salient for such individuals.

Taken together, the positive correlations identified between previous exposure to fire and fire interest are consistent with both a social learning theory perspective and previous empirical research among Western populations. Further research is required to clarify whether the relationship between exposure to fire and fire interest does in fact exist as interpreted, or whether other explanations provide a more accurate picture.

Sensation Seeking

It was hypothesised that higher levels of sensation seeking would be predictive of increased fire interest. Results from both studies supported this hypothesis, with both studies returning significant positive correlations with both the total sensation seeking score and each facet of *thrill and adventure seeking, experience seeking, disinhibition,* and *boredom susceptibility and impulsivity.* However, only the total score and *thrill and adventure seeking* emerged as significant predictors of fire interest. The results suggest that individuals who have a tendency towards sensation seeking may be more likely to have higher levels of fire interest, and this relationship appears to be driven by the thrill and adventure seeking component of sensation seeking.

In the second study, both the total sensation seeking score and the *thrill and adventure seeking* facet were significantly positively correlated with engagement in firesetting behaviour, while the remaining sensation seeking facets did not show a significant relationship. Further, firesetters scored significantly higher on *thrill and adventure seeking* compared to non-firesetters. While thrill/adventure seeking appears to be positively correlated with firesetting, the logistic regression analysis indicated that this factor was not a significant predictor of firesetting.

To further explore the various relationships identified between fire interest, thrill and adventure seeking, and firesetting, a moderation analysis was performed to examine whether thrill/adventure seeking moderated the relationship between fire interest and firesetting status. A significant interaction was identified in this moderation analysis, supporting the existence of a moderating relationship between the three variables with higher levels of thrill/adventure seeking increasing the probability of firesetting behaviour.

The significant positive correlation between thrill/adventure seeking and firesetting behaviour reflects results found in previous research among juvenile populations. Utilising a child sample, Dadds and Fraser (2006) found that firesetting behaviour was associated with a thrill-seeking temperament among boys. Similarly, MacKay et al. (2009) found higher levels of sensation seeking to be associated with firesetting behaviour among their adolescent sample. While these empirical findings among child and adolescent samples are consistent with the results found in the present study, the relationship between sensation seeking and firesetting has not previously been examined among adult populations. The present study is therefore the first empirical research to identify a link between sensation seeking tendencies and firesetting behaviour in an adult sample. Furthermore, although the positive correlation between thrill/adventure seeking and firesetting supports a relationship between these two factors, the findings from the current study showed that this factor in fact moderates the relationship between fire interest and firesetting behaviour. More specifically, the moderation analysis indicates that at low levels of fire interest, thrill/adventure seeking has a greater impact on likelihood of engaging in firesetting behaviour compared to when fire interest is high (refer Figure 2). Individuals with high levels of fire interest appear to have a similar probability of engaging in deliberating firesetting, regardless of their level of thrill/adventure seeking. These findings suggest that an inclination for thrill seeking may be a relevant risk factor for firesetting among those individuals low in fire interest, but less relevant for those

individuals high in fire interest. This holds implications for treatment targets among programmes designed to address firesetting behaviour. For example, aiming to decrease firesetters' propensity for thrill seeking may be an effective intervention for firesetters with low fire interest, but may not have an impact for firesetters with high fire interest.

Although there has been no published empirical research examining the relationship between sensation seeking and fire interest, results of the current study appear consistent with the theoretical background of sensation seeking and its relationship with other risk-taking behaviours. Previous researchers have conceptualised sensation seeking as a trait with biological and evolutionary roots which is likely to have served adaptive evolutionary functions (e.g., increasing explorativeness, sexual variety seeking, and risk-taking; Zuckerman, 2015). Consistent with this evolutionary perspective, individuals high in sensation seeking often make choices reflecting an evolutionary desire for explorativeness and variety seeking. For example, entertainment choices of high sensation seekers demonstrate a preference for audio/visual content, which indicates a taste for novelty, intensity of sensation and arousal, and complexity (Perse, 1996; Rawlings et al., 2000; Schierman & Rowland, 1985; Zuckerman, 2006). In line with this preference for audio/visual stimulation, it is not surprising that individuals high in sensation seeking express an interest in fire. The physical properties of fire provide visual appeal (e.g., vivid colours and flickering shapes), audio feedback (e.g., crackling and popping), and physical stimulation (e.g., warmth). The experience of fire may therefore feed into an individual's desire to seek sensations from the physical environment.

In addition to this evolutionary perspective of sensation seeking, Horsley's (2020) qualitative thesis lends support to the concept of individuals seeking sensations from the physical properties of fire. In her thesis, Horsley quotes fire users as describing their attraction to various properties of fire, including visual (e.g., "I used to find that quite

mesmerising and quite magical and this bright yellow glow in the centre", p. 133), auditory (e.g., "the crackling noise and the pops and the bangs", p. 173), and olfactory aspects (e.g., "something's burning and it just smells nice" p. 172). Among participants identified as criminalised fire users (i.e., deliberate firesetters), Horsley identifies a sub-theme which she terms 'arousal', capturing the immediate impact of fire use on participants' physiological arousal levels. The ability for fire to increase physiological arousal reflects sensation seekers' desire for intensity of sensation and arousal, adding theoretical support to the link between sensation seeking and fire interest identified in the present study.

As well as the arousal obtained via fire's physical properties, fire also appears to hold a special place in the human psyche. Fire is used in rituals and religions across cultures and appears to be viewed as a universally powerful force of nature, for example, fire is used in the celebration of the Olympic Games, in the burning of bodies in funeral pyres seen in Hinduism, and in the practices employed in Pagan rites (Pyne, 2019; Winder, 2009). As a symbol of power and energy (Winder, 2009), the psychological features of fire may appeal to sensation seekers as a more abstract form of sensation seeking.

Furthermore, interest in fire may link to a sensation seeker's attraction to risk. Sensation seeking has previously been found to be associated with risky behaviour such as reckless driving, sexual risk-taking, and substance use (Zuckerman, 2015). Occupationally, the risky vocation of firefighting appears to attract individuals high in sensation seeking, while sensation seekers in the Police and military tend to volunteer for highly risky jobs (Zuckerman, 2015). As fire is undoubtedly a risky element and can cause a huge amount of destruction when uncontrolled, it is possible that the inherently risky nature of fire feeds into sensation seekers' desire for thrill and adventure seeking.

Overall, although this is the first empirical research exploring the relationships between sensation seeking, fire interest, and deliberate firesetting, the findings of the present

study are consistent with related research and theoretical arguments. Thrill seeking emerged as a significant correlate of both fire interest and firesetting, however regression and moderation analyses indicate these relationships are not straightforward and appear to interact with one another. Evolutionary and cognitive perspectives suggest that sensation seekers may be attracted to fire to experience physiological and psychological arousal, concepts which are both consistent with the current findings and supported by previous research among juvenile firesetters and recent qualitative analysis of adult fire users' experiences.

Emotional Dysregulation

It was hypothesised that poorer emotional regulation would be predictive of increased fire interest. This hypothesis was supported in the first study, where emotional dysregulation was significantly positively associated with fire interest. In this study, the subscales of *nonacceptance, goals, strategies,* and *clarity* were significantly positively correlated with fire interest. Regression analyses indicated that the total emotional dysregulation score and the *goals* subscale of this measure were predictive of increased levels of fire interest. However, there was no significant relationship found between emotion dysregulation and fire interest in the second study, for either the total emotional dysregulation score or any of its subscales. There was also no significant relationship identified between emotional regulation and deliberate firesetting in the second study, and no significant differences identified on the total emotion dysregulation score or any of its subscales between firesetters and non-firesetters.

Although emotional dysregulation was identified as a significant predictor of fire interest in the first study, the lack of replication in Study 2 indicates this may have been a spurious finding. Notably, in Study 2 neither the total emotional dysregulation score nor any subscale approached significance as a predictor of fire interest.

The lack of relationship identified between emotional dysregulation and deliberate firesetting is in contrast to previous research in this area. Emotional regulation issues such as

anger (Gannon et al., 2013; Rix, 1994) and low frustration tolerance (Jackson, 1994) have previously been identified as correlates of deliberate firesetting. Furthermore, the 'emotionally expressive/need for recognition' trajectory proposed in the Multi-Trajectory Theory of Adult Firesetting (M-TTAF) identifies poor emotional modulation as a likely risk factor for firesetting (Gannon et al., 2012). Gannon et al. (2012) suggest that firesetters in this trajectory may set fires to draw attention to their emotional needs, having felt unable to obtain support via other means. Firesetters in this trajectory may also engage in firesetting as a self-harm tool in order to release negative affect (Gannon et al., 2012).

It is possible that the relationship between emotional dysregulation and firesetting may differ between apprehended and un-apprehended samples. While most research identifying a relationship between firesetting and emotion regulation factors (e.g., anger) have been conducted among apprehended samples, Barrowcliffe and Gannon (2016) explored such characteristics among groups of un-apprehended firesetters and non-firesetters in the UK. In Barrowcliffe and Gannon's study, firesetters scored significantly higher than non-firesetters on a measure of anger experience and expression, consistent with previous findings among apprehended firesetters. However, no participants in this community sample reported having been motivated by anger or revenge to set their fire(s), while only a small proportion (5%) indicated they had been motivated due to feeling stressed or frustrated (Barrowcliffe & Gannon, 2016). As anger and revenge have previously been identified as important motivating factors for firesetting among apprehended samples, these results suggest that there may be some subtle differences between apprehended and un-apprehended firesetters on such aspects of emotional dysregulation. Some support for this notion is found in Horsley's (2020) thesis, which describes how criminalised fire users reported using fire as a strategy to release a build-up of negative emotions, thereby releasing anger via firesetting. However, such a pattern of fire use was not identified among non-criminalised fire users, suggesting this group

did not employ fire use as an emotion regulation strategy. Observing these differences between apprehended and un-apprehended populations, Tyler (in press) notes that firesetting motives among apprehended samples often reflect antisocial attitudes or issues with emotional expression and communication, while un-apprehended firesetters appear to be motivated by fire interest and factors such as boredom or curiosity. Tyler suggests that these differences may lead to different types of firesetting and influence which firesetters come to the attention of authorities. For example, individuals may be more likely to be apprehended if their firesetting is directed at another person as an expression of anger or revenge, compared to those who set fires out of curiosity or experimentation. This perspective may explain why apprehended firesetters appear to have greater issues with anger or revenge than un-apprehended firesetters.

An alternative explanation for why emotional dysregulation was not identified as a predictor of firesetting in the present study may be due to the way this construct was measured. While previous studies have considered specific aspects of emotional regulation (e.g., anger expression), the present study assessed general emotional dysregulation. It is possible that while firesetters may experience more feelings of anger than non-firesetters, this does not generalise to other areas of emotional regulation.

As a whole, the present findings indicate that general emotion regulation difficulties may not relate to how interested in fire an individual is, or how likely they may be to set fires. This is an interesting divergence from existing firesetting research and suggests that previously identified links between anger and firesetting may not generalise to overall emotional dysregulation, or that un-apprehended firesetters may not be motivated by such emotional needs.

Impulsivity

It was hypothesised that higher levels of impulsivity would be predictive of increased levels of fire interest. In both studies there was no significant correlation found between impulsivity and fire interest, and impulsivity did not emerge as a significant predictor of fire interest in any of the regression model. These non-significant results suggest that impulsivity is not related to how interested in fire a person may be. However, in Study 2, impulsivity was significantly positively correlated with deliberate firesetting, and t-tests showed firesetters scored higher on impulsivity than non-firesetters. Impulsivity was also found to be a significant positive predictor of firesetting. As with the variable of thrill/adventure seeking, a moderation analysis was performed to examine whether impulsivity moderated the relationship between fire interest and firesetting status. In this case, no significant interaction was identified, indicating that the relationship between fire interest and firesetting does not depend on how impulsive someone may be.

The relationship identified in the present study between impulsivity and deliberate firesetting is consistent with previous research and theory in this field. For example, impulsivity factors have been associated with deliberate firesetting among male and female psychiatric populations (Labree et al., 2010; Long et al., 2015). Similarly, impulsivity has been consistently associated with firesetting behaviour in children and adolescents (Bowling et al., 2013; Gaynor & Hatcher, 1987; Kafry, 1980; Kolko & Kazdin, 1991; McCardle et al., 2004). Furthermore, among Lewis and Yarnell's (1951) study of 1,145 firesetters, 48% met criteria for an impulse control disorder. Interestingly, the DSM-V categorises pyromania as an impulse control disorder, although the stringent criteria for pyromania diagnosis means such diagnoses are rare.

In addition to these empirical findings, firesetting theory has also captured the role of impulsivity. Both Functional Analysis Theory (Jackson, 1987) and Dynamic Behaviour

Theory (Fineman, 1980) suggest that a crisis or trauma may trigger or exacerbate impulsive tendencies, leading to an impulsive act of firesetting. More recently the M-TTAF (Gannon et al., 2012) considered the importance of impulsiveness as a psychological vulnerability among some firesetting trajectories. Specifically, Gannon et al. (2012) identified impulsivity as a potential clinical feature for those firesetters following the antisocial, fire interest, and emotionally expressive/need for recognition trajectories. These theoretical viewpoints support the link between impulsivity and firesetting behaviour identified in the present study.

As no prior research has examined how impulsiveness may relate to an interest in fire, the hypothesised link between these two factors was based on the previously described relationship between impulsiveness and firesetting behaviour. Although the present findings support a positive relationship between impulsivity and firesetting, the lack of significant relationship between impulsivity and fire interest suggests that a tendency towards impulsivity does not correlate with an interest in fire; instead fire interest and impulsivity may contribute to firesetting propensity via separate mechanisms.

Taken together, the findings of the current study indicate that individuals with higher levels of impulsivity are more likely to engage in firesetting, and this relationship is independent of how interested in fire they may be.

Levels of Fire Interest and Prevalence of Deliberate Firesetting in New Zealand

Since this is the first study of fire interest and firesetting among adult New Zealanders, the current findings provide the first empirical evidence of levels of fire interest and prevalence of self-reported firesetting in New Zealand. Similar levels of fire interest were reported by the total sample in both of the present studies, although participants in Study 2 reported slightly higher fire interest than those in Study 1. However, consistent with previous research, firesetters reported significantly higher levels of fire interest compared to non-firesetters. Interestingly, when comparing the levels of fire interest identified in the present

studies to those reported in previous research (e.g., Barrowcliffe & Gannon, 2016; Gannon & Barrowcliffe, 2012), the current levels appear to be relatively high. In both studies of the current research, the mean levels of fire interest across the samples was found to be closer to the levels of fire interest reported by firesetters than by non-firesetters in Barrowcliffe and Gannon (2016) and Gannon and Barrowcliffe (2012)'s research. Even the level of fire interest reported by non-firesetters in study 2 was closer to the level reported by firesetters than by non-firesetters (Barrowcliffe & Gannon, 2016; Gannon & Barrowcliffe, 2012). Although this comparable research is limited, these differences may suggest cultural differences in fire interest between UK and New Zealand adults. It is possible that cultural factors present in New Zealand (e.g., outdoor lifestyle, favourable weather, more focus on fire seasons) lends New Zealanders to have more of an awareness of and interest in fire than those in the UK.

Further to these differences in fire interest, the levels of deliberate firesetting reported in study 2 also exceed those reported among comparable community samples. In the present study, 35% of participants reported setting at least one deliberate fire since the age of 10, with 11.4% having set five or more fires. This prevalence of deliberate firesetting is higher than that reported by both Barrowcliffe and Gannon (2016; firesetter prevalence of 17.78%) and Gannon and Barrowcliffe (2012; firesetter prevalence of 11.4%), and far higher than the 1.13% of Americans who reported having set a fire in a nationally representative survey (Blanco et al., 2010; Vaughn et al., 2010). As noted by Vaughn et al (2010), this USA firesetting prevalence rate may have been underreported by participants as a function of socially desirable responding, as the survey was conducted via face-to-face interviews. Regardless of this methodological factor, the apparent disparity between rates of firesetting in New Zealand compared to those in other Western nations cannot be ignored. As with the higher levels of fire interest, the high prevalence of firesetting behaviour in New Zealand may be due to cultural differences between these countries. Environmental differences may

also play a role in these disparate rates, as New Zealand has lower population density and more rural areas than the UK, which may be interpreted by potential firesetters as a lessened risk of apprehension and potential harm. This is a question which future research may wish to explore.

Although these results show that participants in the current samples expressed relatively high levels of both fire interest and firesetting behaviour, findings from study 2 suggest that the relationship between fire interest and firesetting is not a perfect relationship. The moderate correlation between fire interest and firesetting (.44) and small odds ratio (1.07) indicate that while fire interest may be an important contributor to the likelihood of engaging in firesetting, higher fire interest does not necessarily lead to firesetting behaviour. Put another way, not everyone with high fire interest is a firesetter, and a combination of other factors are likely to play a role in the decision to set fires.

Implications

This research represents the first study to directly explore fire interest as a psychological construct and how this may interact with other psychological factors to produce firesetting behaviour. It is also the first study to explore factors that may be associated with an increased interest in fire in the general population. The novel findings of this study have potential implications for both research and practice, each of which will now be considered.

Implications for Theory

As discussed in the Introduction section of this thesis, early firesetting theories have generally not considered how psychological factors may interact with fire interest on the pathway to firesetting (e.g., social learning theory, Dynamic Behaviour Theory, Functional Analysis Theory). However, this theoretical gap has begun to be addressed by recent developments in the psychological literature (e.g., M-TTAF, CoFUT). By integrating the

present findings into the M-TTAF and CoFUT, the results of the current study extend this existing contemporary theory and point to further consideration of the role of such psychological factors.

Although the M-TTAF provides a clear explanation of how psychological vulnerabilities may interplay with developmental and proximal factors (Gannon et al., 2012), it does not elaborate on how each psychological vulnerability may interact with each other. By synthesising the current results with the psychological vulnerabilities described in the M-TTAF, this allows for greater explanatory depth and consideration of how these vulnerabilities may interact with each other. As the results of the present study show that likelihood of firesetting increases based on the presence of certain other factors (e.g., fire interest, thrill seeking, impulsivity), this indicates that multiple psychological vulnerabilities may have an additive effect on the risk of engagement in firesetting. However, the various relationships identified between fire interest, thrill seeking, and impulsivity suggest that assuming a simple additive effect will likely oversimplify how these factors interact and link to firesetting behaviour. For example, although the current results indicate that impulsivity increases the probability of deliberate firesetting consistently across all levels of fire interest, the impact of thrill seeking appears more complex. This example highlights the important of considering how psychological vulnerabilities may interact with each other, in addition to understanding their role in the pathway between developmental factors, proximal triggers, critical risk factors, and firesetting behaviour.

In addition to these M-TTAF considerations, the present study also contributes to wider theory development. Despite fire use serving both adaptive and maladaptive functions, previous research has predominantly focused on fire engagement as a problematic and dangerous behaviour and the influence of fire interest within this context (Tyler & Gannon, 2020). However, recently, researchers in the field have suggested that fire use is more likely

to lie along a continuum ranging from ‘normative’ to ‘problematic’ fire use, rather than fitting into clear-cut categories (e.g., firesetters and non-firesetters; Horsley, 2020; Tyler & Gannon, 2020). Horsley’s (2020) continuum of fire use captures interaction with fire as a process which ranges from non-criminalised fire use to criminalised fire use. Horsley contends that fire use can occur anywhere along this continuum and individuals may engage in fire use which falls towards both ends of the spectrum at different times, and therefore the labels of ‘firesetter’ and ‘non-firesetter’ do not accurately reflect the complex realities of fire use.

Conceptualising fire use along a continuum rather than as a dichotomous behaviour may be considered the first step towards the development of a general theory of fire use. It is suggested that a general theory of fire use would lend valuable perspective to understanding what drives problematic forms of fire use (e.g., deliberate firesetting). As summarised by Horsley (2020, p. 62), “in order to understand criminalised use of fire in the form of arson, we must also understand how and why people engage with fire in a non-criminalised manner”. However, there is currently no general theory which explains both fire use and misuse in the psychological literature. The lack of a general theory of fire use reflects a parallel problem in the sexual offending literature. Schmidt and Imhoff (2020) outline that there is a lack of theoretical framework in which to explain general sexual interest, and in particular how sexual interests develop. Similar to research into fire use, research into sexual behaviour has tended to focus on deviant sexual interests and how these relate to sexual offending rather than considering sexual interest as an everyday phenomenon. Schmidt and Imhoff argue that a theoretical approach to explain the development of general sexual interest will provide a better understanding for how sexual orientations and motivations are related to sexual behaviours. Similarly, it is argued here that a general theory of fire use will provide

valuable insight into how and why people engage with fire in both criminalised and non-criminalised ways.

Given recent research (including the findings of the current thesis) suggests that the role fire interest plays in facilitating fire behaviour is more complex than previously thought, a general theory of fire use (or adaptation to existing theory) is also likely to need to consider the role that fire interest plays in fire behaviour. In particular, the intersection between fire interest and fire behaviour should be considered. Illustrating this point are the findings reported by Butler and Gannon (2020), who found that firesetters and fire service personnel reported similarly high levels of fire supportive scripts and serious fire interest, while fire service personnel reported higher levels of identification with fire than did firesetters. Butler and Gannon's (2020) findings suggest that while heightened fire interest may be an important risk factor for firesetting in some contexts (e.g., among apprehended samples), fire interest itself does not necessarily lead to firesetting behaviour. With this in mind, it is important to consider what factors may influence a relationship between fire interest and firesetting. Results of the current study support the concept of a significant but imperfect relationship between fire interest and firesetting, as fire interest had only a moderate relationship with firesetting behaviour and this relationship was dependent on level of thrill seeking. Any future theory capturing fire interest and fire use should take into account the influence of other factors in the relationship between fire interest and firesetting. For example, what risk factors differentiate between individuals who are interested in fire but do not set fires, and those who are interested in fire and also engage in firesetting? Although the present findings indicate thrill seeking traits may be an important influencing factor in the juncture of fire interest/fire misuse, this is only a starting point. Future theory should also consider the role of potential factors which were not assessed in this study. For example, consideration of the M-TTAF suggests potential examination of the impact of factors such as communication

problems, antisocial attitudes, and aggressiveness (Gannon et al., 2012). These findings underscore the potential need for an integrative theory which captures both behaviours and interests and the factors which may influence these.

Implications for Practice

In addition to the above theoretical considerations, the findings from the current study have important implications for clinical practice in the area of deliberate firesetting, particularly for treatment and risk assessment. A key theme to emerge in this thesis is that whilst fire interest is predictive of firesetting behaviour, this does not appear to have a direct causal relationship with firesetting. The fact that fire interest interacts with personality factors such as thrill seeking to produce firesetting suggests that simply targeting fire interest alone may not be sufficient treatment for firesetting, reinforcing the need for comprehensive multicomponent treatments. These findings provide empirical support for the content of programmes such as the Firesetting Intervention Programme for Prisoners (FIPP; Gannon, 2012) and Firesetting Intervention Programme for Mentally Disordered Offenders (FIP-MO; Gannon & Lockerbie, 2011, 2012, 2014), which target a range of factors empirically identified as being associated with firesetting, including promoting self and emotional regulation skills and reducing fire interest. From a functional perspective, firesetting behaviour may be avoided or reduced if the functions which fire serves for an individual are identified and alternative methods of meeting these needs are explored. For example, an individual who turns to fire to meet sensation seeking needs may desist from firesetting if they learn more adaptive ways of increasing their physiological arousal. In line with this functional perspective, examination of the underlying motivators leading individuals to engage in fire use/misuse will support interventions aiming to reduce problematic use of fire.

Further to these implications for treatment programmes, the current findings also contribute to risk assessment of deliberate firesetting. The findings suggest that whilst fire

interest may be a risk factor for firesetting, it is important to formulate risk scenarios in the context of other factors which have been identified to interact with this to increase the risk of firesetting behaviour. Although the results from the present study provide initial considerations for risk assessment, the complex relationship between firesetting, fire interest, and other predictor variables (such as self regulation and sensation seeking) requires further investigation.

Limitations

There are some limitations to the current study which should be borne in mind when evaluating the findings. Firstly, although a total of 301 participants accessed and completed the studies, it is not possible to ascertain how many individuals viewed the titles of the studies but chose not to access it. It is therefore unclear if the results are representative of all Prolific Academic users. It is also noted that although a wide range of ethnicities were represented in the current sample, there appears to be overrepresentation of participants identifying as Asian (28.1% and 24.2% in the current samples, compared to 11.8% in the New Zealand population) and an underrepresentation of Pākehā (58.9% and 57.0% versus 74.0% in the general population) and Māori (3.4% and 5.4% versus 14.9% in the general population; Statistics New Zealand, 2013). As fire use is known to vary across cultures (Fessler, 2006), further research may benefit from ensuring a representative sample of New Zealand ethnicities. Future research may also consider attempting to replicate the current results among alternative samples to ensure results remain valid cross-culturally.

In addition to sampling limitations, it is noted that the Fire Setting Scale has not previously been normed with a New Zealand population. However, there is currently no fire use scale which has been validated in a New Zealand context. It was felt that this scale may be appropriate to use in a New Zealand sample given comparable legal and social norms around fire in UK and New Zealand contexts (e.g., Westernised use of fire, age of criminal

responsibility). It is however possible that this scale may not be culturally appropriate for the bicultural NZ context, a consideration which future research may wish to explore. Interestingly, the current study returned a mean score on the FSS closer to the 'firesetters' group than to the 'non-firesetters' group reported by Gannon and Barrowcliffe (2010), and a slightly larger standard deviation than both of Gannon and Barrowcliffe's groups. The present research also identified higher internal consistency than Gannon and Barrowcliffe's UK sample ($\alpha = .94$ compared to $\alpha = .85$). Despite these differences, both the current scores and those of Gannon and Barrowcliffe's sample were normally distributed and reflected the full range of scale scores. Results of Study 2 also showed that the Fire Interest subscale of the FSS differentiated between firesetters and non-firesetters. These results suggest that the FSS is a valid construct in this population, despite some potential cultural differences in scores.

The data in this study is also limited by self-report measures and it is acknowledged responses may have been influenced by impression management, at least in study 1, although the mean BIDR-IM score of 6.99 fell within the lower cut-off scores for identifying potentially invalid responses (>12 or <1 for probably invalid, >8 or <2 for may be invalid; Paulhus, 1999). As BIDR-IM was negatively correlated with fire interest and most independent factors in the first study, the BIDR-IM was included as a covariate in order to control for impression management (although this was not required in Study 2). Miller and Chapman (2001) report there is no ideal way to identify real group differences and control for them effectively, however previous research has concluded self-report information to remain reliable despite the presence of socially desirable responding (Mills et al., 2003). Additionally, the BIDR-IM accounted for only 3% of variance in the regression model, indicating a limited effect on the result suggesting any effect is likely to be minimal.

In addition, there are some issues with sample size in the present studies. Although the sample size of the first study was sufficiently powered to detect medium effects according

to Green's (1991) formula, as the sample size was equal to the minimum size required for a medium effect (N = 146 for 12 independent variables), smaller effects are unlikely to have been detected. Additionally, inclusion of fire interest as an independent variable in study 2 led to a slightly underpowered sample size for detecting medium effects, as Green's (1991) formula indicates a sample size of 154 participants is needed to detect medium effects for models including 13 independent variables (N = 149 in Study 2). As there were small odds ratio differences between levels of impulsivity in the second moderation analysis, it is possible that a larger sample size may have detected a significant moderating effect between these variables. Replication of these studies with a larger sample may identify smaller effects which were not found in the current samples. It is also acknowledged that unintentional memory recollection failures may have occurred for participants when reporting their previous exposure to fire, which may perhaps be addressed in future research by recruiting of a younger participant sample.

Finally, it is acknowledged that only criminalised firesetting was captured in the second study, rather than general fire use. Although this is in line with previous research in the firesetting field, the lack of assessment of non-criminalised use of fire limits the ability to contribute to a general theory of fire use. To support the development of such a theory, future studies may benefit from assessing both criminalised and non-criminalised fire use.

Future Directions

The research within this thesis is the first of its kind to explore fire interest as a psychological construct and begin to examine the interaction between firesetting, fire interest, and other psychological factors. Due to the exploratory nature of this study, future research may use these results as a starting point for further studies in the area of fire interest and fire use/misuse. Future research would benefit from refining and addressing some of the limitations of the current research, as outlined above. For example, by utilising larger samples

with more culturally diverse populations to assess validity across cultures and ensure smaller effects are captured, or by exploring the causal direction of the relationship between previous exposure to fire and increased fire interest.

Further, more research is required in order to support the development of a general theory of fire interest/fire use. Future research may benefit from looking at fire interest mechanisms and those who not only self-report criminalised fire use but also report normative fire use, or among those who are regularly exposed to fire (e.g., Butler & Gannon, 2020). Further exploration of the mechanisms which explain the relationship between fire interest and fire use/misuse would also be of benefit to the firesetting literature, for example, testing the relationship between fire interest and other psychological vulnerabilities proposed in the M-TTAF (Gannon et al., 2012). Other factors potentially interacting with fire interest may also be examined, as well as clarification of how emotional dysregulation may or may not be associated with fire interest. Exploration of how fire interest develops and the underpinning mechanisms of this would also provide relevant developmental and contextual information about how fire interest influences firesetting behaviour. This further research would strengthen a general theory of fire interest/fire use and contribute to the wider firesetting literature.

Conclusion

To conclude, the present research is the first to directly examine fire interest as an outcome variable, and the first to provide data on the prevalence of fire interest and firesetting among New Zealand adults. Based on the current results, New Zealanders appear to have relatively high levels of fire interest and high rates of deliberate firesetting, compared to other Western countries such as the UK and USA. However, fire interest itself is not the sole predictor of firesetting, and an increased level of fire interest does not necessarily translate into the behaviour of setting fires. Several factors have been identified as correlates

and predictors of increased fire interest and/or increased firesetting in the present study. Thrill seeking traits were found to moderate the relationship between fire interest and firesetting, while impulsivity appears to increase the likelihood of firesetting at a similar rate across all levels of fire interest. These findings extend previous research and theory regarding the role of fire interest and how this may interact with other factors in generating deliberate firesetting behaviour, and also support a multicomponent approach to therapies addressing criminal firesetting. It is contended that the development of a general theory of fire interest/fire use would contribute to the firesetting literature by providing an understanding of how various factors may influence an individual's level of fire interest and their engagement in fire use or misuse.

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Appendices

Appendix A: Information Sheet (Study 1)

Attitudes and experiences with fire and the role of self and emotional regulation

INFORMATION FOR PARTICIPANTS

You are invited to take part in this research. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is Rosalie Sherrell and I am a Masters student in the Forensic Psychology programme at Victoria University of Wellington. This research project is being completed as part of my thesis, under the supervision of Dr Nichola Tyler.

What is the aim of the project?

This project aims to examine the relationship between people's attitudes and experiences with fire and their self and emotional regulation. Your participation will support this research by helping us to develop our understanding of individual factors associated with attitudes towards fire, which may in turn be helpful for informing educational work in this area. This research has been approved by the Victoria University of Wellington Human Ethics Committee (ResearchMaster Reference: 0000028384).

How can you help?

You have been invited to participate because you are currently registered as a research participant with Prolific Academic. We are asking anyone on Prolific Academic who is over the age of 18 years and resident in New Zealand if they would like to take part.

If you agree to take part, you will complete an online survey, consisting of a series of short questionnaires. The survey will ask you a few questions about yourself (e.g., age, gender, ethnicity) followed by a series of questions about your experiences and attitudes towards

fire, and how you manage your emotions and behaviours. The survey will take you approximately 20 minutes to complete.

What will happen to the information you give?

This research is anonymous. This means that nobody, including the researchers will be aware of your identity. By answering it, you are giving consent for us to use your responses in this research. Your answers will remain completely anonymous and unidentifiable. You have the right to cease your participation in the survey at any point without giving a reason. However, you should be aware, that it will not be possible to retract any answers or information once you submit the survey as participation is anonymous and we cannot link participants with their responses.

Your anonymous data will be stored securely at Victoria University of Wellington and retained for approximately 5 years following any publication of the research. The data you provide will be held confidentially and will not be disclosed to anyone outside the research team (except where governed by law).

If you do not wish to participate in this study please do not click yes on the consent form, as this will begin the study.

What will the project produce?

The information collected as part of the research will be analysed and written up as part of a Masters thesis in Forensic Psychology. The findings may also be written up for publication in professional publications (e.g., academic journal, professional magazine, and book chapters) or reports to key stakeholders, presented at professional and/or academic conferences or as part of training/educational activities/events. A summary of the results of the study will also be posted on the lab website https://ffmhlab.wordpress.com

Following completion of the Masters thesis, the research team and designated students at Victoria University of Wellington may conduct additional analysis of the anonymous research data as part of teaching and research exercises. This is so we can maximise the output from the data to further our understanding of experiences and attitudes towards fire and increase knowledge in the area.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either:

Student:	**Supervisor:**

Rosalie Sherrell
[Redacted]

Dr Nichola Tyler
[Redacted]

We understand that fire as a subject may be a sensitive topic for some people, if you find that any of the questions in the survey evoke difficult feelings for you please do not continue. Should you need support, you may find the following organisation helpful:

Need to Talk?: Free Call or Txt 1737

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email *[redacted]* or telephone *[redacted]*.

If you would like to keep a copy of this information sheet for your future records please take a screen shot and save it somewhere accessible to you now, and/or print a copy of this window now.

Appendix B: Information Sheet (Study 2)

Attitudes and experiences with fire and the role of self and emotional regulation

INFORMATION FOR PARTICIPANTS

You are invited to take part in this research. Please read this information before deciding whether or not to take part. If you decide to participate, thank you. If you decide not to participate, thank you for considering this request.

Who am I?

My name is Rosalie Sherrell and I am a Masters student in the Forensic Psychology programme at Victoria University of Wellington. This research project is being completed as part of my thesis, under the supervision of Dr Nichola Tyler.

What is the aim of the project?

This project aims to examine the relationship between people's attitudes and experiences with fire and their self and emotional regulation. Your participation will support this research by helping us to develop our understanding of individual factors associated with attitudes towards fire, which may in turn be helpful for informing educational work in this area. This research has been approved by the Victoria University of Wellington Human Ethics Committee (ResearchMaster Reference: 0000028384).

How can you help?

You have been invited to participate because you are currently registered as a research participant with Prolific Academic. We are asking anyone on Prolific Academic who is over the age of 18 years and resident in New Zealand if they would like to take part.

If you agree to take part, you will complete an online survey, consisting of a series of short questionnaires. The survey will ask you a few questions about yourself (e.g., age, gender, ethnicity) followed by a series of questions about whether you have intentionally set a fire since the age of 10 years, your experiences and attitudes towards fire, and how you manage your emotions and behaviours. Some examples of the types of survey items you will be asked to respond to are "I concentrate easily", "When I'm upset, I feel out of control", "I like

unexpected situations", and "I like watching fire". The survey will take you approximately 20 minutes to complete.

Please note, if you recently participated in a study with the same title as this one, you are precluded from participating in this study.

What will happen to the information you give?

This research is anonymous. This means that nobody, including the researchers will be aware of your identity. By answering it, you are giving consent for us to use your responses in this research. Your answers will remain completely anonymous and unidentifiable. You have the right to cease your participation in the survey at any point without giving a reason. However, you should be aware, that it will not be possible to retract any answers or information once you submit the survey as participation is anonymous and we cannot link participants with their responses.

Your anonymous data will be stored securely at Victoria University of Wellington and retained for approximately 5 years following any publication of the research. The data you provide will be held confidentially and will not be disclosed to anyone outside the research team (except where governed by law).

If you do not wish to participate in this study please do not click yes on the consent form, as this will begin the study.

What will the project produce?

The information collected as part of the research will be analysed and written up as part of a Masters thesis in Forensic Psychology. The findings may also be written up for publication in professional publications (e.g., academic journal, professional magazine, and book chapters) or reports to key stakeholders, presented at professional and/or academic conferences or as part of training/educational activities/events. A summary of the results of the study will also be posted on the lab website https://ffmhlab.wordpress.com

Following completion of the Masters thesis, the research team and designated students at Victoria University of Wellington may conduct additional analysis of the anonymous research data as part of teaching and research exercises. This is so we can maximise the output from the data to further our understanding of experiences and attitudes towards fire and increase knowledge in the area.

If you have any questions or problems, who can you contact?

If you have any questions, either now or in the future, please feel free to contact either:

Student:
Rosalie Sherrell
[Redacted]

Supervisor:
Dr Nichola Tyler
[Redacted]

We understand that fire as a subject may be a sensitive topic for some people, if you find that any of the questions in the survey evoke difficult feelings for you please do not continue. Should you need support, you may find the following organisation helpful:

Need to Talk?: Free Call or Txt 1737

Human Ethics Committee information

If you have any concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email *[redacted]* or telephone *[redacted]*.

If you would like to keep a copy of this information sheet for your future records please take a screen shot and save it somewhere accessible to you now, and/or print a copy of this window now.

Appendix C: Consent to Participate (Studies 1 and 2)

Attitudes and experiences with fire and the role of self and emotional regulation

CONSENT TO PARTICIPATE

Your response to this consent statement and your corresponding survey responses will be held for approximately *five* years following any publication.

Researchers: Rosalie Sherrell, School of Psychology, Victoria University of Wellington.
Dr Nichola Tyler, School of Psychology Victoria University of Wellington

- I have read the Information Sheet and understand the project as it has been explained.
- I agree to take part in an online survey.

I understand that:

- By participating I confirm that I am 18 years or over.
- This survey is anonymous so I cannot be identified by researchers or anyone who may read the resulting publications.
- I have the right to withdraw from the survey at any stage without giving a reason. However, once I have submitted the survey, I understand that it will be impossible to retract my answers.
- My data will be held securely and confidentially.
- Participant payment will be made following completion of the study in line with the Prolific Academic guidelines.
- Findings may be used for a Masters thesis and/or professional publications (e.g., academic journal, professional magazine, and book chapters), reports to key stakeholders, presented at professional and/or academic conferences or as part of training/educational activities/events.
- The anonymous data from this project will be retained for up to 5 years following any publication of the data. The research team and designated students at Victoria University of Wellington may conduct additional analysis of the anonymous research data as part of teaching and research exercises.
- By clicking I agree, and answering the survey that follows I consent to participate in this study and for the information that I provide to be used in the Masters thesis and any related publications or presentations

Appendix D: Debrief Sheet (Study 1)

Debrief Sheet

Attitudes and experiences with fire and the role of self and emotional regulation

Thank you for participating in this research.

As part of this study we asked you to tell us a little bit about yourself. We then asked you to complete a series of questionnaires about self and emotional regulation, interest in fire, and exposure to fire. This included the Fire Setting Scales (FSS; Gannon and Barrowcliffe, 2012) which looks at people's attitudes, interests, and identification with fire, as well as the Barratt Impulsiveness Scale – Brief (Steinberg et al., 2013), the sensation seeking subscale of the Zuckerman-Kuhlman-Aluja Personality Questionnaire – Short Form (Aluja et al., 2018), and the Difficulties in Emotion Regulation Questionnaire (Gratz & Roemer, 2004), which look at different aspects of self and emotional regulation. We also asked you to complete an adapted version of Murray et al.'s (2015) fire experiences questionnaire and a measure of socially desirable responding (BIDR; Paulhus, 1988).

We asked you to complete these questions as we are interested in learning whether previous exposure to fire and poorer self and emotional regulation are predictive of increased fire interest.

There has been no previous research which has directly examined whether certain psychological factors and previous fire exposure are associated with increased levels of fire interest. However, there is some theoretical research that suggests that higher levels of exposure to fire may be associated with increased levels of fire interest, and that this may also be influenced by individual factors such as self-regulation (e.g., Vreeland & Levin, 1980). We hope that this research will help us to further understand fire interest as a construct and the psychological and personality factors that might be associated with this.

If you have any questions regarding the study, please contact us at the following:

Student:
Rosalie Sherrell
[Redacted]

Supervisor:
Nichola Tyler
[Redacted]

Once again, we thank you for the time you have spent completing the survey. We are grateful that you participated in our research, which we hope will be important in helping us understand more about fire interest in the future.

If any questions, or any of your answers to these have raised difficult feelings, you may find the following free service helpful:

Need to Talk?: Free Call or Txt 1737

If you have any serious concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email *[redacted]* or telephone *[redacted]*.

If you would like to keep a copy of this debrief information for your future records please take a screen shot and save it somewhere accessible to you now, and/or print a copy of this window now.

Appendix E: Debrief Sheet (Study 2)

Debrief Sheet

Attitudes and experiences with fire and the role of self and emotional regulation

Thank you for participating in this research.

As part of this study we asked you to tell us a little bit about yourself. We then asked you to complete a series of questionnaires about self and emotional regulation, interest in fire, and exposure to fire. This included the Fire Setting Scales (FSS; Gannon and Barrowcliffe, 2012) which looks at people's attitudes, interests, and identification with fire, as well as the Barratt Impulsiveness Scale – Brief (Steinberg et al., 2013), the sensation seeking subscale of the Zuckerman-Kuhlman-Aluja Personality Questionnaire – Short Form (Aluja et al., 2018), and the Difficulties in Emotion Regulation Questionnaire (Gratz & Roemer, 2004), which look at different aspects of self and emotional regulation. We also asked you to complete a question by Gannon and Barrowcliffe (2012) about whether you have intentionally used fire in the past, an adapted version of Murray et al.'s (2015) fire experiences questionnaire and a measure of socially desirable responding (BIDR; Paulhus, 1988).

We asked you to complete these questions as we are interested in learning whether previous exposure to fire and poorer self and emotional regulation are predictive of increased fire interest. We are also interested in exploring the relationship between these factors and the way people may misuse fire.

There has been no previous research which has directly examined whether certain psychological factors and previous fire exposure are associated with increased levels of fire interest. However, there is some theoretical research that suggests that higher levels of exposure to fire may be associated with increased levels of fire interest, and that this may also be influenced by individual factors such as self-regulation (e.g., Vreeland & Levin, 1980). We hope that this research will help us to further understand fire interest as a construct and the psychological and personality factors that might be associated with this.

If you have any questions regarding the study, please contact us at the following:

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[Redacted]

Supervisor:
Nichola Tyler
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Once again, we thank you for the time you have spent completing the survey. We are grateful that you participated in our research, which we hope will be important in helping us understand more about fire interest in the future.

If any questions, or any of your answers to these have raised difficult feelings, you may find the following free service helpful:

Need to Talk?: Free Call or Txt 1737

If you have any serious concerns about the ethical conduct of the research, you may contact the Victoria University HEC Convenor: Dr Judith Loveridge. Email *[redacted]* or telephone *[redacted]*.

If you would like to keep a copy of this debrief information for your future records please take a screen shot and save it somewhere accessible to you now, and/or print a copy of this window now.

Appendix F: Battery of Measures (Studies 1 and 2)

Attitudes and experiences with fire and the role of self and emotional regulation

Section 1: Demographic Information

What age are you?

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years or older

With which gender do you most strongly identify?

- Male
- Female
- Other
- Prefer not to say

With which ethnicity do you most strongly identify? Please select all that apply.

- New Zealand European/Pākehā
- Māori
- Pasifika

- Asian
- European
- Middle Eastern
- African
- Latin American
- Other

What is your occupation?

- [Free text response field]

Section 2: Assessment of Fire Interest

Fire Interest subscale of the Fire Setting Scale (Gannon & Barrowcliffe, 2012)

The following 10 items are presented in a randomised order using a 7 point Likert Scale (1 = not at all like me, 7 = very strongly like me). An attention check item has also been included.

Participant instructions: Please indicate how you feel the following statements apply to you by responding on the scale provided.

- I like to watch and feel fire
- I get excited thinking about fire
- I like watching fire
- I like watching fire being extinguished
- I like to feel the heat from fire
- I am fascinated by fire
- I have a strong interest in fire

- Please respond (7) very strongly like me
- I am attracted to fire
- Fire equipment paraphernalia interests me
- I find fire intriguing

Section 3: Assessment of Previous Exposure to Fire

The following items are adapted from Murray et al.'s (2015) fire experiences questionnaire.

Participant instructions: Please answer the questions below as accurately as possible.

1. Before you turned 10 years old, how often were you in the presence of fire(s)? (E.g., log fires, bonfires, campfires.)
    a. Daily or almost daily
    b. A few times a week
    c. A few times a month
    d. A few times a year
    e. A few times during my entire childhood
    f. Never

2. Between the ages of 10 and 18 years old, how often were you in the presence of fire(s)? (E.g., log fires, bonfires, campfires.)
    a. Daily or almost daily
    b. A few times a week
    c. A few times a month
    d. A few times a year

e. A few times during my entire childhood

f. Never

3. Since the age of 18 years old, how often were you in the presence of fire(s)? (E.g., log fires, bonfires, campfires.)

    a. Daily or almost daily

    b. A few times a week

    c. A few times a month

    d. A few times a year

    e. A few times since the age of 18

    f. Never

Section 4: Assessment of Personality Factors

Barratt Impulsiveness Scale – Brief (Steinberg et al., 2013)

The following 8 items are presented using a 4 point Likert Scale (1 = rarely/never, 4 = almost always/always). An attention check item has also been included.

Participant instructions: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and respond on the scale provided. Do not spend too much time on any statement. Answer quickly and honestly.

- I plan tasks carefully
- I do things without thinking

- I don't "pay attention"
- I am self controlled
- Please respond (4) almost always/always
- I concentrate easily
- I am a careful thinker
- I say things without thinking
- I act on the spur of the moment

Difficulties in Emotion Regulation Scale (Gratz & Roemer, 2004)

The following 36 items are presented using a 5 point Likert Scale (1 = almost never [0-10%], 5 = almost always [91%-100%]). Two attention check items have also been included.

Participant instructions: Please indicate how often the following statements apply to you by responding on the scale provided.

- I am clear about my feelings
- I pay attention to how I feel
- I experience my emotions as overwhelming and out of control
- I have no idea how I am feeling
- I have difficulty making sense out of my feelings
- I am attentive to my feelings
- I know exactly how I am feeling
- I care about what I am feeling
- I am confused about how I feel
- When I'm upset, I acknowledge my emotions

- Please respond (5) almost always [91%-100%]
- When I'm upset, I become angry with myself for feeling that way
- When I'm upset, I become embarrassed for feeling that way
- When I'm upset, I have difficulty getting work done
- When I'm upset, I become out of control
- When I'm upset, I believe that I will remain that way for a long time
- When I'm upset, I believe that I will end up feeling very depressed
- When I'm upset, I believe that my feelings are valid and important
- When I'm upset, I have difficulty focusing on other things
- When I'm upset, I feel out of control
- When I'm upset, I can still get things done
- When I'm upset, I feel ashamed at myself for feeling that way
- When I'm upset, I know that I can find a way to eventually feel better
- When I'm upset, I feel like I am weak
- When I'm upset, I feel like I can remain in control of my behaviours
- When I'm upset, I feel guilty for feeling that way
- When I'm upset, I have difficulty concentrating
- When I'm upset, I have difficulty controlling my behaviours
- When I'm upset, I believe there is nothing I can do to make myself feel better
- When I'm upset, I become irritated at myself for feeling that way
- When I'm upset, I start to feel very bad about myself
- Please respond (1) almost never [0-10%]
- When I'm upset, I believe that wallowing in it is all I can do

- When I'm upset, I lose control over my behaviour
- When I'm upset, I have difficulty thinking about anything else
- When I'm upset, I take time to figure out what I'm really feeling
- When I'm upset, it takes me a long time to feel better
- When I'm upset, my emotions feel overwhelming

Sensation Seeking subscale of the Zuckerman-Kuhlman-Aluja Personality Questionnaire – Short Form (Aluja et al., 2018)

The following 16 items are presented using a 4 point Likert Scale (1 = disagree strongly, 4 = agree strongly). An attention check item has also been included.

Instructions: A number of statements are shown below that describe some ways in which people act and think. Please indicate for each statement how much you agree or disagree. If you have not experienced a particular circumstance, please try to describe how you would act or what you think about that situation.

- I like some physical activities that are somewhat risky
- I would like travelling a lot, with lots of change and excitement
- I like "wild" uninhibited parties
- I am bad at maintaining a routine
- If I were in the army I might volunteer for exciting but dangerous duties
- I would like to travel to foreign lands where the people are quite different from my own country
- I like to let myself go and do impulsive things just for fun
- Please respond (4) agree strongly

- I like unexpected situations
- I think I would enjoy being a fire-fighter
- I would not like a job involving a lot of travel
- One of my main goals in life is to experience intense and pleasurable sensations
- I hate doing the same all the time
- I would like to learn to fly an airplane
- I enjoy getting into new situations where you can't predict how things will turn out
- I do not try to restrain my urges to have exciting experiences
- I prefer interesting tasks with creative solutions over repetitive tasks with straightforward solutions

<u>The Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1998)</u>

The 20 items below are presented with a 5 point Likert Scale (1 = not true, 5 = very true).

Participant instructions: Please indicate how much you agree with the following statements by responding on the scale provided.

- I sometimes tell lies if I have to
- I never cover up my mistakes
- There have been occasions when I have taken advantage of someone
- I never swear
- I sometimes try to get even rather than forgive and forget

- I always obey laws, even if I'm unlikely to get caught
- I have said something bad about a friend behind his/her back
- When I hear people talking privately, I avoid listening
- I have received too much change from a sales person without telling him or her
- I always declare everything at customs
- When I was young I sometimes stole things
- I have never dropped litter on the street
- I sometimes drive faster than the speed limit
- I never read sexy books or magazines
- I have done things that I don't tell other people about
- I never take things that don't belong to me
- I have taken sick-leave from work or school even though I wasn't really sick
- I have never damaged a library book or store merchandise without reporting it
- I have some pretty awful habits
- I don't gossip about other people's business

Appendix G: Firesetting Measure (Study 2 only)

Gannon and Barrowcliffe (2012)

Participant instructions:
The following question relates to your use of fire. Please think about fires that you may have set intentionally.

For example, please think about fires you may have set on purpose including:

- Fires set to annoy other people

- Fires that are set as a result of boredom (e.g. setting fire to things because it is something to do)

- Fires set to create excitement (e.g. fires set because they are interesting and exhilarating)

- Fires set for revenge (e.g. to get back at someone and to scare or harm them or their property)

- Fires set for insurance purposes (e.g. to gain money from a false insurance claim)

- Fires set as a result of peer pressure (e.g. because of a dare, or being bullied, or just going along with a group of friends)

- Fires set to destroy evidence (e.g. to get rid of evidence and cover up another crime)

Please do not consider fires set accidentally, fires set for organised or social events (e.g. social occasions, barbecues, or hāngi) or fires set before the age of 10.

How many intentional fires have you started?

0

1

2

3

4

5+