Randomized Controlled Trial of

The Arson Prevention Program for Children

(TAPP-C)

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Abstract

Despite the serious consequences that can derive from youth fire involvement, and the extensive use of fire intervention programs, efficacy data for existing treatments is limited and includes only one randomized controlled trial (RCT). The current RCT examined the relative benefits of a multimodal, collaborative firesetting intervention by comparing a modified protocol of The Arson Prevention Program for Children (TAPP-C), which included fire service and mental health components, to the standard treatment, which is fire safety education only (FSE). The study examined change in fire-specific safety knowledge, attitudes and behaviors, and is the first to examine change across broader indices of behavioural and emotional well-being, and parenting constructs. The study sample comprised 27 fire-involved youth, aged 6-16, referred to the TAPP-C program at a large teaching hospital, and their caregiver. Caregiver-youth dyads were randomly assigned to a modified TAPP-C or FSE intervention with data collected at pre- and post-intervention, and 3-month follow-up. Results showed both interventions were effective in reducing firesetting, fire interest, and behavioural and emotional difficulties. No recidivism was reported for either group post-intervention or at 3-month follow up. Results for the parenting constructs revealed negative perceptions of the caregiver-child relationship. Preliminary results suggest fire-involvement may be associated with externalized parental locus of control (PLOC) orientation, and significant relationships were found among parental cognitions, PLOC, and perceived parental competence. Novel findings showed youth deficit in executive function (EF), and that greater EF deficit was significantly related to greater youth-reported fire-interest and behavioural difficulties. Youth participants performed poorly on an impulsivity task, suggesting great impairment

in this area. Only youth who received the modified TAPP-C intervention showed significant improvement on the impulsivity task, highlighting a unique benefit for interventions including a mental health component. Finally, results showed readiness to change significantly improved post-treatment for caregivers and youth in both groups. As only the second RCT of a firesetting intervention, the results represent a significant contribution to the existing literature and establishment of best practice intervention by providing preliminary data on the relative efficacy of FSE and combined, collaborative approaches.

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Introduction

Youth firesetting is a dangerous and costly behaviour. In Canada, approximately 1,300 fires are started annually by children engaging in fire play and result in an average of 20 deaths, 150 burn injuries and $14 million in property damage (Windsor Fire and Rescue Services, 2022). In Ontario, youth firesetting accounts for over 50% of arsons (Windsor Fire and Rescue Services, 2022). In the United States between 2014 and 2018, children playing with fire caused an estimated annual average of 30,460 fires, resulting in an estimated 50 civilian deaths, 510 civilian injuries, and $205 million in direct property damage each year (Campbell, 2021). Most home structure fires resulting from child fire play were started in a bedroom, accounting for 34% of the fires, and more than 80% of home structure fires that resulted from fire play were started by children aged ten or younger (Campbell, 2021). In Ontario, high rates of firesetting have been found in youth (27%; MacKay, Paglia-Boak, Henderson, Marton, & Adlaf, 2009), and between 2000 and 2009, 21% of all fires involving child fatalities were caused by children playing with fire starting materials (The Office of the Fire Marshal [OFM], 2011). During this period, a total of 91 children died in fires (OFM, 2011). Most recently, statistics from the OFM show that in Ontario, between 2012 and 2021, residential fires resulted in 761 civilian deaths; 28 fatalities were children aged 15 and younger (OFM, 2023).

In 2009, the Ontario Coroner's Office conducted a retrospective cohort study reviewing all Ontario residential fire fatalities that occurred between 2001 and 2006 involving children under the age of 16. Over this period, 39 fire events resulted in 60 child fatalities. Fire play, most often involving matches and lighters, was found to be the leading cause of the fires, accounting for 26% of the fires (followed by electrical failure

at 20%). Fire play directly caused 10 fires and 12 deaths. Notably, the fires caused by fire play all took place during waking hours (between 11am and 11pm) and occurred in the absence of adult supervision. Children from families that had a history of involvement with the Children's Aid Society (CAS) were approximately 32 times more likely to die in fires (Chen, Bridgman-Acker, Edwards, & Lauwers, 2011).

Firesetting appears to be a recurring behaviour in the absence of intervention. One study found high rates of recidivism (up to 59%) in this population (patient and nonpatient samples) (Kolko, Bridge, Day, & Kazdin, 2001), highlighting the necessity for intervention. In response to this devastating behaviour, firesetting intervention programs have been widely implemented; yet there is an absence of research examining the efficacy of these programs. Existing studies have also failed to specify how treatment components specifically relate to treatment outcome (Adler, Nunn, Northam, Lebnan, & Ross, 1994). It is still unknown if, and how, firesetting interventions actually function to reduce firesetting behaviours. More research is required to determine a best-practice, evidence-based intervention for youth firesetting.

Fireplay is common among youth and is defined as fire-related behaviours motivated by curiosity and/or experimentation rather than by a malicious intent to harm or cause damage (Sharp, Blaakman, Cole, & Cole, 2006**)**. Fire involvement is a term that encapsulates all forms of fire-related behaviour, regardless of motivation or intention (i.e., fire involvement intended as experimentation as well as intended to harm or cause damage). Fire involvement can be motivated by impulsivity, boredom, curiosity, attention-seeking, maliciousness or a pathological interest in fire. It is defined as any unsanctioned or dangerous fire-related behaviour that has been threatened, planned or

carried out (e.g. match and/or lighter play, fire play, firesetting or arson, and bomb-making) (MacKay, Henderson, Root, Warling, Gilbert, & Johnstone, 2004). Although *fire involvement* is not captured in the form of a psychological diagnostic category in its own right, the *Diagnostic and Statistical Manual of Mental Disorders - Fifth Edition TR* (DSM-5 TR) includes *firesetting* as one of the criteria for diagnosing conduct disorder (i.e. “has deliberately engaged in fire setting with the intention of causing serious damage”) (American Psychiatric Association [APA], 2022). Conduct disorder is the most common diagnosis given to juvenile firesetters (Becker, Stuewig, Herrera, & McCloskey, 2004; Dadds & Fraser, 2006; Forehand, Wierson, Frame, Kemptom, & Armistead, 1991; Jacobson, 1985; Kolko & Kazdin, 1989a, 1991a; MacKay, Henderson, Del Bove, Marton, Warling, & Root, 2006; McCarty & McMahon, 2005). Firesetting is also the main criterion for diagnosing pyromania (i.e. “Deliberate and purposeful fire setting on more than one occasion” [APA, 2022]), which is considered to be rare in children, with firesetting being more typically associated with conduct disorder, attention-deficit/hyperactivity disorder, or an adjustment disorder (APA, 2022). It is specified in the diagnostic criteria for pyromania that the firesetting is not better explained by conduct disorder, a manic episode, or antisocial personality disorder. The diagnostic categories of conduct disorder and pyromania both fail to capture the more common forms of youth fire involvement, which lack a deliberate intent to set fires, such as match or lighter play. Firesetting as part of "developmental experimentation in childhood" is included with the differential diagnosis considerations for pyromania (APA, 2022).

Prevalence of Child and Adolescent Firesetting

Prevalence estimates of firesetting in children and adolescents vary considerably, as methodological factors (e.g., the operational definition of firesetting, sampling population, and informant recruited to provide data) greatly influence research results (MacKay, Feldberg, Ward, & Marton, 2011). Some estimates have indicated that for every fire started by a youth that is reported, between two and five fire incidents are not reported (Baretto, Boekamp, Armstrong, & Gillen, 2004). It has also been reported that only about 20 to 25 percent of youth firesetters ever become known to intervention services (Stadolnik, 2000). In particular, self-report rates of firesetting by youth and caregivers are important to consider. Youth may not be honest when self-reporting, and caregivers may be unaware of a youth's firesetting as this behaviour is often covert, resulting in under-reporting when only caregiver informants are utilized (Kolko, 1985; Loeber, Wung, Keenan, Giroux, Stouthamer-Loeber, Van Kammen, et al., 1993). One study found that only 28% of community parents are aware of their child's fire-involvement (Del Bove, Caprara, Pastorelli, & Paciello, 2008). Additionally, low rates are reported when firesetting is strictly defined as with malicious intent to cause serious damage to objects or persons (e.g., 0.1 to 0.4%; Lahey, Applegate, Barkley, Garfinkel, McBurnett, Kerdyk, et al., 1994; Gelhorn, Hartman, Sakai, Mikulich-Gilbertson, Stallings, & Young, 2009). Self-report studies that utilize more inclusive definitions of firesetting (e.g., unsanctioned or unsupervised use of ignition materials to burn targets) show that approximately 10% to 57% of elementary school aged children will have set a fire in the absence of a supervising adult (Cole, Grolnick, Laurenitis, McAndrews, Matkoski, & Schwartzman, 1986; Kafry, 1978; Martin, Bergen, Richardson, Roeger, &

Allison, 2004). During adolescence, self-report studies indicate that unsanctioned firesetting is not uncommon, with prevalence rates ranging from 4.5% to 33% (Chen, Arria, & Anthony, 2003; Del Bove et al., 2008; Howell-Bowling & Omar, 2014; MacKay et al., 2009; Martin et al. 2004). Given that unsanctioned firesetting is often a covert activity, many fires are undetected, or the causes of such fires are unknown (Doley, Fineman, Fritzon, Dolan, & McEwan, 2011).

One survey of 1, 351 children in grades 1 to 12, conducted by the British Columbia Fire Service, found that 88% of boys and 81% of girls reported that they had played with or started a fire by high school (Jones & Jackson, 1999). Another survey of 5, 416 children in Oregon found that by the end of sixth grade, 57% reported having set a fire without adult supervision (Simonson & Bullis, 2001). In Ontario, a survey of 3, 965 students in grades 7 to 12 found that 27% of the youth reported at least one episode of firesetting during the past year; 40.5% reported lifetime firesetting, but no firesetting during the previous 12 month time-frame (MacKay et al., 2009). Of those reporting firesetting in the previous year, 13.7% reported 1 or 2 episodes and 13.5% reported 3 or more episodes. Males reported more fire involvement than females, and few females (8.5%) reported being involved in more than 1 or 2 episodes during the past year; however, many females (61.5%) did report some lifetime fire involvement. Although fireplay appears to be a common behaviour among youth, most fireplay is never reported (Sharp et al., 2006).

The prevalence rate of firesetting in clinical samples varies substantially depending on the setting (outpatient versus inpatient), the age and sex of the child, and the definition of fire involvement, with rates ranging from 2% (Jacobson, 1985) to 52%

(Kolko & Kazdin, 1988). Overall, males appear to engage in firesetting more frequently than females in both community samples (Chen et al. 2003; MacKay et al., 2009; Martin et al. 2004), and clinical samples (Kolko et al. 2001), with the male-to-female ratio of fire involvement falling between 6:1 (Perrin-Wallqvist & Norlander, 2003) and 9:1 (Fineman, 1980). This gender difference begins at an early age (Dadds, Fraser, Frost, & Hawes, 2005; Grolnick, Cole, Laurentis, & Schwartzman, 1990) and continues into adulthood (Vaughn, Fu, DeLisi, Wright, Beaver, Perron, et al., 2010). Notably, research examining female fire involvement is scarce. The majority of research on firesetting adolescents uses samples including predominantly male participants who are involved in fire intervention programs (Dadswell, Sambol, Zervos, Harris, & Ball, 2023). One recent meta-analysis found that of 25 samples (including 12, 294 participants), 92.7% of participants were male (Sambrooks, Olver, Page, & Gannon, 2021). Some recent, rare research examining females suggests that emotional dysregulation, personality disorders and a history of trauma are important factors in the firesetting behaviour of women and girls (Nanayakkara, Ogloff, Davis, & McEwan, 2020; Roe-Sepowitz & Hickle, 2011). More research is required to understand gender differences, if any, in firesetting.

Fire involvement appears to decline over the course of development, as a greater number of younger children have been shown to be involved with fire compared to adolescents. Specifically, it has been consistently reported that younger children express greater interest in fire (Block, Block, & Folkman, 1976; Chen et al. 2003; Dadds & Fraser, 2006) and more frequently engage in match play, fire play, and firesetting compared to older children (Dadds & Fraser, 2006; MacKay et al., 2009). This is not to say that adolescence is a developmental period associated with less risky fire involvement

behaviour in general. In fact, adolescence is often a time of heightened risk taking, and as Lambie, Randell and McDowell (2014) proposed, this age group in particular may be more likely to engage in "copycat" firesetting behaviours. With social media inundating many facets of adolescent life, they have immediate and unsupervised access to problematic representations of youth firesetting on social media platforms such as YouTube (Thomas, MacKay, & Salsbury, 2012). Fire interest typically remains an interest until the age of 12, when fire experimentation starts to increase and then manifest between the ages of 13 and 16 (Pooley & Ferguson, 2017).

Lambie and colleagues (2023) investigated age differences in the risk factors, motivations and behaviours of firesetting in a large sample (n = 1790) of firesetting children (aged 3 to 11) and adolescents (aged 12 to 17). Results showed that children were significantly less likely than adolescents to have engaged in pre-intervention offending, to have used an accelerant, and to be motivated by boredom. However, children were significantly more likely than adolescents to have set fires inside their residence, to have hyperactivity problems, to have negative feelings when lighting fires, and to have experienced neglect and household deprivation. This study highlights the early emergence of family dysfunction, victimization, as well as psychosocial and behavioural problems, for firesetting children and adolescents. Overall, research examining age differences between child and adolescent firesetting remains scarce and lacks consensus; further research would help reveal the specific assessment and treatment needs for these age groups (Lambie, Randell, Ioane, Best, & Reed, 2023).

Theoretical Perspectives & Models of Juvenile Firesetting

Early perspectives on firesetting were dominated by psychodynamic theories and frameworks, such as Freud's (1932) proposed link between firesetting, enuresis, and sexual desire, which has garnered little support in the research literature. Psychodynamic accounts of firesetting were deemed speculative, at best, and were beset with methodological problems and other limitations such as poor measurement of its key constructs (Ward, Ruttle, & MacKay, 2015). Beginning in the 1980s, perspectives on juvenile fire setting shifted to models that apply behavioural, cognitive-behavioural, and social learning principles. Individual characteristics, as well as family and environmental factors, are all now considered to be important in understanding the development, maintenance, and persistence of youth firesetting. Fineman's dynamic-behavior theory of firesetting (Fineman, 1980, 1995) is one example of such a model, which views firesetting behaviour as resulting from the interaction of risk factors from these domains, including individual factors (e.g., demographic and psychological variables), family and social factors (e.g., parenting and peer variables), and environmental factors (i.e., conditions in the individual's immediate environment that encourage firesetting behaviour).

Patterson (1982) proposed a social learning model of juvenile antisocial behaviour; the Coercion Model. This model takes a developmental perspective, whereby firesetting behaviour is viewed as an advanced behaviour on an antisocial trajectory, that is developed through both learning and experience in two stages. Within the family environment, a child is first exposed to ineffective, harsh and unpredictable parent management practices (e.g., lack of clear rules and expectations, inappropriate strategies

for monitoring and responding to child compliance or disobedience, lack of supervision), which prevent the child from predicting likely responses to their own behavior (e.g., negative behaviour may be either ignored or punished, and positive behaviour is not rewarded nor reinforced). It has been shown that caregivers who experience social disadvantage, substance abuse and dependence, or a high level of stress are at risk for these ineffective parenting practices (Patterson, Reid, & Dishion, 1992). These practices cause dysfunctional caregiver-child interactions involving conflict and confrontation, whereby aggressive behaviour is modeled, learned, and ultimately negatively reinforced by the caregiver giving way to the child, which additionally reinforces the caregiver's ineffective parenting. These negative exchanges promote the progression of antisocial behaviours, through disobedience, fighting and tantrums, lying, and stealing. Firesetting occurs later in this developmental chain of antisocial behaviours. As the child reaches adolescence, ongoing poor parental monitoring and supervision of the youth, caregiver-child conflict, an antisocial peer group, and academic problems all contribute to the risk that the antisocial behaviour will persist and progress (i.e., to criminality) (Patterson & Dishion, 1985). Patterson's model has been tested and empirically supported in several studies (e.g., Patterson & Dishion, 1985; Ramsey et al., 1990) and some evidence for the hypothesis that firesetting represents an advanced level of antisocial behaviour has also been found (Forehand et al., 1991; Stickle & Blechman, 2002). However, research is lacking regarding the developmental course of firesetting.

An ecological risk model for juvenile firesetting has also been supported by research findings (Kolko & Kazdin, 1986), which points to groups of risk factors. This model builds on the psychosocial model by both specifying and operationalizing the

individual, social, and immediate environmental factors that are related to the onset, severity, and maintenance of fire-involvement behaviour (Gaynor, 1991). These risk factor groups include, *learning experiences and cues* (i.e., early modeling of fire behaviours; early interest in and direct experience with fire; availability of corrective adult models; and access to fire materials), *the child's cognitive, behavioural, and motivational profile* (i.e., limited fire-safety skills; deficits in social skills; presence of covert antisocial behaviours such as property destruction, stealing, and lying; firesetting motivation; and affect arousal such as heightened levels of anger and curiosity), and *parental and family influences and stressors* (i.e., limited parental supervision and monitoring; inconsistent and/or harsh discipline strategies; parental emotional distance and lack of involvement with the child; parental psychopathology, including alcohol abuse, antisocial behaviour, depression, schizophrenia and psychosis; and stressful life events).

Features of Youth Firesetters

Understanding the factors associated with firesetting has important implications for treatment and intervention, particularly in providing mental health professionals who work with these youth with direction regarding treatment targets for both fire-specific and general mental health intervention. Research findings implicate hyperactivity (Dadds & Fraser, 2006; McCarty & McMahon, 2005) and impulsivity (Kolko & Kazdin, 1991a; McCarty & McMahon, 2005; Walters, 2023), as well as anger and emotional dysregulation (Chen et al., 2003; Forehand et al., 1991; Jacobson, 1985; Kolko & Kazdin, 1991a; McCarty & McMahon, 2005; Sakheim & Osborn, 1999; Stickle & Blechman, 2002) as important risk factors for firesetting. In younger children, heightened curiosity

and excitement about fire and impulsivity can lead to increased experimentation and play with ignition materials, such as matches and lighters. These factors, combined with poor supervision, easy access to fire-setting materials, and the fact that young children are more likely to experiment with fire within the home (Harpur & McConnell, 2013), can lead to devastating consequences. In fact, the most common fires that result in a child's death are fires started by children through fire play (Harpur & McConnell, 2013). Heightened emotional arousal, coupled with a limited understanding of cause and effect and a lack of awareness of potential consequences of fire play, can impede the use of basic emergency fire-safety skills and can also lead to increased internalizing and externalizing behaviour difficulties. Curiosity and attraction to fire has been theorized to be innate in human beings, as it serves a survival purpose (Ellithy, Hawke, Ward, & Henderson, 2021). Even very young children (as young as age 2) show this curiosity, with attraction to factors such as the changing colours of flames, the flames responsiveness to breath and movement, and the objects used to ignite fires (Pollack-Nelson, Faranda, Porth, & Lim, 2006). Fire involvement occurring during the preschool years can therefore be considered developmentally appropriate (Hanson, MacKay, Atkinson, Staley, & Pignatiello, 1995; Kafry, 1980), although when this normative curiosity is combined with poor caregiver supervision practices and easy access to ignition materials, the outcomes can be serious and even deadly (Kolko, & Kazdin, 1989a).

There is little research available on fire play for very young children, even though fire interest and fire play are common in this demographic. Fireplay begins typically around age 2 to 3 and progresses to more intentional firesetting behaviours between the

ages of 5 and 9 (Gaynor, 2002). Data from a preschool sample (ages 2 to 6), which examined the psychosocial risk factors associated with firesetting, indicated that most preschoolers who set fires are male, and are motivated by curiosity (Ellithy et al., 2021). This study also highlighted exposure to firesetting models such as online images and videos, or witnessing someone play with fire, mental health symptoms (i.e., externalizing symptoms within the clinical range) and having an accomplice as important risk factors for firesetting behaviour. Results additionally showed that children who were disciplined or punished for their firesetting behaviour were engaged in more firesetting incidents.

In older children and adolescents, difficulties with attention, impulsivity, and anger and frustration regulation are factors that likely contribute to firesetting behaviour (Kolko & Kazdin, 1991a; Lambie, Ioane, Randell, & Seymour, 2013). Firesetting youth are more likely to have a history of aggression (Sakheim & Osborn, 1999) or display current aggression (Chen et al., 2003; Forehand et al., 1991; Jacobson, 1985; McCarty & McMahon, 2005; Repo & Virkkunen, 1997; Stickle & Blechman, 2002) when compared with nonfiresetting peers. Firesetting youth have also been shown to experience more social problems and peer rejection compared to nonfiresetting youth (Chen et al., 2003; Sakheim & Osborn, 1999), as well as greater impairment in their primary attachments (Nurcombe, 1964; Sakheim, Vigdor, Gordon, & Helprin, 1985). In their study examining fire-related and attentional factors in an adolescent firesetting sample, Hoerold and Tranah (2014) reported that adolescent firesetters had high levels of impulsivity and callousness compared to a parallel sample of adolescents displaying antisocial behaviours, and both groups exhibited high levels of uncaring traits and low cognitive empathy. High impulsivity was also found to be related to a higher frequency of

firesetting, and the authors identified impulsivity as a potentially important target for assessment and treatment in the adolescent firesetting population.

Children and adolescents who are involved with fire experience greater rates of mental health diagnoses including attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD) in addition to displaying more general difficulties at home, school and with peers (Becker et al., 2004; Dadds & Fraser, 2006; Howell-Bowling & Omar, 2014; Jackson Hope, & Glass, 1987; Kolko, 1996; Lambie et al., 2013; Repo & Virkkunen, 1997). Howell-Bowling and Omar (2014) investigated school-related predictors of youth firesetting in a normative sample. They found that adolescents endorsing poor academic performance and poor attitudes towards school were more likely to set fires than those endorsing higher academic performance. They also found that problems with attention were predictive of firesetting. Higher externalizing, internalizing, and total problems were found in individuals who reported setting fires relative to peers that did not fire-set (Howell-Bowling & Omar, 2014). Unhoo et al. (2015) also examined firesetting within the school context using official register data from emergency services in Sweden and determined that 44% of all arson cases between 1992 and 2008 were committed by individuals aged 15 to 25, 81% of which were male. They also examined motives for school arsons in youth aged 15 and under and reported that 33% of the acts were coded as play vandalism; only 8% were coded as vindictive vandalism. Other motives included obstructing school activities (21%), destroying evidence to hide acts of theft (5%), and unintended fires (10%) that were often committed in the presence of 3 to 5 peers. Another group identified (24%) was

youths with a psychiatric diagnosis who were characterized by engaging in repetitive firesetting and acting alone (Unhoo, Persson, Ekbrand, & Lindgren, 2015).

Firesetting is additionally associated with psychopathology and substance use in adolescence (MacKay et al., 2009). Conduct disorder and ADHD are the most common mental health diagnoses found in firesetting children and adolescents (Becker et al., 2004; Dadds & Fraser, 2006; Forehand et al., 1991; Jacobson, 1985; Kolko & Kazdin, 1989a, 1991a; Lambie et al., 2013; MacKay et al., 2006; McCarty & McMahon, 2005; Sasaki, Hakosima, Inazaki, Mizumoto, Okada, Mikami, Tsujii, & Usami, 2023). It is important to highlight that, in clinical settings, firesetting is rarely (4%) the primary presenting problem (Stewart & Culver, 1982), and presents alongside these other difficulties. Barreto & Parker (2022), in particular, note the potential for co-occurring internalizing (e.g., anxiety and depression) and externalizing disorders (e.g., ADHD) in youth firesetters, which present more commonly in acute child mental health treatment centers or psychiatric settings. One recent retrospective case–control study in Japan compared the clinical characteristics of child and adolescent psychiatric outpatients who engaged in fireplay or arson (n = 64) with a control group without such behaviors (n = 2,268) (Sasaki et al., 2023). The most prevalent diagnosis found in the fire-involved case group was ADHD (57.8%); antisocial behaviour was also found in 46.9% of the case group (Sasaki et al., 2023). Firesetting adolescents have more contact with mental health (Bailey, Smith, & Dolan, 2001; Moore, Thompson-Pope, & Whited, 1996; Räsänen, Hirvenoja, Hakko, & Väisänen, 1995) and social services (Bailey et al., 2001), and more frequently report higher levels of psychological distress (MacKay et al., 2009), suicidal ideation and behaviour (MacKay et al., 2009; Martin et al., 2004; Räsänen et al., 1995; Tanner,

Hasking, & Martin, 2015a, 2015b), and alcohol and substance use problems (Bailey et al., 2001; MacKay et al., 2009; Martin et al., 2004; Räsänen et al., 1995; Tanner et al., 2015a) compared to non-firesetting adolescents.

Fire-specific factors, such as age of onset of fire involvement, curiosity about fire, and severity of firesetting play an important role in the maintenance of firesetting behaviours (MacKay et al., 2006), and have been shown to distinguish high-rate firesetters from low-rate firesetters and desisters (i.e., those who stop their fire involvement) (Martin et al., 2004). Other factors have been shown to differentiate firesetting from non-firesetting youth, including exposure to inappropriate models of fire-related behaviour, curiosity about fire, greater knowledge of items that burn (Kolko & Kazdin, 1989a, 1989b, 1991b), current fire involvement (Kolko & Kazdin, 1989a, 1989b; MacKay et al., 2009), and a history of fire involvement (Hanson, MacKay-Soroka, Staley, & Poulton, 1994). Firesetting recidivism has been linked to the severity of firesetting, firesetting interest, and antisocial behaviour (MacKay et al., 2006; Repo & Virkkunen, 1997). Above and beyond the great cost to society in terms of damage and casualties, youth firesetting has been linked to future criminal behaviour (Becker et al., 2004; Lambie et al., 2013; Sambrooks et al., 2021), and childhood fire involvement has been found to be a strong predictor of adult arson (Rice & Harris, 1996). In fact, prior or concurrent antisocial behaviour is the most common trait noted in firesetting youth (Kolko et al., 2001; MacKay et al., 2006). Even when matched for the presence of conduct disorder, firesetting youth have more extreme levels of antisocial behaviour (Forehand et al., 1991; Stickle & Blechman, 2002). It has been reported that more than

half of individuals with a history of firesetting engaged in further diverse criminal activity not involving fire (Sambrooks et al., 2021).

A recent meta-analysis examined risk and protective factors associated with youth firesetting over a 30 year period, and included 39 independent samples with 22,292 juveniles (Perks, Watt, Fritzon, & Doley, 2019). Results showed that fire-specific variables, including history of fire involvement and fire interest in particular, most strongly differentiated between firesetters and non-firesetters (control groups were youth living in the community, forensic samples, and clinic referred youth). Other risk factors identified for firesetters included extensive histories of problematic behaviours, adverse familial events, higher rates of emotional dysregulation, and greater prevalence of mental health disorders. Protective factors in general were also less often identified for firesetters. The results of this meta-analysis emphasize the complexity of problems that impact the juvenile firesetting population.

There is a lack of research investigating the role of family and parenting factors in juvenile firesetting. Links have been shown between firesetting and single-parent households (Pollinger, Samuels, & Stadolnik, 2005; Root, MacKay, Henderson, Del Bove, & Warling, 2008), and firesetting youth have been shown to experience more frequent disruptions in their caregivers (Strachan, 1981). The OFM observed that fire events caused by child fire play were frequently associated with child welfare involvement, prompting a 2009 study by the Ontario Coroner's Office, which revealed that between 2001 and 2006, 58% of deaths caused by fire play were children involved with a children's aid society (Chen et al., 2011). Parenting practices have also been investigated, and several studies have shown that firesetting children and adolescents

experience a greater frequency of harsh, dysfunctional, and physically abusive parenting practices compared to their non-firesetting counterparts (Bailey et al., 2001; Becker et al., 2004; Bradford & Dimock, 1986; Dadds & Fraser, 2006; McCarty & McMahon, 2005; Ritvo, Shanok, & Lewis, 1983). Firesetting youth have additionally been shown to endorse lower parental warmth (McCarty & McMahon, 2005), and severe maternal rejection has been linked to high risk firesetting (Sakheim & Osborn, 1999). Firesetting youth who have been maltreated demonstrate greater frequency and versatility of firesetting, and are more likely to persist with firesetting, compared to non-maltreated firesetters (Root et al., 2008). Serious parental psychopathology has been reported in caregivers of children involved with fire, such as depression (Kolko & Kazdin, 1986; McCarty & McMahon, 2005) and substance use (Becker et al., 2004; Showers & Pickrell, 1987). One Australian study examined the prevalence of developmental disadvantage in a sample of firesetting offenders, and the extent to which that disadvantage could differentiate between recidivist and one-time firesetters (Bell, Doley, & Dawson, 2018). Specifically, the study identified that a history of abuse, the absence of parental figure through childhood, problematic substance use, poor academic achievement, and the presence of speech, learning and reading deficits are common among firesetters. Notably, the presence of childhood abuse and learning disability were risk factors for recidivism (Bell, Doley, & Dawson, 2018). Although family and parenting factors have been implicated as important risk factors for juvenile firesetting, further investigation is warranted.

Youth Firesetting Recidivism

Studies considering predictive factors for youth firesetting recidivism have examined both fire-specific and psychosocial factors. Del Bove et al. (2008) reported that recidivism was predicted by the extent of a youth's psychopathology in a community sample. Firesetting recidivism was found in 15% of their sample 2 to 6 years after completing a fire-specific assessment. In a forensic sample, Repo and Virkkunen (1997) found that 15.6% of youth had been convicted of a new arson offense during a 6-year follow-up period. In a sample of outpatient firesetters, MacKay et al. (2006) reported a 26% recidivism rate; degree of antisociality and firesetting severity, as well as assessed level of fire interest, were found to be related to recidivism. Adler, Nunn, Northham, Lebnan, and Ross (1994) reported a 40% recidivism rate in sample of child and adolescent firesetters after a brief intervention.

Del Bove and MacKay (2011) developed a classification system for youth firesetters that considers both fire-specific general mental health variables. Using cluster analysis, results yielded three distinct groups of firesetters framed by risk level; a group with low rates of general mental health risk factors as well as the most limited fire involvement histories, a multi-risk group with the highest levels of risk on mental health and fire-specific variables, and an intermediate group with significant fire involvement histories as well as high levels of home instability (i.e., child welfare involvement, out-of-home placements, and abuse).The lowest rate of firesetting recidivism (9%) was found in the group with limited mental health and fire-specific risk factors. The intermediate group had a moderate rate of recidivism (30%), and the multi-risk group had the highest

rate of recidivism (50%). These results were concluded to provide evidence of different developmental pathways and etiological routes to youth firesetting.

Lambie et al. (2013) examined offending in a sample of youths in New Zealand who had completed a short fire awareness and intervention program (Fire Awareness and Intervention Programme; FAIP), in a follow-up study. Comparing a subsample of offending youths to a group of non-offending youths across the 10-year follow-up period, only 2% committed an arson offense, although general offending rates were high (59%). Offending was shown to be predicted by both fire-setting behaviour and a history of abuse, and youths who were rated as at high risk to reoffend were diagnosed with higher rates of attention problems. The presence of family stress and a diagnosis of ADD/ADHD were also associated with previous firesetting behaviour.

In a later study, Lambie, Randell, Krynen, Reed, & Ioane (2019) followed a large national sample (n = 1,790) of children from the same program (i.e., FAIP), up to 10 years after intervention. Results showed that most (62%) had committed an offense (primarily moderate or severe offending) post-intervention, while only 5% had committed an arson offense post-intervention. Additionally, victimization, psychosocial and emotional problems, previous conduct problems, and child welfare history were all found to be associated with post-intervention offending and/or offending severity.

Watt, Geritz, Hasan, Harden, and Doley (2015) compared the prevalence of firesetting in an adolescent school sample with a sample of juvenile offenders. They found higher firesetting frequency in the offending sample compared with the school sample. The severity of fires set by the offending sample was also greater. Of note, match-play in starting fires was common in both samples, with 20% of adolescents in

both samples reporting having lit 10 or more fires. Repetitive firesetting was more likely in youths with higher levels of fire interest and affect towards fire, as well as persistent thinking about fire, and persistent firesetting was related to antisocial behaviour.

Dadswell and colleagues (2021) examined the prevalence of persistent firesetting among 61 youth (aged 5 to 17 years) who completed the Fire-CAP program in Victoria, Australia, and identified differences between persistent and non-persistent firesetters after intervention. The results showed that 32.8% of the sample persisted with firesetting behaviour (including both matchplay and/or firesetting behaviour) at 12-month post-intervention follow-up. Compared to non-persistent firesetters, persistent firesetters scored significantly higher on a parent-report firesetter risk screening tool. Parents of persistent firesetters also reported their children were younger at firesetting onset, reported a greater history of firesetting, and reported higher levels of internalizing, externalizing and social issues. These results indicate that youth at the greatest risk of firesetting recidivism have an increased history of firesetting as well as complex psychosocial concerns (Dadswell, Kurt, Ball & Bruck, 2021).

Sambrooks et al. (2021) examined reoffending in their meta-analysis of 25 samples of untreated adults and children with a history of firesetting. Results indicated that between 57% and 66% of untreated firesetters engage in general reoffending, between 8% and 10% engage in criminal arson, and approximately 20% engage in deliberate firesetting behavior. Remarkably, the odds of firesetting during the follow-up period were 5 times greater for known firesetters compared with other offenders.

The results of these studies indicate that youth firesetting is associated with a host of fire-specific and psychosocial factors at both the individual and family levels. Most

notably, these studies highlight the high rates of youth firesetting recidivism, and link youth firesetting to future criminal behaviour. Interventions for youth firesetting are of paramount importance to address youth firesetting recidivism and its costly and deadly consequences.

Youth Firesetting Intervention: Assessment and Treatment

Due to the dangerousness and high costs of youth firesetting, interventions can be found in most North American communities. The most common intervention model is comprised of fire safety education (FSE) provided by fire service professionals (Adler et al., 1994; Bumpass, Brix, & Preston, 1985; Kolko, 1988). FSE is the preferred or only intervention component available in many jurisdictions outside Ontario. This has also been found to be the case in England and Wales (Palmer, Caulfield, & Hollin, 2007). Additionally, it is common for fire service professionals to conduct firesetting risk assessments and make referrals to mental health services (Adler et al., 1994; Bumpass et al., 1985; Kolko, 1988). The United States Fire Administration (USFA) of the Federal Emergency Management Administration (FEMA), one of the most well-known fire service organizations, developed and revised the Juvenile Firesetter Intervention Handbook to assess firesetting youth (FEMA, 1979, 1983, 2002). The FEMA program is based on risk assessment (via structured interviewing and questionnaires) and classifies youth as Low, Definite, or Extreme Risk for further firesetting, to determine the nature of recommended interventions. Specifically, youth classified as Low Risk are provided with fire safety education, while youth rated as Definite or Extreme Risk are referred to mental health or other social service agencies for assistance. Determining a youth's level of risk for further firesetting is perhaps the most consistent feature of the fire service

professional's work with juvenile firesetters (MacKay, Ruttle, & Ward, 2012). Of note, the FEMA assessment instruments require fire service personnel to make clinical ratings of appearance, intelligence, and other features of mental status and psychopathology, despite an absence of published research to validate fire service professionals undertaking these tasks. Additionally, despite these instruments' lengthy (i.e., more than forty years) and widespread use, there are, to date, no peer-reviewed studies on their reliability or concurrent or predictive validity. However, there are currently no alternative, fully validated peer-reviewed instruments to assess firesetting severity or to predict firesetting recidivism (MacKay et al., 2012; Tyler, Gannon, & Sambrooks, 2019).

Rarer are multimodal, firesetting-specific treatment programs that include a psychological intervention. These treatments typically involve two components: a psychological intervention (typically behavioural therapy or cognitive-behavioural therapy [CBT]) that targets firesetting behaviours and child and family mental health factors, as well as an educational intervention in the form of FSE to promote fire safety knowledge and skills (Adler et al., 1994; Bumpass et al., 1985; Kolko, 2001). Although behaviour therapy treatments have used satiation (repetitive firesetting under supervision) to extinguish firesetting behaviour (Adler et al., 1994), the CBT-based treatments typically introduce new cognitive and behavioural skills to control the behaviour (Kolko, Herschell, & Scharf, 2006). These multimodal treatments do not always use a mental health professional to deliver the psychological intervention; sometimes it is fire service professionals who implement such interventions (e.g., Adler et al., 1994). The type and level of professional training required to successfully implement psychologically-oriented

firesetting interventions is unknown, as no research is available on this topic (MacKay et al., 2012).

A number of fire-specific assessment measures have additionally been developed for empirical studies of juvenile firesetters. Several instruments to assess firesetting were developed by Kolko and Kazdin through their research with children aged 6 to 12 years. The Firesetting History Screen (Kolko & Kazdin, 1988) measures the frequency of match play and firesetting. The Firesetting Risk Interview (Kolko & Kazdin, 1989a, 1989b) is a caregiver-report questionnaire that includes both fire-specific subscales (i.e., curiosity, early experience, fire competence, fire knowledge, and exposure) and general factors such as supervision, discipline, and frequency of harsh discipline. The Fire Incident Analysis (Kolko & Kazdin, 1991b, 1994) provides a quantitative assessment of specific fire incidents. MacKay and colleagues have also developed a battery of fire-specific assessment tools (Henderson, MacKay, & Peterson-Badali, 2006; MacKay et al., 2004), including the Fire Involvement Interview (FII; MacKay et al., 2006; Root et al., 2008), a semi-structured interview that obtains detailed information about a youth's fire involvement history, the Fire Interest Questionnaire (FIQ; MacKay et al., 2006; MacKay et al., 2009), which measures fire interest and fire-related behaviours (as reported independently by both youth and caregivers), and the Fire Involvement Risk Evaluator for Youth (FIRE-Y; MacKay & Henderson, 2009), which provides a structured format that identifies and operationalizes the fire-specific risk factors to be evaluated, as well as aides the facilitation of professional judgement about an individual's firesetting risk. They also developed a fire-specific Stroop task to provide an experimental measure of fire interest (Gallagher-Duffy, MacKay, Duffy, Sullivan-Thomas, & Peterson-Badali,

2009). Finally, Stadolnik (2010) developed the Firesetting Risk Assessment Tool for Youth (FRAT-Y). This tool can be used with children aged 5 to 17 years, and similar to the FIRE-Y, is completed by a mental health professional to organize assessment information and make ratings of estimated risk for firesetting (i.e., low, moderate or high risk). This tool additionally allows clinicians to consider firesetting motivations, to help identify appropriate interventions.

A youth's fire-related history, interest, and firesetting incidents are important factors to assess to gain an understanding of their firesetting behaviour and to facilitate the estimation of risk for further firesetting behaviour. However, given that research is still limited on the diagnostic and prognostic reliability and validity of fire-specific assessment measures, it is imperative that these instruments be used in conjunction with standardized measures of youth and family psychosocial functioning to ensure a comprehensive and valid summary of the youth's mental health functioning. Comprehensive assessment practices additionally aid case formulation as well as the selection and implementation of appropriate treatment (MacKay et al., 2012).

Review of Intervention Research

Despite the serious consequences of youth fire involvement and the extensive use of fire intervention programs, little is known about the efficacy of existing interventions and treatments. While treatment outcome studies have been conducted on interventions for child and adolescent externalizing behavioural disorders (e.g., treatments for conduct disorder) and disruptive behavioural problems in general (Estrada & Pinsof, 1995; Feinfeld & Baker, 2004; Kazdin & Wassell, 2000), few empirical studies have examined the outcomes of treatments for firesetting specifically. Therefore, the relative efficacy of

fire service, mental health, or collaborative/combined approaches for this age group remains unknown. How the different components (i.e., FSE and CBT) of multimodal firesetting treatments specifically relate to treatment outcome also remains unclear.

One early treatment study examined a new firesetting prevention program delivered by fire service professionals, used by the Dallas Fire Department (Bumpass et al., 1985). The main component of the program was a psychological technique called "graphing," intended to help firesetting youths to recognize the association between *events* that trigger firesetting, and *feelings* that lead to firesetting behaviour. In an interview with a youth, a graph is drawn to visually depict connections between feelings, behaviours and firesetting events. The graph is then discussed to help the youth see the cause-effect relationship between feelings, behaviours, and events. The goal is for the youth use their feelings as a signal that they are at-risk of "acting out," and to prompt them to choose adaptive responses other than setting fires. The study found that, after the first year of the new program, out of 150 youth (ages 5 to 13) that were in the program, only 3 (2%) had set subsequent fires. This was a significant improvement over the previous program (which did not include a psychological component); a recidivism rate of 32% was found for 198 youth firesetters treated over the three years before the new program was implemented. Although the new program appears to have been effective in preventing the recurrence of firesetting behaviour, the study's methodology was limited as it did not use a controlled design (i.e., no control group) and lacks long-term follow-up data. Nevertheless, this study provided some of the first empirical data showing that fire department-based interventions could significantly reduce firesetting recidivism in youth.

An Australian outcome study examined a multi-modal intervention program for firesetting youth (ages 5 to 16) who were classified as either “curious” or “pathological” (Adler et al., 1994). Fire service professionals implemented the program. Curious firesetters were assigned to one of two conditions: a brief control condition which consisted of fire safety information given to caregivers in the form of a pamphlet, or an experimental condition which consisted of two to three sessions of home intervention comprised of FSE, a behaviour modification component (i.e., parents were taught and implemented a satiation program whereby the youth lit and extinguished a fire under parental supervision three times, consecutively, per day over a two week period, and then with reduced frequency for the next six weeks), negative consequences (i.e., parents gave negative consequences for any unsupervised firesetting), and the Bumpass graphing procedure (i.e., a fire service professional attempted to assist the youth in recognizing the emotional antecedents of their firesetting and to help them to develop alternative, adaptive response behaviours). Pathological firesetters were randomly assigned to these same conditions, with the addition of a psychiatric referral.

This study found a significant decrease in the frequency and severity of firesetting across all groups. The mean rate of firesetting for the entire sample (N = 138) fell from 7.1 fires in the year before referral, to 1.5 fires in the 12 months after joining the program. Severity of firesetting was also reduced for the entire sample; 44 children had set one fire that caused or threatened property damage and 15 children had set 2 or more such fires in the year before referral, compared with 9 children setting such hazardous fires and none setting more than one fire in the 12 months after the intervention. However, there were no significant differences found between the FSE control condition

and the behavioural intervention condition in either of the groups; participation in the fire service “psychological” intervention provided no additional improvement. Notably, this study did not include any measures of general behaviour or attitudes at follow-up and therefore was unable to measure behavioural or attitudinal changes after intervention. The design was also limited in that treatment fidelity was not tracked in the behavioural intervention condition, and treatment dosage was not consistent across the condition groups. Nevertheless, this was the first controlled study to report that brief intervention by fire service professionals can have an impact on firesetting, even in youth with serious recurrent firesetting. However, the rate of firesetting during the follow-up period was approximately 40% (40/99), which highlights the recurrent nature of juvenile firesetting, despite some form of intervention.

These early treatment studies (i.e., Bumpass et al., 1985; Adler et al., 1994) were the first to go beyond single case reports. They additionally reinforced the primary role of fire service professionals in dealing with juvenile firesetters, by showing decreased firesetting as the result of fire service interventions. A third intervention study was conducted on 24 young (ages 4 to 8), hospitalized firesetters in the U.S. (Kolko, Watson, & Faust, 1991). It found that a brief CBT group focusing on fire safety and prevention skills training (comprised of instruction and practice in fire safety concepts and preventive activities with a nurse or developmental specialist) was more effective than individual fire assessment and awareness discussions (also with a nurse or developmental specialist) in reducing fire involvement and increasing fire safety knowledge post-training and at 6-month follow-up, according to parental reports.

Kolko (2001) completed the first randomized clinical trial comparing FSE and CBT interventions with 54 firesetting youth (ages 5 to 13). This is, to date, the only study of its kind. In this study, referred firesetters and their parents were randomly assigned to either a FSE condition or a CBT condition. The FSE intervention consisted of eight sessions of instruction in fire safety and prevention skills, provided by a fire service professional. The CBT intervention consisted of eight sessions with a mental health professional, which provided youth with exposure to the graphing technique and instruction in problem-solving skills (i.e., learning to critically evaluate the risks and benefits of involvement with fire and other negative behaviours), and parents with instruction on the motives of firesetting, promoting prosocial activities, and behaviour management principles (such as monitoring, reinforcement and providing consequences). These conditions were then compared with a brief intervention consisting of a 2-contact home visit by a firefighter (FHV), which was designed to parallel “routine service." The home visit cases included youth whose parents had called their local department and requested the home visit; therefore, participants were not randomly assigned to this intervention. Twenty-one cases were randomized to the CBT condition and 17 cases were randomized to the FSE; at the time of the study, 16 cases were awaiting a HVF, but only 11 cases were successfully recruited into the HVF group. Ultimately, after attrition, 46 youth completed the intervention and post-assessment.

Results of the Kolko (2001) study showed improvements in all three intervention groups post-intervention and at 1 year follow-up with regards to fire involvement (including both firesetting and matchplay), with CBT showing a significantly greater reduction. However, while FSE and CBT were both more efficacious than the home visit

at reducing the frequency of reported fires post-intervention, CBT was only marginally better. Results supported some advantage for CBT in reducing the proportion of cases exhibiting matchplay after intervention, with FSE only approaching a significant result for such a reduction. At follow-up (1-year), recidivism (based on aggregated child and parent reports) was actually higher for the CBT condition (24%) than for the FSE condition (15%), although both rates were lower than the rate for the FHV condition (50%). It should be noted that the FSE condition involved more intensive, structured, and monitored training of fire safety skills (i.e., delivered in 8 sessions) than is typically provided by the fire service in their FSE interventions, and treatment dosage was also not comparable across conditions (i.e., 8 weekly 1-hour sessions in the CBT/FSE conditions, compared to a single 1-hour session with a follow-up phone call in the HVF condition). This may explain, at least in part, why the FSE and CBT condition groups showed similar, favourable results compared to the FHV condition group post-intervention, and why the FSE condition group had the lowest recidivism rate at follow-up. The follow-up data from this study further highlights that the recidivism rate for juvenile firesetting is substantial (15-24%), despite multi-session intervention. Additionally, and in contrast to the findings of Adler et al. (1994), the skills-focused and manualized multi-session FSE and CBT treatments each produced significantly better outcomes compared to the brief fire service intervention, suggesting that more intensive intervention might be more effective in reducing recidivism.

Kolko, Herschell and Scharf (2006) conducted a follow-up to this study, in which they examined the specificity, moderators, and predictors of firesetting recidivism. Interestingly, they found that FSE and CBT had differential effects. Specifically, FSE

exerted specific effects on knowledge about fire and fire safety skills, whereas CBT tended to show specific effects only on positive problem-solving skills. An exploratory analysis suggested that exposure to fire models/materials, a child's general fire knowledge, and family functioning were moderators of FSE and CBT. Additionally, fire history, fire interest/attraction, and externalizing behaviors were found to be predictors of firesetting recidivism. The study provided preliminary evidence that both fire-specific and general mental health factors are important mediators and moderators of treatment outcome and, as such, warrant further study as potentially important factors to target in firesetting interventions.

Franklin, Pucci, Arbabi, Brandt, Wahl, & Taheri (2002) reported on a brief (one day) intervention program for juvenile firesetters located at a trauma burn center. This program emphasized the consequences (i.e., the medical, financial, legal, and societal impacts) of firesetting, as well as individual accountability and responsibility. Participants in the program (132 children and youth aged 4 to 17 years) received education from a varied group of professionals including fire fighters, nurses, trauma surgeons and social workers, as well as a peer-counselling component involving discussions with former program graduates and burn victims. They also spent time in the burn unit, debridement room, skin bank and morgue. Caregivers were required to attend the program with their youth. During the follow-up period (ranging from 8 months to 2.5 years), only 1 participant set a fire, compared with a 36% recidivism rate in a random control group (n = 102) that did not receive the intervention program. The recidivism rate was tracked using fire department and court follow-up records, which is a serious limitation to this study as recidivism was only captured when it resulted in contact with

police or fire departments; no systematic, self-report follow-up was conducted with participants. However, the low rate of recidivism found lends support to the effectiveness of even very brief interventions, and replication of this study is warranted.

In addition to their research examining offending in firesetting adolescents after completion of the New Zealand based Fire Awareness and Intervention Program (FAIP) (see Youth Firesetting Recidivism section above), Lambie, Seymour, & Popaduk **(**2012) conducted an evaluation of FAIP using thematic analysis, to explore both youth and caregiver perceptions of the intervention. FAIP is a free, specialist intervention program for youth who set fires, delivered by trained firefighters. Participants reported that the relationships built at the program's outset were essential for them having a positive and beneficial experience in FAIP. It was also found that the mode of program delivery was important, and impacted how program context was learned. Specifically, visual aids facilitated learning and discussion of fire-safe practices. Additionally, participants reported that content curated to their developmental level (e.g., child versus late-adolescence) was most meaningful. Having a supportive caregiver involved was noted by the youth to be helpful for learning the program's content. Finally, participants who identified as Māori recommended that language-specific content be incorporated in the program, highlighting the dominant Eurocentric approach of the intervention. This program was recently redesigned (i.e., the Ahikura Whānau-Centred Fire Education Programme) with new cultural-specific content to be more relevant and better serve the needs of the community, and to address the steady decline of program referrals. This new holistic approach takes into account a participant's age, cultural background, past behaviour, and learning abilities (Fire and Emergency New Zealand, 2023).

Recently, Johnston and Tyler (2022) conducted a review of research examining the effectiveness of FSE interventions; of the 23 studies reviewed, eight were evaluations of pure FSE and fifteen were evaluations of multicomponent interventions. They concluded that in all the studies they reviewed, FSE interventions (including both pure FSE and multicomponent interventions) were reported to show some level of effectiveness; however, they also found poor reliability of these findings due to weak methodological designs. Specifically, they found preliminary evidence that pure FSE interventions may have some benefits for reducing firesetting behaviours and increasing fire safety knowledge in youth. However, they also found methodological issues with many of the studies, including small and highly specific samples (which limits the generalizability of the findings), and either a lack of reoffending data, or data that relied solely on parental self-report or police data. Additionally, the lack of comparison groups across the studies prevents the evaluation of whether pure FSE delivered on its own is more or less effective compared to alternative approaches (such as collaborative, multicomponent interventions), or to no intervention at all. Tentative support was also found for multicomponent treatment approaches in reducing firesetting recidivism in youth, especially for youth with more severe and complex psychological and behavioural issues. Furthermore, several of the studies provided preliminary evidence that multicomponent treatment may additionally benefit a youth's problematic or offending behaviour. However, similar methodological concerns were noted for the multicomponent treatment studies including the use of small samples, a lack of comparison groups and the use of low-quality measures of recidivism that fail to capture covert or undetected firesetting behaviours. Additionally, a majority of the

multicomponent interventions were tailored to meet the specific needs of their participant(s), resulting in varied content and treatment approaches across the studies. Only one study compared multicomponent treatment to pure FSE (i.e., Kolko, 2001), so conclusions could not be drawn about the effectiveness of multicomponent treatment compared with pure FSE. Reoffending rates across all of the reviewed studies were highly varied, reported to be between 2% and 31%, and were dependent on the outcome measure used. Of note, studies that measured family and staff perspectives of the interventions reported that participants were satisfied with their intervention and felt that they had significant impacts on raising fire safety awareness and decreasing firesetting behaviour. The authors of the review determined that further research is required to determine the effectiveness of FSE interventions for youth firesetting.

The empirical studies reviewed above raise questions about the relative efficacy of popular firesetting intervention and treatment programs, particularly given the high recidivism rates that were reported. These studies also highlight the need for more data on treatment outcome. The specific effects of different treatment components (included in multimodal interventions) on treatment outcomes also remain unclear. Despite reports of reductions in firesetting recidivism and/or severity subsequent to both brief, as well as more intensive, fire service and mental health interventions, further research evaluating the strengths and weaknesses of these interventions is essential (Johnston & Tyler, 2022; MacKay et al., 2012). Although preliminary data is promising for the efficacy of fire safety education and mental health interventions for juvenile firesetters, peer-reviewed studies evaluating the effectiveness of these components (delivered as both separate and combined treatment approaches) are not available (MacKay, Ward, & Ruttle, 2016).

Given the paucity of available research, empirically supported firesetting intervention programs have not yet been established. The present study addressed this research gap through a randomized, controlled trial of The Arson Prevention Program for Children (TAPP-C).

The Arson Prevention Program for Children (TAPP-C)

The Arson Prevention Program for Children (TAPP-C) is currently used in children's mental health centres and fire departments across Canada. TAPP–C was developed in the early 1990s as a joint venture of the Centre for Addiction and Mental Health (CAMH), The Office of the Fire Marshall of Ontario and the Toronto Fire Service. The empirically-based program addresses fireplay and firesetting behaviours by children and youth through standardized assessment and intervention. The program is collaborative as it involves both fire service professionals and mental health professionals working with children, youth and their families. TAPP-C provides services to children and youth aged 2 to 17 years, who have one or more instances of unsanctioned fire-involvement within the past 12 months (MacKay et al., 2004), and their families.

TAPP-C risk assessments are provided by trained mental health professionals. The assessments involve semi-structured interviewing with youth and their caregiver(s) and utilize a battery of fire-specific assessment tools (i.e., the FII, Fire Safety Survey [FSS], FIQ, and FIRE-Y), in addition to other standardized general mental health screening questionnaires as deemed appropriate by the clinician. Written reports are provided to families upon completion of the assessment, which summarize the factors contributing to a youth's risk for future involvement, and also include treatment recommendations.

TAPP-C's manualized intervention program is multimodal and is comprised of motivational interviewing (MI), cognitive-behavioural therapy (CBT), and Parent Management Training (PMT) provided by a mental health professional, as well as fire safety education (FSE) provided by a fire service professional. The intervention can be delivered as a stand-alone treatment or in combination with other, more general mental health treatments as deemed necessary. TAPP-C's intervention program is derived from a social learning theoretical framework and is based primarily on three principles: 1) Fire involvement by children and adolescents indicates an absence of fire-safe behaviours, 2) Fire-related behaviours are learned, and 3) The family home, or an alternative caregiving environment, is an important setting for learning fire-safe behaviours (MacKay et al., 2004).

The fire service component of the TAPP-C intervention is designed to provide initial safety for the family (given the high rate of recidivism in the home of untreated youth) as well as basic fire safety education (e.g., what to do if there is another fire, how to prevent one). The mental health component is designed to build on the fire service component. It provides participants (caregivers and youth) with a model of their firesetting behavior via individualized feedback about their risk factors and needs, and improves participants' motivation (i.e., via MI) to reduce fire-related behaviors. It also provides strategies for reducing fire-related behaviors, modifies factors related to means (i.e., availability of ignition materials) and opportunity (i.e., unsupervised time), and provides caregivers with strategies for modeling and positively reinforcing fire-safe behaviour.

PMT programs are commonly used with parents of children and adolescents displaying disruptive behaviours (most often with parents of children with CD, ODD and aggressive behaviour), and there is much evidence to suggest the efficacy of these programs in reducing such behaviours (Estrada & Pinsof, 1995; Feinfeld & Baker, 2004; Helander, Asperholm, Wetterborg, Öst, Hellner, Herlitz et al., 2024; Kazdin, 2005; Kazdin, Glick, Pope, Kaptchuk, Lecza, Carrubba et al., 2018; Larson, Fossum, Clifford, Drugli, Handegard, & March, 2009; Reid, Webster-Stratton, & Hammond, 2003). By reducing behavioural problems, these programs can also reduce or prevent secondary problems, such as peer rejection and school problems (Laird, Jordan, Dodge, Pettit, & Bates, 2001). The Incredible Years Parenting Program is one such program that includes a PMT component, and it has been identified as a "well-established" treatment for conduct disorder (Larsson et al., 2009; Reid et al., 2003; Webster-Stratton & Bywater, 2019). These programs aim to teach parents skills to help reduce their children's externalizing behaviours. PMT programs that specifically focus on improving parental monitoring practices have also been found to be efficacious with adolescents who display problem behaviours (Dishion & McMahon, 1998). The PMT component of the TAPP-C intervention aims to teach caregivers skills to help reduce their children's fire-related behaviours. This is achieved by teaching caregivers how to promote fire-safe behaviour in their children, how to better supervise, monitor, reward and provide consequences for their children's behaviour, and how to appropriately plan for any potential future difficulties (MacKay et al., 2004).

CBT has also been used extensively with children who display disruptive externalizing behaviours and difficulties with impulse control; research suggests that

CBT is effective with this population (Kazdin & Wassell, 2000; Larson & Lochman, 2002). CBT has further been successfully used to help adolescents with anger management difficulties, whereby adolescents are taught to identify their aggressive behaviour and the conditions that both provoke and maintain it (Lochman, 1992). Most of the research evidence supporting the use of CBT for child externalizing behavioural problems comes from efficacy studies conducted in university settings (Riise, Wergeland, Njardvik, & Öst, 2021). In their meta-analysis of 51 treatment effectiveness studies (including 5295 patients), Riise and colleagues (2021) investigated the effectiveness of CBT for ADHD, CD and ODD for children and adolescents receiving routine clinical care. The results showed that 44% of children and adolescents with externalizing disorders achieved remission after treatment, and more than 50% of the participants were remitted at follow-up. Completion rates for treatment were also impressive, with 86% of the participants with externalizing disorders completing CBT. These encouraging results suggest that CBT for externalizing disorders is effective in real-world settings (Riise et al., 2021). The CBT component of the TAPP-C intervention aims to teach children and adolescents skills and strategies to recognize and control their fire-related impulses and behaviours (MacKay et al., 2004).

There is some evidence to suggest that when PMT and CBT are combined for use with children and adolescents with disruptive behaviours, treatment is more effective than when these components are delivered alone (Kazdin, Siegel, & Bass, 1992; Webster-Stratton & Hammond, 1997). Many existing treatment programs for children and adolescents with disruptive behaviours are multicomponent interventions (August, Egan, Realmuto, & Hektner, 2003; Lochman & Wells, 2003; Miller & Prinz, 2003; Reid et al.,

2003; van de Wiel, Matthys, Cohen-Kettenis, & van Engeland, 2003) and are providing evidence for the efficacy of comprehensive programming including both parent and child components (Kazdin et al., 1992). Most recently, in a systematic review and meta-analysis evaluating the effects of PMT, Parent–Child Interaction Therapy (PCIT), and PMT combined with CBT, Helander and colleagues (2024) examined data from 25 RCTs on children (ages 2 to 13 years) with clinical levels of disruptive behavior. Contrary to expectations, the results showed that, in the few studies found, the addition of child CBT to PMT did not yield larger effects than PMT alone or being on a waiting-list for treatment. While the authors conclude that these results do provide evidence for offering PMT to children with clinical levels of disruptive behavior, they state that more research is required before conclusions can be drawn regarding the efficacy of combined PMT and CBT programs with this population, particularly given the large variability in effect sizes and limited number of available studies on such combined treatments (Helander, Asperholm, Wetterborg, Öst, Hellner, Herlitz, & Enebrink, 2024).

McCarty & McMahon (2005) identified a broad array of risk factors for persistent youth firesetting. The risk factors included both child characteristics (such as aggression, antisocial/delinquent behavior, and hyperactivity/impulsivity) and specific family and parenting characteristics (such as elevated parental depressive symptoms, interparental conflict, and the use of ineffective discipline strategies). This study highlighted the need for multicomponent, preventive interventions to adequately attend to these risk factors (McCarty & McMahon, 2005). The study investigators emphasized the importance of FSE interventions being supplemented with general mental health interventions, such as CBT to address child externalizing problems, as well as parent training to address

parental factors such as disciplinary strategies (McCarty & McMahon, 2005). Consistent with other multicomponent intervention approaches for children with problem behaviours, the TAPP-C model advises that both the caregiver (PMT) and child (CBT) intervention modules of the TAPP-C intervention be administered whenever possible (MacKay et al., 2004).

In addition to the PMT and CBT interventions, which are administered by mental health professionals, the TAPP-C program also involves a brief, manualized FSE intervention that is implemented by fire service professionals. Fire service professionals provide children, adolescents and their families with home fire safety checks and FSE sessions. This component, based on services typically provided by fire departments in their efforts to address fire involvement by children, is considered important because of the need to address the significant safety issues associated with fire involvement by children.

Calls for collaborative, multi-modal firesetting interventions are noted in the research literature. In a national survey of fire intervention programs available in England and Wales, the authors declared that despite there being a lack of established practice for treating firesetters, practice appeared to be at its best when treatments were collaborative, such as interventions involving partnerships between fire services and youth offending services (Palmer, Caulfield, & Hollin, 2007). Multidisciplinary interventions that allow for collaboration across community-based services, including mental health agencies, fire departments, and child welfare agencies, have also been identified as having the greatest impact in serving the complex needs of this population (Henderson et al., 2006; Kolko, 2002; Lambie, McCardle, & Coleman, 2002; McCarty & McMahon, 2005; Putnam &

Kirkpatrick, 2005; Sharp et al., 2006). Lambie and colleagues (2002) argue that such collaborative, multidisciplinary interventions, when combined with ongoing research, will result in better informed clinical practices and lower rates of firesetting recidivism.

A North American survey of juvenile firesetting interventions found that while most fire intervention programs comprised of firesetting risk assessments (88%) and at least a single session of fire safety education, almost half of the programs additionally included a mental health component (Kolko, Scharf, Herschell, Wilcox, Okulitch, & Pinsonneault, 2008). Approximately one-third (30%) of these multidisciplinary interventions provided short-term counseling services, and approximately one-quarter (24%) provided extended therapy services. A minority of these programs provided group counseling, specialized restitution, residential treatment, special graphing techniques, satiation, or mentoring. It therefore appears that there is a more recent push for firesetting interventions that are both collaborative and include a mental health component. The TAPP-C model is consistent with both of these elements.

Present Study

Study Rationale

Data on the efficacy of interventions for firesetting children and youth is limited thus far. Several empirical studies suggest that intervention is effective in reducing, but not eliminating, firesetting behavior; however, only one of these studies was a randomized controlled trial (RCT) (i.e., Kolko, 2001). Preliminary follow-up data from the TAPP-C program (from 1 to 2 years after program completion) conducted with approximately 200 families suggests that 75% of parents report no further fire involvement by their children upon completion of TAPP-C treatment (MacKay et al.,

2004). While this (phase 1) data is limited by the fact that it was not gathered through an RCT, it does suggest that TAPP-C may have potential benefit for families who participate. The next step that is necessary to establish TAPP-C's efficacy is to conduct an RCT. Given the morbidity and mortality associated with fire involvement by children and the ubiquity of fire service-based interventions to address fire involvement, however, it is not ethically acceptable to use a no-treatment control group. Instead, an RCT comparing the TAPP-C intervention (albeit, modified to address various methodological research constraints; see below) to a fire service intervention, will ensure that all families are provided with measures to improve safety and will permit examination of the relative contribution of each of these interventions.

The present study design is consistent with designs used in other treatment outcome studies in the literature which examine children with fire-involvement and externalizing behaviours in general (e.g. Feinfeld & Baker, 2004; Kolko, 2001). Caregiver and youth (aged 6 to 16) dyads were recruited from an outpatient child psychiatry clinic in Ontario and were randomly assigned to one of two treatment conditions: an FSE condition or a modified TAPP-C condition. After receiving their respective intervention, participants in each condition group were placed on a 3-month waitlist for the other intervention to facilitate the collection of follow-up data. The present study was both a replication and extension of the Kolko (2001) RCT study. The present study included a sample of a broader age range (i.e., children ages 6 to 16, compared to Kolko's more limited sample of children ages 5 to 13), as well as a shorter FSE protocol (i.e., 4 sessions compared with 8 sessions) in order to match the length of intervention typically provided in the field, thus, improving upon ecological validity. The

study was also able to examine the relative benefits of multimodal, collaborative intervention by including a treatment condition that combines various approaches (e.g., fire safety as well as psychological components). Furthermore, treatment dosage was equated across intervention groups, a limitation of the Kolko (2001) study. Additionally, the present study included measures of emotional and behavioural functioning, as well as caregiver measures, in addition to fire-specific assessment measures; thus, we were able to examine the impact of intervention upon these important variables. The establishment of best practice intervention requires corroboration of findings across research sites. The present study will strengthen existing data by providing additional data on the relative efficacy of FSE and combined, collaborative approaches that include a mental health component.

Study Goals and Expectations

The present study tested an enhanced model of service delivery for firesetting youth that includes a mental health component provided by mental health professionals. The TAPP-C protocol is the intervention for juvenile firesetters used in the majority of jurisdictions in Ontario at the current time. The present study will help to validate this practice. Beyond Ontario, FSE is the standard intervention, and therefore FSE can be considered "service as usual." The present study compared a modified TAPP-C protocol that maintains the integrity of the TAPP-C program (see below), which includes both fire service and mental health components, to the most common treatment, which is FSE alone. Specifically, the study examined the benefits (if any) to fire-involved youth and their caregivers, by participating in a modified TAPP-C intervention comprising of both mental health (including a fire-specific risk assessment, MI, and the skills-based CBT and

PMT components of the standardized, manualized TAPP-C treatment) and FSE (including a home safety check [HSC] session with a trained fire educator) components. Such benefits were compared with those potentially gained through participation in a standardized, manualized fire service intervention (i.e., that does not include a mental health component), comprising of fire safety education, an intervention that mimics those which are traditionally available outside of Ontario.

The study was designed to examine change across a number of domains that tap both fire-specific safety knowledge, attitudes, and behaviors as well as indices of general mental health. Considering the substantial evidence for the success of CBT and PMT programs in reducing problem behaviours in children and adolescents, it was expected that the TAPP-C intervention, which adds CBT and PMT components to a fire intervention program, will reduce more generalized behavioural difficulties, in addition to reducing fire involvement behaviours. Specifically, it was expected that youth would be able to apply the problem-solving and impulse control skills learned in the intervention, which were reinforced and supplemented by the parenting skills taught to their caregiver(s), in a generalized manner to other problems they encounter, not just in situations related to fire-involvement. Presumably, youth receiving a FSE intervention may show change in their fire safety knowledge and behaviour, but not in their general behavioural and mental health profiles. It was also expected that youth and caregivers would benefit from the TAPP-C intervention in terms of their motivation to address and change their fire-related behaviours. Specifically, given that the TAPP-C intervention targets such motivation via elements of MI, it was expected that youth and caregivers receiving this intervention would show greater improvement in their motivation and

readiness to change their behaviour, compared with FSE intervention. Readiness to change is a construct that has not been examined in the juvenile firesetting population and is particularly relevant in treatment research.

The difficulties with impulsivity and problem solving, in addition to problem behaviours, that have been reported in youth who display firesetting behaviours could be related to a deficit in executive functioning (EF). EF is the ability to plan and guide behaviour to achieve a goal in an efficient manner, and involves cognitive processes including working memory, reasoning, task flexibility, and problem solving, as well as planning and execution (Bernstein & Waber, 2007). Executive functions include the ability to initiate and stop actions, to monitor and adapt behavior, and to plan future behavior when faced with novel tasks and situations, including anticipating outcomes and adapting to changing situations. Deficits in EF have been found to be associated with behavioral problems, including firesetting, such as in alcohol-exposed children (Brown, Spiller, Carter, Osmonson, Porth, Bishop-Deaton et al., 2022; Kodituwakku, Karlberg, & May, 2001) and children with ADHD (e.g., Schmitt, Miller, & Long, 2012). Since impulsivity has been identified as a risk factor for firesetting behaviour (Geller, 1992; McCarty & McMahon, 2005; Sakheim & Osborn, 1986), and impulsivity and problem behaviours are both related to EF, youth who are involved with fire may also present with an EF deficit. EF has not been specifically examined in the juvenile firesetting population, which was an exploratory area of inquiry in the present study. EF is particularly relevant in the present investigation, as the TAPP-C intervention teaches skills related to EF, specifically, skills to decrease impulsivity and improve problem solving (i.e., in the child CBT component; see below). It is possible that youth receiving

the TAPP-C intervention might show improvements in impulsivity, in contrast to youth receiving the FSE intervention. Moreover, such improvements could be of additional benefit by further reducing fire involvement behaviours in participants in this condition group, compared with participants in the FSE group who did not receive instruction targeting these areas.

Benefits were also expected for caregivers receiving the TAPP-C intervention, as they learned new parenting strategies and skills (i.e., in the caregiver PMT component; see below). Not only were caregivers expected to increase their knowledge of fire-related safety practices, they were also expected to show increases in their perceived sense of control and competency in their role as a caregiver. We were particularly interested in examining parental cognitions and perceptions of the caregiver-child relationship in the juvenile firesetting context, and how the constructs of competency and perceived sense of control might be altered by treatment, as caregivers can play a primary role in intervention for youth fire involvement. These are, to date, unexplored areas, and are relevant to the present study because parenting strategies and education form a crucial component of the TAPP-C intervention (i.e., PMT). In general, parental cognitions have been shown to play an important role in parent-child relationships (Bugental & Johnston, 2000). Such cognitions not only contribute to parenting behaviour and thus, a child's behaviour, but they can also be affected by the behaviour of the child being parented; that is, a reciprocal relationship (Ohan, Leung, & Johnston, 2000).

Parental self-efficacy (also termed parenting self-esteem), that is, how confident parents feel in their ability to handle their child’s problems (Johnston & Mash, 1989), is one parental cognition that has been shown to be related to child behavioural difficulties.

Specifically, parenting self-efficacy, or how competent a parent perceives themself to be in their parenting role, may be negatively affected by parenting a child with behavioural problems, which in turn can lead to further behavioural difficulties as a parent becomes less able to respond effectively to a child's needs (Ohan et al., 2000). Greater perceived competence in parenting is associated with the tendency to assess situations as less problematic and to feel confident that difficulties can be resolved (Mash & Johnston, 1990; Coleman & Karraker, 1998, 2003). Low levels of parental self-efficacy often result in poor persistence, depression and diminished satisfaction in the parenting role (Johnston & Mash, 1989). Research has consistently shown negative correlations (ranging between -.2- and -.40) between parenting self-efficacy and reports of child behavioural difficulties in samples of children both with (e.g., Johnston, 1996; Pisterman, McGrath, Firestone, Goodman, Webster, Mallory, & Goffin, 1992) and without (e.g., Johnston & Mash, 1989; Lovejoy, Verda, & Hays, 1997) behaviour disorders (e.g., ADHD). Moreover, parenting self-efficacy has been shown to be improved with psychological parenting interventions. For example, Anastopoulos and colleagues (1993) found that, relative to wait list controls, parents of school-aged children with ADHD who completed a nine-session parent training program showed increases in parenting self-esteem and improvements in the overall severity of their child's ADHD symptomatology, which were maintained two months after treatment. Sofronoff and Farbotko (2002), found that a parent training program, designed for parents of children with Asperger syndrome, led to a reported increase in parental self-efficacy and a significant decrease in the number of problem behaviours reported by parents. Feinfeld and Baker (2004) evaluated the efficacy of a manualized, multimodal treatment program for young externalizing children, by

randomizing families to an immediate 12-week parent and child treatment condition or to a delayed treatment condition. Relative to the waitlist condition, parents receiving treatment reported significant reductions in child behaviour problems, improved parenting practices (i.e., increased consistency, decreased power assertive techniques), an increased sense of efficacy, and reduced parenting stress. There was also a trend toward parents improving their attitudes toward their children. Finally, Bloomfield and Kendall (2012) showed improved parental self-efficacy three months after completion of a group parenting program. The relationship between parental self-efficacy and juvenile fire involvement has not been investigated; however, it is reasonable to expect that parental self-efficacy would be related to this dangerous problem behaviour and could be positively impacted by intervention, as has been shown with other challenging child behaviours.

Related to parenting self-efficacy is parental locus of control (PLOC), a parent's perceived control over child behaviour (Campis, Lyman, & Prentice-Dunn, 1986), which is based on Rotter's (1966) 29-item Locus of Control questionnaire. An internal PLOC reflects a parent who believes that they are able to control and affect their child's behaviour because of their own effort, skills, or abilities, while an external PLOC reflects a parent who believes that forces external to them (such as luck, fate, chance, or powerful others) are in control of their child's behaviour, and expects that their own efforts are therefore futile. PLOC is another construct that has been found to influence parenting behaviour (Bugental, Ellerson, Lin, Rainey, Kokotovic, & O'Hara, 2002), which subsequently may influence child behaviour (Slep & O'Leary, 1998). Research has shown that an external PLOC orientation is associated with externalizing behaviour

problems in children (Mouton & Tuma, 1988; Roberts, Joe, & Rowe-Hallbert, 1992), a relationship that is likely bidirectional (Morton, 1997). Specifically, PLOC may contribute to the development of child behaviour problems, for example, a parent with an external PLOC may give up on a child exhibiting behaviour problems, leading to inconsistent or permissive parenting practices (Roberts et al., 1992); however, it is also likely that parents feel less in control as a result of their child's difficult behaviour, contributing to an external PLOC (McCabe, Goehring, Yeh, & Lau, 2008). A parent's locus of control orientation has also been shown to be an influential factor in parent-child interactions (Chandler, Wolf, Cook, & Dugovics, 1980) and communication patterns between children and adults (Bugental, Caporael, & Shennum, 1980), and has been associated with parental perceptions of the source of a child's problems (Harris & Nathan, 1973). One prospective study comparing data on mothers' and fathers' locus of control with their child's behavior outcomes found that parent internality (i.e., internal PLOC) was associated with more positive child outcomes than parent externality (i.e., external PLOC) (Nowicki, Iles-Caven, Gregory, Ellis, & Golding, 2017). Specifically, it was found that when both parents had internal PLOC, their children had more positive outcomes in sleeping, eating, and tantrum behavior as compared to any other parent locus of control combination. However, there was one exception; parents with an external PLOC had a less restrictive attitude, which appeared to have a more beneficial effect on picky eating. These results highlight the important role parental locus of control can play in shaping child behaviours, and the authors call for interventions that promote more internal locus of control among parents. The modification of PLOC is a primary aspect of many parent training programs (Roberts et al., 1992). PLOC has not been examined in

the context of juvenile fire involvement, which is a significant externalizing problem behaviour. The present study examined PLOC and how it might be related to other parenting variables, as well as fire-specific and generalized behavioural variables, in a sample of youth firesetters. It was also expected that PLOC might be impacted by the TAPP-C intervention as it includes a PMT component; specifically, that a decrease in external PLOC (to a more internal PLOC) would be observed.

Finally, we were interested in examining parental perceptions of the child/adolescent-caregiver relationship in the juvenile firesetting population. How a parent perceives their child/adolescent-caregiver relationship is likely influenced by a child's behaviour. Just as parenting practices and cognitions affect a child's behaviour, it is also true that a child's behaviour affects the parenting practices and cognitions of their caregiver(s) (Ohan, Leung, & Johnston, 2000); that is, child behaviour is not only affected by aspects of their environment, but their behaviour also exerts affects upon their environment, in a reciprocal manner. Child externalizing behaviours, such as anger, oppositionality, noncompliance and rule-breaking, have been shown to have adverse effects on families. One study found that, compared to parents of typically developing children, parents of children with externalizing behaviour problems reported higher levels of child-related stress, more negative impact on their social life, as well as more negative and less positive feelings towards parenting (Donenberg & Baker, 1993). In the context of juvenile firesetting, firesetting behaviour is not only linked to dysfunctional and maladaptive parenting practices (see "Features of youth firesetters" section, above), but also is linked to significant disruption in family interactions and relationships (Kolko & Kazdin, 1990). The family relationships of fire-involved youth have been characterized

as conflictual, negative, and unaffectionate (Siegelman & Folkman, 1971; Vandersall & Wiener, 1970), and higher levels of negative family interactions have been found for these youth compared to non-firesetting peers (Lambie et al., 2013; Vreeland & Waller, 1980). Thus, the parent-child relationship is a highly relevant area of inquiry in this population. We were additionally interested in examining how parental perceptions of their relationship with their child might be related to parental self-efficacy and PLOC. In the present study of fire-involved youth, it was expected that caregivers would report more negative and problematic perceptions of the child/adolescent-caregiver relationship.

To summarize these caregiver factors, parental self-efficacy and PLOC are constructs that merit investigation in the juvenile firesetting population, particularly in the context of treatment, as evidence has shown that they are directly related to other externalizing child behavioural problems. Parental perceptions of the child/adolescent-caregiver relationship also warrant consideration in the context of youth firesetting, as it is reasonable to expect that this relationship could be adversely affected by a child's fire involvement and such perceptions could also be relevant to treatment outcome. Further, it is unknown whether firesetting interventions positively impact these constructs, as has been shown after parental interventions for other problem behaviours (e.g., problematic behaviours associated with ADHD and Asperger disorder). The present study included an examination of these constructs in a sample of fire-involved children and youth and their caregivers. We were also interested in how parental self-efficacy and parental locus of control might be impacted by intervention, specifically, whether they were susceptible to change with treatment. We additionally were interested in relationships among these constructs, including how parenting self-efficacy and parental locus of control might be

related to each other, and to parental perceptions of the child/adolescent-caregiver relationship. Finally, we were interested in the relationships between these parenting constructs and fire-specific behaviours, as well as more generalized emotional and behavioural difficulties, in youth.

Research Questions and Hypotheses

The present study had several hypotheses and addressed several exploratory questions, which are listed below.

Fire-Specific Variables

We expected both groups, modified TAPP-C and FSE, to show improvements on all fire-specific variables post-intervention and at follow-up, compared with pre-intervention, given that both groups received FSE. However, we anticipated greater improvements in participants in the modified TAPP-C intervention condition, compared with participants in the FSE intervention condition, given that this group received a combined treatment approach that also included a mental health component specifically targeting areas identified as risk factors for firesetting behaviour (i.e., problem-solving and impulsivity), as well as a parenting component.

Hypothesis 1. It was anticipated that at post-intervention and follow-up (3 months), caregivers and youth in the modified TAPP-C intervention condition group would report, on average, a lower frequency of fire involvement (i.e. lower recidivism) and an overall lower level of fire interest (measured by an overall Total Fire Interest score comprised of the following components: reduced access to fire materials, increased skills related to fire-safety and impulse control, and more fire-safe attitudes) for the youth

participants, compared with the reports of participants in the FSE intervention condition group.

Generalized Behavioural Variables

It was expected that youth who received the modified TAPP-C intervention would show greater improvements on a broad range of behavioural difficulties, compared with youth who received the FSE intervention. Specifically, it was expected that the skills taught as part of the mental health component (i.e., impulse control and problem-solving) would also be useful for reducing a broad array of other problematic behaviours, as these skills are generalizable beyond situations related to fire-involvement. The parenting component of the modified TAPP-C intervention was also expected to be of benefit in reducing problematic behaviours in the youth participants (in addition to reducing fire-specific behaviours).

Hypothesis 2. It was anticipated that at post-treatment and follow-up (3 months), participants (both caregivers and youth) in the modified TAPP-C intervention condition group would report, on average, fewer youth emotional and behavioural difficulties, compared with their pre-intervention reports, and compared with the post-treatment and follow-up reports of participants in the FSE condition group.

Parenting Variables

It was anticipated that caregivers would report problematic perceptions of the child/adolescent-caregiver relationship at pre-intervention. Associations were additionally anticipated at pre-intervention both among the parenting variables (including parental self-efficacy, PLOC and perceptions of the child/adolescent-caregiver relationship) as well as between the parenting variables and the youth behavioural and

fire-specific variables. It was also anticipated that parental self-efficacy and parental locus of control (PLOC) would benefit from treatment; that is, that parental self-efficacy would be higher and PLOC would be more internal in the study sample at post-intervention and follow-up, compared with pre-intervention. Finally, it was expected that these variables would be more positively impacted by the modified TAPP-C intervention than the FSE intervention, reflected by greater improvements on these variables in the modified TAPP-C intervention group post-intervention and at follow-up.

Hypothesis 3a. It was expected that, prior to beginning their interventions, caregivers would report more negative perceptions of the child/adolescent-caregiver relationship, given the evidence citing linkages between these constructs and externalizing behaviour difficulties in children.

Hypothesis 3b. Relationships were expected among the parenting variables at pre-intervention; specifically, that higher levels of external PLOC would be associated with lower levels of parental self-efficacy, and with more negative perceptions of the child/adolescent-caregiver relationship, and vice versa. It also was anticipated that lower levels of parental self-efficacy would be associated with more negative perceptions of parenting confidence at pre-intervention, and vice versa (i.e., a positive correlation), given that they measure similar parenting constructs, that is, competence and confidence in the parenting role.

Hypothesis 3c. Positive and negative relationships were expected between the parenting variables and the youth- and caregiver-reported fire-specific and generalized behavioural variables at pre-intervention. Specifically, it was anticipated that a more external locus of control, lower levels of parental self-efficacy, and a more negatively

perceived child/adolescent-caregiver relationship, would be associated with greater youth- and caregiver-reported fire-specific and generalized behavioural difficulties, and vice versa (i.e., a more internal locus of control, higher parental self-efficacy, and a more positively perceived child/adolescent-caregiver relationship would be associated with fewer fire-specific and generalized behavioural difficulties).

Hypothesis 3d. It was expected that parental self-efficacy would be higher and PLOC would be more internal (reflected by lower scores) in the study sample at post-intervention and follow-up, compared with pre-intervention. Greater benefits were expected for caregivers in the modified TAPP-C intervention condition group, given that these participants received PMT as part of the mental health component. Specifically, it was expected that caregivers who received the modified TAPP-C intervention would report, on average, greater parenting self-efficacy and a more internalized parental locus of control post-intervention and at follow-up, compared with their pre-intervention reports and compared with caregivers in the FSE condition group.

Exploratory Research Questions

EF and impulsivity in the youth participants, as well as readiness to change (in both youth and caregiver participants) were exploratory areas of inquiry in the present study. We examined how EF and impulsivity presented in the youth in the study sample and explored how they related to each other, as well as to the youth fire-specific and generalized behavioural variables, at pre-intervention. Finally, we examined how impulsivity and readiness to change were affected by the treatment interventions (if at all).

Hypothesis 4a. It was expected that the youth participants would present with an EF deficit as reported by their caregivers, as well as impaired performance on an impulsivity task, at pre-intervention.

Hypothesis 4b. A negative relationship was expected between youth EF (as reported by their caregiver) and performance on an impulsivity task at pre-intervention, such that more impaired EF (reflected by higher scores) would be associated with poorer performance on the impulsivity task (reflected by lower scores), and vice versa. It was also expected that at pre-intervention, EF would be related to the fire-specific and generalized behavioural variables, such that more impaired EF would be associated with greater youth behavioural difficulties, as well as a higher incidence of fire-specific behaviour, and vice versa. It was additionally anticipated that at pre-intervention, youth performance on an impulsivity task would be related to the fire-specific and generalized behavioural variables, such that poorer performance would be associated with greater youth behavioural difficulties, as well as a higher incidence of fire-specific behaviour, and vice versa.

Hypothesis 4c. It was expected that post-intervention, youth receiving the modified TAPP-C intervention would show improved performance on a task of impulsivity compared with their pre-intervention performance, as the TAPP-C intervention teaches skills to decrease impulsivity and improve problem solving. The performance of youth receiving the FSE intervention was not expected to change between pre- and post-intervention, as this intervention does not include instruction on these skills. Impulsivity was not examined at follow-up, as the impulsivity task was not re-administered (as per measure guidelines).

Hypothesis 4d. Higher reported readiness to change was expected post-intervention and at follow-up compared with pre-intervention for youth and caregiver participants in both intervention groups; however, greater improvements were expected for participants in the modified TAPP-C intervention, as this intervention included elements of motivational interviewing which targets treatment readiness.

Method

Participants

The study sample was drawn from the TAPP-C program at an outpatient child psychiatry clinic in Ontario, located at the Centre for Addiction and Mental Health (CAMH), a large teaching hospital. At the time of data collection (2011 to 2013), this program functioned at the CAMH as a stand-alone service with a dedicated multidisciplinary team of psychologists and social workers, as well as psychology trainees, and also included collaborative services from TAPP-C trained fire-educators from local fire services. Currently, TAPP-C assessments continue to be conducted at the CAMH outpatient child psychiatry clinic, and training continues to be offered for community-based agencies. TAPP-C services are advertised to the community via pamphlets and Web listings, and referrals are accepted from family physicians, schools, child welfare agencies, mental health agencies, and the juvenile justice system. Participants in the study were: male and female children and youth, ages 6 to 16, who were referred to TAPP-C for at least one episode of fire involvement in the preceding year; and their caregiver. An a priori power analysis was independently conducted by the Biostatistical Consulting Service at CAMH for sample size estimation. Results indicated that with a sample of 40 youth-caregiver dyads in each of the two intervention groups

(i.e., a total sample of 80 youth-caregiver dyads), we would be able to detect a significant difference ($\alpha = 0.05$) in post-treatment scores across the two study groups, with an effect size of 0.35 and a power of 0.83.

To be eligible for the study, participants had to meet the following inclusionary criteria: 1) age 6 to 16 years, 2) first time participating in the TAPP-C program, 3) at least one episode of fire involvement in the preceding 12 months, and 4) one caregiver who was willing to participate in the study, including completing all home assessment visits (to ensure consistency in caregiver reports to enable comparability across time points), as well as participating in the modified TAPP-C treatment, if so randomized. Excluded from the study were the following youth: 1) youth who were concurrently participating in another fire-related treatment, 2) youth referred from the youth justice system who required a TAPP-C assessment to inform upon imminent court proceedings (e.g., sentencing, residential placement planning), as it would not have been ethical to delay such proceedings (i.e., to await the results of an assessment) to accommodate potential randomization to the FSE intervention condition, 3) youth referred from a child welfare agency who were residing in temporary residential placements and required a TAPP-C assessment to determine their next placement (it would not have been ethical to delay a placement decision to accommodate potential randomization to the FSE intervention condition), and 4) youth residing outside of the catchment areas of participating fire departments.

Over the course of the study, which ran from January 2011 until April 2013, 63 youth were referred to the TAPP-C program at the CAMH. These were fewer referrals than was expected based on referral history within the program; specifically, the program

enrolled 40 to 60 participants annually over the decade prior to this study's commencement. Of the referrals received, 37 youth were deemed eligible based on the study's inclusionary/exclusionary criteria, although, 6 of these cases did not progress beyond the initial referral (i.e., families did not respond to intake staff's contact attempts; referral agents were notified and the cases were subsequently closed) and, as 2 of the cases were siblings, one sibling was randomly chosen (i.e., via coin toss) to participate. Of the remaining 30 eligible cases, all caregivers contacted and invited to participate in the study provided consent for the family's participation and enrolled in the study. Of the 30 youth-caregiver dyads enrolled in the study, 27 dyads successfully completed a pre-intervention assessment visit and were randomized to an intervention condition, comprising the initial study sample (See Table 1). In total, 14 dyads were randomized to the modified TAPP-C intervention, and 13 dyads were randomized to the FSE intervention. Twenty-two dyads (81.5%; 12 in the modified TAPP-C intervention condition, 10 in the FE intervention condition) successfully completed their assigned intervention and post-intervention assessment measures. Twenty-one youth (78%) and 19 caregivers (70%) completed follow-up assessment measures (3 months after completing their intervention).

Table 1. *Study Sample at Data Collection Points*

	Pre-Intervention		Post-Intervention		Follow-up	
Sample	Youth	Caregiver	Youth	Caregiver	Youth	Caregiver
Total Sample (N)	27	27	22	22	21	19
Mod TAPP-C (N)	14	14	12	12	11	11
FSE (N)	13	13	10	10	10	8

The study sample (N = 27 dyads) consisted predominantly of male youth (n = 25; 93%) and female caregivers (n = 23; 85%) (See Table 2). The average age of the youth was 12.2 ± 2.73 (SD) years, ranging from 6.25 to 16.75 years. The youth were referred by a variety of sources, including mental health agencies (37%), child welfare agencies (26%), family physicians (19%), schools (7%), probation services (7%), and hospitals (4%). Table 2 provides an overview of these sample characteristics. A more detailed overview of the sample characteristics, including a breakdown for each of the condition groups, is provided in the results section.

Table 2. *Characteristics of the Study Sample Pre-Intervention*

Characteristics	Sample (n = 27)
Gender Youth: (male/female)	25/2
Age Youth: Mean ± SD (Range), years	12.21 ± 2.73 (6.25-16.57)
Gender Caregiver: (male/female)	4/23
Referral Source: (N/%)	
Mental Health Agency	10/37
Child Welfare	7/25.9
Family Doctor	5/18.5
Other	5/18.5

Participant Attrition

Despite providing their initial consent to participate, three of the thirty enrolled dyads dropped out of the study prior to completing their pre-intervention assessment visit. Two of these families were ultimately unable to engage with the program due to low caregiver motivation, and one youth declined to participate in the study during their pre-intervention assessment visit. Of the twenty-seven dyads successfully randomized to an intervention condition, five withdrew from the study (18.5%). Four of these dyads withdrew from the study after completing their pre-intervention assessment visit and

prior to beginning their assigned intervention (two due to the youth's geographic relocation, one due to serious parental health issues, and one due to parental conflict over the child's participation). A fifth dyad withdrew (caregiver motivated) from the study after commencing their intervention (i.e., modified TAPP-C intervention), after the clinician contacted child welfare authorities due to child safety concerns.

Additionally, follow-up data were not collected from one dyad as the youth's whereabouts was unknown and the caregiver had not had contact with the youth for several months. Follow-up data were also not collected from two other caregivers, although data was collected from the youth in these dyads. One of these caregivers did not return their follow-up assessment measures (arrangements were made to complete their materials via mail rather than an assessment visit due to family bereavement), and one youth was moved to a new residential placement and no longer had contact with their caregiver.

Assessment Measures

All youth and caregiver participants completed a battery of both standardized and experimental measures. The full battery and domains of function being measured are described in detail below. A summary of the measures administered at each assessment data collection point (i.e., pre- and post-intervention, and follow-up) follows.

TAPP-C Background Information Form

All participants completed the TAPP-C Background Information form, which contains items on child and family demographics and background characteristics, including history of mental health service, ethnicity, language, living situation, school

classroom type, disabilities, parental highest level of education, and child welfare involvement.

Current Level of Supervision Form

All caregiver participants completed the Current Level of Supervision form, which includes items about a youth's current living situation (i.e., where/with whom does the youth currently reside), and the level of supervision (i.e., typical, increased, or highest level of supervision is required, compared with the level required for a typical youth of the same age) a youth receives on a daily basis when at their residence, at school, and out in the community. This form was added to the test battery after the study commenced when researchers noted the transient living situations of many of the youth participants, to capture and measure the changing living arrangements of the youth across the data collection time points. Therefore, this information was not gathered for all participants. The level of supervision data was not analyzed for the purpose of the dissertation due to both the small sample of data collected as well as inconsistency in how participants interpreted the wording of items on the form.

TAPP-C Fire Interest Questionnaire (FIQ)

All participants completed the TAPP-C Fire Interest Questionnaire (FIQ), which measures fire interest and fire-related behaviours (MacKay, Henderson, Del Bove, Marton, Warling & Root, 2006). Caregivers completed the FIQ Parent-Report, and children/adolescents completed the FIQ Self-Report. On the Parent-Report, caregivers are asked to rate the extent to which 54 sentences/sentence stems designed to capture interest in fire and fire-related materials, and fire-related behaviours apply to their children (e.g., is interested in fire; has played with matched, unsupervised). Caregivers are also asked

four specific questions regarding, age of onset of fire-play (i.e., how old was your child the first time he/she: i) played with matches or lighters, ii) burned something that he/she wasn't supposed to), frequency of fire-play (i.e., in the last 12 months, how many times has your child set something on fire that he/she wasn't supposed to), and frequency that the child carried matches or lighters on their person (i.e., in the last 12 months, how often did your child carry matches or lighters in his/her pockets, purse or bag), and are asked to indicate which of the provided responses is accurate/appropriate. Response options for the age of onset questions include, 'never played with matches or lighters,' '5 years old or younger,' 'between 6 and 9 years old,' and '10 years old or older.' Response options for frequency of carrying matches or lighters on their person include, 'never,' 'rarely,' 'sometimes,' 'often' and 'always.' The frequency of fire-play question is an open-ended count question.

On the FIQ Self-Report, children/adolescents are asked to rate the extent to which 54 sentences/sentence stems designed to capture interest in fire and fire-related materials, and fire-related behaviours, apply to themselves (e.g., I am interested in fire; I have played with matches when no adults were around). Adolescents are also asked to indicate the most accurate/appropriate response to the same four specific questions regarding age of onset of fire-play, frequency of fire-play, and frequency that they carry matches or lighters on their person that caregivers are asked (described above), as they apply to themselves.

When the FIQ Parent- and Self-Reports were re-administered post-intervention and at follow-up, the instructions for completing the questionnaires were modified to reflect the appropriate time interval (i.e., rather than considering their behaviour over the

past 12 months, participants were asked to consider their behaviour since their pre- and post-intervention assessment visits). The frequency questions were also modified (e.g., at post-intervention, "Since your first visit with TAPP-C researchers [date provided], how many times has your child set something on fire that he/she wasn't supposed to?;" at follow-up, "Since your last visit with TAPP-C researchers [date provided], how many times have you set something on fire that you weren't supposed to?"). The age of onset questions were not re-administered as they do not measure change.

Items for both FIQ reports are rated on a four-point Likert Scale from 0 (not at all) to 3 (very much). Items were created based on items/constructs in the theoretical or empirical literature about children's expressions of fire interest (Federal Emergency Management Agency, 1983) as well as clinical work with firesetting children, youths, and their parents (Hanson et al., 1994; Hanson et al., 1995). Item scores are summed to provide an overall fire interest score, with higher scores reflecting greater interest in, or curiosity about, fire and fire-related materials. An internal consistency analysis of this measure revealed good internal consistency among the items, with an alpha coefficient of 0.89, and the fire interest score showed significant correlations with self-reported firesetting frequency (r=0.44), self-reported psychopathology (r=0.56), and caregiver-rated psychopathology (r=0.45) (Gallagher-Duffy et al., 2009).

Wechsler Abbreviated Scale of Intelligence (WASI)

All children and adolescents completed the Vocabulary and Matrix Reasoning subtests of the Wechsler Abbreviated Scale of Intelligence (WASI), a shortened and reliable measure of the Wechsler Intelligence Scales (Wechsler, 1999). Scores for these subtests and an overall IQ Score (FSIQ) were obtained to be used descriptively. The

Vocabulary subtest consists of 42 items, and measures expressive vocabulary, verbal knowledge and fund of information, and is a good measure of both crystallized and general intelligence. The *Matrix Reasoning* subtest consists of 35 items and measures nonverbal fluid reasoning and general intellectual ability. The WASI can be used with children and adults, ages 6 to 89. The WASI has very good reliability and validity. Internal reliability ranges from 0.87 to 0.92 for the subtests, and from 0.92 to 0.97 for the IQ scales, for the children's sample. Test-retest reliability ranges from 0.77 to 0.86 for the subtests, and from 0.88 to 0.93 for the IQ scales, for the children's sample. The WASI has good construct validity, supported by the intercorrelations of the WASI subtests and IQ scales and by the results of factor analyses, and good content validity, supported by a content analysis and an expert review.

Behaviour Rating Inventory of Executive Function (BRIEF)

All caregivers completed the Behaviour Rating Inventory of Executive Function (BRIEF), which assesses executive function behaviours in children in the home and school environments (Gioia, Isquith, Guy, & Kenworthy, 2000). This questionnaire can be used for children ages 5 to 18. The 86 items comprise 8 scales that measure different aspects of executive functioning: *Inhibit* (10 items; assesses the ability to inhibit, resist, or not act on an impulse); *Shift* (8 items; assesses the ability to move freely from one situation, activity, or aspect of a problem to another as the circumstances demand); *Emotional Control* (10 items; addresses the manifestation of executive functions within the emotional realm); *Initiate* (8 items; assesses ability to begin a task and independently generate ideas, responses, or problem-solving strategies); *Working Memory* (10 items; measures the capacity to hold information in mind for the purpose of completing a task);

Plan/Organize (12 items; measures ability to manage current and future-oriented task demands); *Organization of Materials* (6 items; measures orderliness of play, work, and storage spaces); and *Monitor* (8 items; assesses work-checking habits and evaluates a personal monitoring function). Sample items are as follows: “Has trouble finishing tasks (chores, homework),” and “Has trouble putting the brakes on his/her actions.” Item raw scores are converted to T-scores based on normative data, which provides a Behavioural Regulation Index (BRI) (includes Inhibit, Shift, and Emotional Control), a Metacognition Index (MI) (includes Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor), and a Global Executive Composite (GEC) (includes raw scores for all 8 scales). Higher T-scores indicate greater degrees of executive dysfunction, with a T-score of 65 or more representing an abnormally elevated score, and being clinically significant. To assess validity, an Inconsistency Scale indicates the extent to which the respondent answers similar BRIEF items in an inconsistent manner relative to the clinical samples, and a Negativity Scale measures the extent to which the respondent answers selected BRIEF items in an unusually negative manner relative to the clinical samples. Internal reliability is high, ranging from 0.80 to 0.98. Test-retest reliability ranges from 0.72 to 0.84. The BRIEF has good construct validity, supported by factor analyses, and good content validity, supported by high interrater agreement among an expert panel of pediatric neuropsychologists.

Behaviour Assessment System for Children-2 (BASC-2) Parent Rating Scales (PRS)

All caregivers completed the Parent Rating Scales (PRS) of the Behaviour Assessment System for Children-2 (BASC-2), which measures both adaptive and problem behaviours in children and adolescents (ages 2 to 21) in the community and

home setting (Reynolds & Kamphaus, 2004). The child version has 160 items and can be used with caregivers of children aged 6 to 11, and the adolescent version has 150 items and can be used with caregivers of adolescents aged 12 to 21. Items are rated on a four-point Likert scale from 1 (Never) to 4 (Almost Always). Both versions comprise 14 primary scales, which broadly assess externalizing problems, internalizing problems, and adaptive skills (i.e., adaptability; activities of daily living; aggression; anxiety; attention problems; atypicality; conduct problems; depression; functional communication; hyperactivity; leadership; social skills; somatization; and withdrawal). There are also 7 optional content scales, which are more specific and syndrome oriented than the primary scales (i.e., anger control; bullying; developmental social disorders; emotional self-control; executive functioning; negative emotionality; and resiliency). The scales form 4 composite scores: an overall Behavioral Symptoms Index, Adaptive Skills, Externalizing Problems, and Internalizing Problems. The PRS also includes 3 validity scales (i.e., *F* index; Response Pattern Index; and Consistency Index), which monitor failure to pay attention to item content, attempts to portray the child in a highly negative or positive light, lack of motivation to respond truthfully, and poor comprehension of the items. Higher T-scores (60-69) indicate higher levels of maladaptive behaviours, with a T-score of 70 or more representing an abnormally elevated score and being clinically significant.

The PRS scales have high internal consistency, with coefficient alphas ranging from 0.89 to 0.95 for the composite scales, from 0.83 to 0.87 for the child individual scales, and from 0.83 to 0.86 for the adolescent individual scales. The coefficient alphas are consistent between males and females, between clinical and nonclinical groups, and at different age levels. Test-retest reliability is also high, ranging from 0.78 to 0.92 for the

composite scales, and at 0.84 and 0.81 for the child and adolescent levels respectively. The PRS has good construct validity, supported by factor analyses and scale intercorrelations and is also moderately to highly correlated with other behavioural measures (e.g.; ASEBA; Conners' Parent Rating Scale-Revised; and BRIEF). The PRS has good content validity, supported by a content analysis and an expert review.

BASC-2 Self-Report of Personality (SRP)

All children and adolescents completed the Self-Report of Personality (SRP) of the Behaviour Assessment System for Children-2 (BASC-2), which provides insight into a child's or adolescent's thoughts and feelings (Reynolds & Kamphaus, 2004). The SRP-Interview Form (SRP-I) (65 items) is used with children aged 6 to 7 and is administered in interview-format (20-30 minutes), whereby children provide yes-or-no responses to items. The SRP-I comprises 7 primary scales (i.e., anxiety; attitude to school; attitude to teachers; atypicality; depression; interpersonal relations; and social stress), which form an overall composite score: Emotional Symptoms Index.

The SRP-Child Form (SRP-C) (139 items) is used with children aged 8 to 11, and the Adolescent Form (SRP-A) (137 items) is used with adolescents and young adults aged 12 to 21. Items on the Child and Adolescent forms are rated either on a four-point Likert scale from 1 (Never) to 4 (Almost Always), or in a True-False format. The child version comprises 14 primary scales (i.e., anxiety; attention problems; attitude to school; attitude to teachers; atypicality; depression; hyperactivity; interpersonal relations; locus of control; relations with parents; self-esteem; self-reliance; sense of inadequacy; and social stress), and the adolescent version comprises 16 primary scales (same as child scales, with the addition of sensation seeking and somatization scales). There are also 4

optional content scales for the adolescent version, which aid in interpreting the primary scales and broaden content (i.e., anger control; ego strength; mania; and test anxiety). The scales form 5 composite scores, which are identical for the child and adolescent versions: an overall Emotional Symptoms Index, Inattention/Hyperactivity, Internalizing Problems, Personal Adjustment, and School Problems. The SRP-C and SRP-A also include 5 validity scales: the *F* Index, the Response Pattern Index, the Consistency Index (all described above), the *L* Index (measures child's tendency to give an extremely positive picture of themselves); and the *V* Index (detects invalid responses due to poor reading comprehension, failure to follow directions, or poor contact with reality).

Higher T-scores (60-69) on the SRP scales indicate higher levels of maladaptive behaviours, with a T-score of 70 or more representing an abnormally elevated score, and being clinically significant. The SRP scales have, generally, high internal consistency, with coefficient alphas ranging from 0.83 to 0.96 for the composite scales, and from 0.67 to 0.88 for the individual scales (with median values near 0.80). The coefficient alphas are reasonably consistent between combined-sex and separate-sex groups, between clinical and nonclinical groups, and at different age levels. Test-retest reliability is also high, ranging from 0.74 to 0.84 for the composite scales, and with median levels of 0.70, 0.71 and 0.75 for the SRP-I, SRP-C, and SRP-A respectively. The SRP has good construct validity, supported by factor analyses and scale intercorrelations, and is also moderately to highly correlated with other behavioural measures (e.g.; ASEBA; Conners-Wells' Adolescent Self-Report Scale; CDI; RCMAS; Brief Symptom Inventory; MMPI-2; and BDI-II). The SRP has good content validity, supported by a content analysis and an expert review.

Parenting Relationship Questionnaire- Child and Adolescent (PRQ-CA)

All caregivers completed the Child and Adolescent Form of the Parenting Relationship Questionnaire (PRQ-CA), which captures a parent's perspective on the parent-child relationship (Kamphaus & Reynolds, 2006). This measure can be used with caregivers of children and adolescents aged 6 to 18. The 71 items comprise 7 scales that measure different dimensions of the parent-child relationship: *Attachment* (measures the affective, cognitive and behavioural relationship between a parent and child that results in feelings of closeness, empathy and understanding towards the child); *Communication* (measures the quality of information exchanged between parent and child and the parent's listening skills which promote trust); *Discipline Practices* (measures the tendency of a parent to consistently apply consequences/punishment for child misbehaviour along with the belief that rule establishment and adherence is desirable); *Involvement* (measures the extent to which parent and child participate together in activities and parent's knowledge of the child's activities); *Parenting Confidence* (measures the comfort, control and confidence of the parent in the parenting process and making parenting decisions); *Satisfaction With School* (measures the parent's belief that the child's school is meeting the child's educational and emotional needs); and *Relational Frustration* (measures the parent's level of stress/distress in relating to and controlling the child's behaviour along with the tendency to be overreactive and frustrated in common parenting situations). All items are rated on a four-point Likert scale from 1 (Never) to 4 (Almost Always). The PRQ-CA also includes 4 validity scales (i.e., *F* index; *D* index; Response Pattern Index; and Consistency Index), which monitor failure to pay attention to item content, attempts to portray the child in a highly negative or positive

light, lack of motivation to respond truthfully, and poor comprehension of the items. Higher T-scores (60-69) on the Relational Frustration scale indicate a relatively high level of frustration that should be carefully monitored and may require intervention, with a T-score of 70 or more indicating significant relationship problems, usually severe enough to warrant intervention. Lower T-scores (31-40) on the remaining scales indicate the presence of potential or developing relationship problems, with a T-score of 30 or less indicating significant relationship problems which warrant an appropriate intervention.

The PRQ-CA scales have high internal consistency, with median coefficient alphas ranging from 0.82 to 0.87 for the norm groups (based on sex and different age levels). Test-retest reliability is also good, with a median level of 0.79. The PRQ-CA demonstrates good construct validity, supported by scale intercorrelations, and is also moderately to highly correlated with other parent-child measures (Parent-Child Relationship Inventory, Parenting Stress Index [PSI], and the Stress Index for Parents of Adolescents [SIPA]), and other child behavior measures (BASC-2:PRS, BASC-2:Self-Report of Personality, PSI, and the SIPA), indicating relatively good agreement between the instruments.

Test of Everyday Attention for Children (TEA-Ch)

All children and adolescents completed the *Walk, Don't Walk* subtest of the Test of Everyday Attention for Children (TEA-Ch), which assesses attention in children ages 6 to 16 (Manly, Robertson, Anderson, & Nimmo-Smith, 1999). *Walk, Don't Walk* measures a child's/adolescent's ability to sustain their attention and inhibit responses to action. When they hear a tone (called go tones), children/adolescents are required to take one step along a path of 14 squares drawn on a sheet of paper, making a mark for each

step. When the children/adolescents hear a different tone (no-go tones), it is a signal not to take another step. The go tones are presented at regular intervals, while the no-go tone occurs between the 2nd and 12th steps. The intervals between the tones start at 1,500 ms for Item 1 and are held constant within each item. The intervals are reduced with each new item, with a maximum of 500 ms interval on Item 20. Children/adolescents must sustain attention on the task and demonstrate impulse control to prevent themselves from taking a no-go step. If a child/adolescent avoids the target square they receive 1 point, whereas a mark in the square is recorded as a failure and does not receive a point. The number of correct items reported out of 20 is the final score. Raw scores can then be converted to age-scaled scores (via normative tables for each sex) with corresponding percentile bands. The TEA-Ch has good test-retest reliability (children/adolescents were retested between five and twenty days following the first administration), specifically, 0.71 for the *Walk, Don't Walk* subtest. It also has good validity, supported by structural equation modeling. Convergent validity is also good, as it is significantly associated with other common attention measures (i.e. Stroop, Trails Test, and Matching Familiar Figures Test).

University of Rhode Island Change Assessment Scale (URICA)

All adolescents (ages 12 to 16) completed the University of Rhode Island Change Assessment Scale (URICA), which measures an individual's level of motivation for change in terms of four stages of change: precontemplation, contemplation, action, and maintenance (DiClemente & Hughes, 1990). The scale has 32 items, with eight items for each of the four stage-specific subscales. Items are written in a generic format so the scale can be modified for different target behaviours. In this study, participants were

instructed to respond to items based on their fire involvement. Items are rated on a five-point Likert scale from 1 (strong disagreement) to 5 (strong agreement). Scores for each of the four stages are obtained. Subscale scores can be used to track shifts in attitudes related to the specific stages of change. The subscales can be combined (summing the means of the contemplation, action and maintenance scales and then subtracting the mean precontemplation score) to yield a second-order factor called *Readiness to Change,* that can be used to assess readiness to change at entrance to treatment. *Readiness to Change* scores range from −2 to +14, with higher values indicating greater motivation to change. The URICA has good reliability; internal consistency analyses produced Coefficient Alphas ranging from 0.88-0.89 for the four subscales. It also has good construct validity, supported by theoretically consistent relationships among URICA subscales and related dimensions of change.

Readiness to Change Ruler

All children, adolescents and caregivers completed the Readiness to Change Ruler, which provides a quick assessment of a person's present motivational state relative to changing a specific behavior, and can serve as the basis for motivation-based interventions to elicit behavior change (Zimmerman, Olson, & Bosworth, 2000). Participants are asked to indicate on a linear scale from 0 to 10 their current position in the change process. A "0" on the left side of the scale indicates "not prepared for change" and a "10" on the right side of the scale indicates "already changing." The lower numbers indicate less readiness, and the higher numbers indicate greater readiness for change. A score above 5 shows that the person is willing to consider change.

The ruler-scale format was also used to assess how participants were doing throughout the study. At each session, child/adolescent participants were asked to indicate on a linear scale from 0 to 10 their response to each of the following questions: "How are you doing?" and "How is it going at home?" At each session, caregivers were asked to indicate on a linear scale from 0 to 10 their response to each of the following questions: "How is your child doing?" and "How are you doing as a parent?"

Parental Locus of Control Scale (PLOC)

All caregivers completed the Parental Locus of Control Scale (PLOC) which measures parental locus of control, that is, a parent's (internal) or child's (external) power in a given child-rearing situation (Campis, Lyman, & Prentice-Dunn, 1986). The scale comprises of 47 self-report items, which are rated on a five-point Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree). In addition to a Total score, the 47 items also form five subscales: *parental efficacy* (10 items), *parental responsibility* (10 items), *child control of parent's life* (7 items), *parental belief in fate/chance* (10 items), *and parental control of child's behaviour* (10 items).

Higher scores indicate a greater external locus of control. A high Parental Efficacy subscale score indicates that a parent does not feel effective in exercising their parental role. A high Parental Responsibility subscale score indicates that a parent does not feel responsible for their child's behaviour. A high Child Control subscale reflects parents who feel that their child's needs and demands dominate their lives. A high Fate/Chance subscale score reflects parents who tend to believe that parenting and child behavior are influenced by external factors such as fate or chance. A high Parent Control subscale score reflects parents who feel unable to control their child's behavior. Finally, a

high Total Score corresponds to a more external locus of control, while a lower total score refers to a more internal locus of control.

The PLOC has good reliability and validity. It has good to excellent internal consistency, with alpha coefficients of 0.92 for the total scale and 0.65 to 0.77 for the subscales. It also has good construct validity as a majority of correlations are in predicted directions with General Self-efficacy, PSI Sense of Competence, GPPI Responsibility, MCRE Overindulgence, PSI Child Demandingness, and PSI Restriction of Role. Although normative data is not available for this measure, means are available for a group of 60 parents who did not report difficulties in their parenting role (Group A), and a group of 45 parents who requested counselling services for parenting problems (Group B). The measure has good known-groups validity, as it significantly distinguishes between these parenting groups.

Parenting Sense of Competence Scale (PSOC)

All caregivers completed the Parenting Sense of Competence Scale (PSOC), which measures parental self-efficacy on two dimensions: efficacy (a parent's perceived competence in the parenting role) and satisfaction (the extent to which parents are satisfied with the parenting role as reflected by their level of anxiety and frustration) (Johnston & Mash, 1989). The scale comprises of 16 self-report items (7 items comprise the efficacy factor, and 9 items comprise the satisfaction factor) that are rated on a six-point Likert scale from 1 (Strongly Agree) to 6 (Strongly Disagree). The efficacy and satisfaction factor scores are summed to provide a PSOC Total score. Higher scores indicate greater parental self-efficacy. There are two versions of the PSOC; one version

uses the term “mother” and the other uses the term “father” in the self-report items, to be used appropriately as caregivers identify themselves as a parent.

The PSOC has good reliability and validity. Internal consistency of the PSOC was found to be 0.79 and alpha coefficients for the subscales were 0.75 for the Satisfaction factor and 0.76 for the Efficacy factor. Support has been found for the PSOC’s two-factor structure (Ohan, Leung, & Johnston, 2000), indicating that efficacy and satisfaction are distinct aspects of parenting self-esteem.

Pre-Intervention Assessment Measures

During their pre-intervention assessment visit, all child and adolescent participants completed, in the following standardized order, the Readiness Ruler, selected WASI subtests (Vocabulary and Matrix Reasoning), the FIQ Self-Report, the BASC-2 SRP (Interview version [ages 6 to 7], Child version [ages 8 to 11], or Adolescent Version [ages 12 to 16], as was appropriate for their age), and the TEA-Ch *Walk, Don’t Walk* subtest. Adolescent participants (ages 12 to 16) also completed the URICA, after completing the Readiness Ruler. The WASI was used for descriptive purposes and was only administered during the pre-intervention assessment visit.

All caregivers completed, in the following standardized order, the Current Level of Supervision form, Readiness Ruler, the FIQ Parent-Report, the BASC-2 PRS and PRQ-CA, the PSOC, the PLOC, and the BRIEF Parent Form. Prior to completing these assessment measures, demographic and relevant background information regarding the youth and family (i.e., living situation, previous mental health contacts and diagnoses, schooling, history of contact with a child welfare agency, etc.) was collected via the TAPP-C Background Information form, a questionnaire created for the study.

Post-Intervention Assessment Measures

During their post-intervention assessment visit, all child and adolescent participants completed, in the following standardized order, the Readiness Ruler, the URICA (ages 12 to 16), the FIQ Self-Report, the BASC-2 SRP, and the TEA-Ch Walk, Don't Walk subtest. All caregivers completed the Current Level of Supervision form, the Readiness Ruler, the FIQ Parent-Report, the BASC-2 PRS and PRQ-CA, the PSOC, the PLOC, and the BRIEF Parent Form, consistent with measures completed during the pre-intervention assessment visit.

Follow-Up Assessment Measures

During their follow-up assessment visit, all child and adolescent participants completed, in the following standardized order, the Readiness Ruler, the URICA (ages 12 to 16), the FIQ Self-Report, and the BASC-2 SRP. The TEA-Ch Walk, Don't Walk subtest was not re-administered at follow-up, as a third version of the test is not available. All caregivers completed the Current Level of Supervision form, the Readiness Ruler, the FIQ Parent-Report, the BASC-2 PRS and PRQ-CA, the PSOC, the PLOC, and the BRIEF Parent Form, consistent with measures completed during the pre- and post-intervention assessment visits.

Intervention Conditions

Equating Treatment Dosage for Condition Groups

To equate treatment dosage across both condition groups, modifications were made to the structure of the manualized intervention sessions. In the FSE intervention, the final FSE session in the TAPP-C Fire Service Educator's Manual (Johnstone, Gilbert, MacKay, & Henderson, 2004) was divided into two sessions, with the final review and

graduation being moved to an additional session; this created 4 sessions in total (a home safety check and three FSE sessions). The content of the sessions was not altered in any way. This was not considered a major deviation from treatment as usual, as it is a common practice for fire educators to hold additional (or in some cases fewer) sessions to complete learning materials or to be flexible and adaptive to a youth's learning needs.

In the modified TAPP-C intervention, a fire-specific risk-assessment was integrated into the clinician-delivered, manualized treatment sessions (rather than during separate sessions), whereby half of the first session was dedicated to assessment and half of the second session was dedicated to assessment feedback. It was possible to condense the sessions in this manner because the assessment questionnaires were completed prior to the sessions (during the participants' pre-intervention assessment home visit), which provided significant time savings. Given that intervention is considered to begin with assessment (i.e., an assessment is a form of intervention, as fire-safe practices are promoted and encouraged throughout typical assessments, as unsafe practices are disclosed by families), administering assessment and treatment in this way was not thought to be a significant deviation from, or to interfere with, TAPP-C assessment and treatment goals. The treatment sessions followed the TAPP-C Clinician’s Manual for Preventing and Treating Juvenile Fire Involvement (Mackay et al., 2004), with the following structural changes. Sessions 3 and 4 of the manual were delivered together in a single session, and the core content elements (i.e., review of progress, planning for future risk, certificate presentation) from Session 5 were implemented at the end of the final intervention session, rather than during a separate session. The content of the manualized material was not altered, and thus the integrity of the TAPP-C program was maintained.

To summarize, the modified TAPP-C intervention included 4 sessions in total, as follows. Session 1 included a home safety check, provided by a fire safety educator. Sessions 2 and 3 were provided by a TAPP-C clinician, and each included fire-specific risk assessment, as well as treatment (utilizing sessions 1 and 2 from the TAPP-C treatment manual). Session 4 was also provided by a TAPP-C clinician and included treatment (utilizing core content from sessions 3, 4, and 5 of the TAPP-C treatment manual). Interestingly, this is the protocol most often completed by families participating in the TAPP-C program at the current time. While most families complete their assessment and several treatment sessions, many do not sustain attendance through Session 5, and content from different sessions is often delivered in a single session to reduce the number of appointments for these often complex families.

Therefore, participants in both condition groups received 4 sessions in total, including a home safety check and three respective sessions with either a TAPP-C mental health clinician or fire educator, as per their treatment randomization. Fire educators and TAPP-C clinicians were briefed regarding the research protocol and the structural changes to service delivery via a one-day workshop. Instructional materials reminding educators of the changes accompanied referral packages for the FSE intervention. TAPP-C clinicians were provided with research packages for each participant, including assessment and treatment materials to be used during each session.

The Fire Safety Education Intervention (FSE)

The FSE intervention followed the TAPP-C fire service educator manualized intervention program, using the Fire Service Educator's Manual (Johnstone et al., 2004), with the structural changes outlined above. This program involves specially trained fire

service professionals who provide home fire safety checks and FSE. The FSE intervention was delivered in four sessions, as follows. The home fire safety check was completed as soon as possible after the pre-intervention assessment measures were completed and involved helping the youth and their caregiver(s) to evaluate and improve fire safety in their home. Homes were checked for working fire alarms and the entire family was helped to develop and practice a home escape plan. Homes were also checked to ensure that ignition materials were not accessible to the youth. Home safety checks were approximately 60 to 90 minutes in length (mean session length = 85 minutes; SD = 18.37).

After the home fire safety check was completed, the youth attended three additional FSE sessions, which were approximately 60 to 90 minutes in length (session 1 mean length = 78.33 minutes, SD = 20.92; session 2 mean length = 80.63 minutes, SD = 21.12; session 3 mean length = 66.67 minutes, SD = 13.23). These sessions were held either at the youth's home or the local fire station, as fire station resources permitted; however, the final session was always held at the local fire station where the youth was given a tour and a certificate of achievement to commemorate their completion of the program. The FSE sessions were designed to be developmentally appropriate to the age of a youth; the manual provides individualized content by age group. Level 1 was designed for preschool children ages 2 to 4, Level 2 was designed for children ages 5 to 8, Level 3 was designed for pre-teens ages 9 to 12, and Level 4 was designed for teens ages 13 and greater. The FSE sessions educated the youth and their family about fire prevention, detection and escape. Homework exercises were also given to the youth, which were reviewed at their next session.

The Modified TAPP-C Intervention

The modified TAPP-C intervention was comprised of both mental health and FSE components. The mental health component included a fire-specific risk assessment, MI, and the skills-based CBT and PMT components of the standardized, manualized TAPP-C treatment, as per the changes outlined above. The mental health component was provided by a trained TAPP-C clinician over three sessions, which were approximately 90 to 120 minutes in length (session 1 mean length = 124.62 minutes, SD = 20.66; session 2 mean length = 126.25 minutes, SD = 26.73; session 3 mean length = 92.5 minutes, SD = 32.51). Importantly, youth in this condition group also received a standardized, manualized home safety check session (mean session length = 63.21 minutes; SD = 20.06) with a trained fire educator (prior to beginning their mental health component), consistent with the FSE intervention condition group (see above) and following the standard TAPP-C protocol, to ensure safety.

The TAPP-C structured assessment protocol was administered by TAPP-C assessors, including psychologists and paid research staff who were completing, or had completed, doctoral degrees in clinical psychology and were supervised by senior psychologists within the program. As part of the assessment, participants were administered the Fire Involvement Interview (FII; MacKay, et al., 2006) and the Fire Safety Survey (FSS). The FII is a semi-structured interview about the youth's fire involvement and the FSS is a survey about a youth's access to fire materials, and education and knowledge about fire involvement and safety. The FII and FSS were administered separately to both caregiver and child/adolescent participants. Additionally, the youth's developmental history was reviewed with their caregiver(s) via interviewing.

Caregivers completed a mental health screening measure regarding their youth (i.e., the Global Appraisal of Individual Needs - Short Screener [GAIN-SS]) as per typical CAMH protocol; this measure was not used as part of the present study. Other measures used to inform the assessment were completed during the pre-intervention assessment visit, and included the FIQ and BASC. Participants received assessment feedback, whereby findings and recommendations from their written assessment report were shared.

The treatment component followed the TAPP-C Clinician's Manual for Preventing and Treating Juvenile Fire Involvement (MacKay et al., 2004), with the structural changes outlined above. This treatment program involved three CBT sessions with the youth participants and three PMT sessions with their caregiver(s), which ran concurrently with each participant being assigned their own clinician. The caregiver and youth sessions contained some overlapping content, and some content that was unique to each. Sessions began and ended with a joint meeting of the caregiver(s), youth and clinicians to review session content and home practice exercises. Each session included a check-in about any further fire involvement, reviewed information about the youth's fire-specific experience related to the session topic, provided psychoeducation and in-session practice of a target skill, and take-home practice exercises for skill development.

Caregivers were taught how to promote fire-safe behaviour in their children, how to better supervise, monitor, reward and consequence their children's behaviour, and how to appropriately plan for any potential future difficulties. Youth were taught skills and strategies to recognize and control their fire-related impulses and behaviours. They learned the Stop Now and Plan (SNAP) cognitive-behavioural strategy, which is typically used with youth who have difficulty with emotion regulation. In the TAPP-C clinician

manual, the SNAP strategy is modified to be relevant for fire-involvement behaviour, to help youth regulate their fire-involvement behaviours by getting them to stop, think, and plan positive alternatives before they act impulsively. Other session topics included: the dangerousness of fire involvement, the importance of fire-safe attitudes, the role of fire-safe behaviours for the family, understanding and eliminating access to all fire-related materials, eliminating inappropriate modeling of fire-related behaviour, understanding high-risk situations and triggers to fire involvement, improving supervision and monitoring practices, developing alternative responses to triggers, understanding consequences of fire involvement and developing an appropriate consequence plan, gaining support from others, planning for the future, and monitoring for risk.

Procedure

Once referred to the TAPP-C program at the CAMH, an intake worker contacted the referred youth's caregiver(s) to obtain more information about the youth and family, and about the fire involvement that initiated the referral. If the referred youth met the study's inclusionary criteria, the intake worker asked for the caregiver's consent to have a member of the TAPP-C research team contact them via telephone to discuss an opportunity for participation in a research study (in all cases, consent was provided). A study investigator then contacted the caregiver via telephone to introduce the study and explain the research protocol. In cases where a caregiver indicated that they were interested in participating (all caregivers initially agreed to participate), a pre-intervention assessment visit was then scheduled for two research staff to meet with the caregiver and the referred youth at their residence (at the family's convenience). Figure 1, below, provides an overview of the study design.

At the start of the pre-intervention assessment visit, all study protocols were reviewed again, and caregivers and youth were asked to provide written consent/assent for their participation in the study. Written consent was obtained from caregivers and youth aged 16. Verbal assent and, when appropriate (depending on reading and writing ability), written assent was obtained from youth ages 6 to 15. The pre-intervention assessment measures were then administered, with the youth and caregiver each working separately with a researcher. The pre-intervention assessment visits took an average of 114 minutes (SD= 22.89) to complete.

Once the pre-intervention assessment visit was complete, participants were randomly assigned to either the FSE intervention condition (i.e., a home safety check and three fire education sessions with a fire educator), or the modified TAPP-C intervention condition (i.e., a home safety check and three assessment/treatment sessions with a mental health clinician). Participants were randomized in blocks of four, by age group, to ensure comparability between the two condition groups (i.e., that each age group was equally represented in each of the condition groups). The age groups were as follows: 6 to 9; 10 to 13; 14 to 16. The randomization procedure was independently created by the Biostatistical Consulting Service, at the CAMH. In total, 27 youth-caregiver dyads were randomized to an intervention condition; 14 to the modified TAPP-C intervention, and 13 to the FSE intervention.

After being randomized to an intervention condition, participants received their assigned intervention over approximately a 3-month interval (see Figure 1). Fire service professionals (including trained fire educators from the Toronto Fire Service, Oshawa Fire Service, Vaughan Fire Service, Brampton Fire Service, Durham Fire Service, and

East Gwillimbury Fire Service, as determined by the jurisdiction in which a participant resided) administered the FSE intervention, and mental health professionals (i.e., clinicians in the TAPP-C program at the CAMH) administered the modified TAPP-C intervention. Twenty-two dyads were treatment completers. On average, participants completed their interventions over 95 days (SD= 72.35); however, further analyses (i.e., an independent samples T-test) revealed that the intervention condition groups significantly varied in their treatment completion times. Participants in the modified TAPP-C intervention condition completed their intervention, on average, over 63 days (M= 62.93; SD= 27.55), which fell within the protocol timeline, whereas participants in the FSE condition group took significantly longer to complete their intervention, taking an average of 133 days (M= 113.4; SD= 90.97), which fell beyond the protocol timeline; $t(10.37)= -2.36$, $p< .05$.

Figure 1. *Study Design*

Modified TAPP-C Intervention Group n = 14	Home Safety Check + Mental Health Components	Fire Safety Education Waitlist (3 months)	Fire Safety Education *If requested
Fire Safety Education Group (FSE) n = 13	Home Safety Check + Fire Safety Education	Mental Health Components Waitlist (3 months)	Mental Health Components *If requested
Time (months)	0 Pre-Intervention	3 Post- Intervention	6 Follow-up

Once participants completed the final session of their assigned intervention, their assigned mental health clinician or fire educator notified a study investigator. Caregivers were then contacted by the study investigator and a post-intervention assessment visit was scheduled to complete the post-intervention assessment measures at their residence. On average, the post-intervention assessment visits were completed 8 days (SD= 6.01) after a participant's final intervention session. The post-intervention assessment visits took an average of 72 minutes (SD= 13.6) to complete.

After completing their post-intervention assessment visit, participants were placed on a 3-month waitlist to receive the other intervention, to enable the collection of follow-up data. Participants then completed follow-up assessment measures during a follow-up assessment visit (at their residence) approximately 3 months after completing their assigned intervention. On average, the follow-up assessment visits were completed 96 days (SD= 13.72) after the post-intervention assessment visit. The follow-up assessment visits took an average of 66 minutes (SD= 13.05) to complete. Each family received $35 at the conclusion of their follow-up assessment visit, as compensation for their participation in the study. Families were then offered the intervention provided in the other treatment condition (i.e., participants in the FSE condition were offered the modified TAPP-C intervention, and participants in the modified TAPP-C intervention condition were offered the FSE intervention), which was made available upon request. In total, 7 participants in the modified TAPP-C intervention condition went on to complete FSE sessions, and 1 participant in the FSE condition went on to complete the mental health component of the TAPP-C intervention.

It was decided that the pre-intervention, post-intervention, and follow-up assessment measures be collected at the participants' homes, rather than at the CAMH, to ensure that data was obtained in, as much as possible, an unbiased and standardized manner. Importantly, had participants in the FSE intervention condition completed their data-collection assessment visits at the CAMH, it would have been a direct departure from typical FSE interventions, which do not involve contact with mental health agencies. Additionally, we believed that a visit to a mental health agency would, in itself, be a form of intervention and could thus directly bias the data, particularly the pre-intervention data, which was meant to provide a baseline indication of functioning (i.e., functioning *prior* to intervention). Although collecting data in a participant's home can also incur vulnerability to bias (e.g., a greater chance of participants providing socially desirable responses to a "guest" visiting their home; responses being influenced by participant wanting to project a particular image of their home life, perhaps due to anxiety or embarrassment about the condition of residence), as well as administration challenges due to an inability to control the assessment environment (e.g., distractions such as noise and activities of other family members; lack of appropriate work area to conduct assessment), many of these issues are not unique to this setting, and in fact, can also arise in a mental health setting (e.g., distraction due to noise and activities of other clients, socially desirable responses given in context of the hierarchical, researcher-participant relationship). Thus, we believed that the risk of biasing our results would have been greater if data were collected at the CAMH. To ensure the safety of research staff while meeting with families in the community, home visits were conducted by pairs of researchers, and staff followed standard CAMH safety procedures and guidelines

for working with clients when offsite. All of the data-collection assessment visits were completed at the participants' homes, with the exception of two cases. Specifically, one family was not comfortable with home visits, and another family lacked an appropriate home environment for the home visits; thus, their pre-intervention, post-intervention and follow-up assessment visits were completed in an office at the CAMH, although they followed the standardized protocol in all other aspects.

Treatment fidelity was monitored in both intervention groups. In the modified TAPP-C intervention, the TAPP-C progress note forms completed by clinicians at the end of each treatment session were reviewed. These forms listed treatment targets for each session in the form of a checklist and required clinicians to indicate the topics covered and successfully completed in the session. In all cases, clinicians met their treatment targets. In the FSE intervention, fire educators received frequent (approximately every 3 weeks) follow-up phone and email contacts from study investigators to check in regarding the status of the participants' progress, and their implementation and adherence to the research protocol (particularly regarding study timelines, which was a struggle for participants in this condition group). Fire educators also completed a checklist at the end of each home safety check (for both condition groups) and FSE session, which listed content targets and learning goals, and required educators to indicate the topics covered and successfully completed in the session. Fire educators varied in their completion and provision of these checklists, although treatment targets were met in all cases where this documentation was provided.

The majority of cases followed the research protocol, completing their intervention within three months and completing all data collection visits on time. The

most common protocol deviations involved difficulties upholding study timelines, most notably in the FSE intervention condition group, which took, on average, twice as long to complete their intervention, compared with the modified TAPP-C intervention condition group. These same difficulties also contributed to participant attrition (see above). Although clinicians and fire educators strove to uphold the 3-month timeframe for implementing the study interventions, at times they had to go beyond this timeframe to accommodate unexpected events, such as illnesses and bereavement in participant families (occurred in three cases in the FSE intervention condition group), and transient living arrangements (two cases, one in each intervention condition group, geographically re-located), as well as to accommodate and work within the demands and constraints of their own busy work environment (two cases were delayed due to the scheduling difficulties of their fire educator) and the schedules of other service providers working with participants (e.g., child welfare workers assisting foster families). Other protocol deviations involved data collection challenges, such as in cases where youth experienced changes to their caregiving situation, which prevented the collection of follow-up data, and cases where data could not be collected within a participant's home.

Results

Approach to Data Analysis

The statistical approach used for this study was to perform mixed ANOVAs to enable examination of both within and between group differences pertaining to the study variables across all three data time points. Although T-tests might also have been appropriate, this approach was rejected as T-tests are more sensitive to deviations from normality in smaller sample sizes (Kim & Park, 2019). T-tests also have the risk of

increased type I error in cases where multiple tests are performed (i.e. when examining data across more than two time points). Descriptive analyses were also conducted and included means, standard deviations, ranges, and frequencies. Correlations were additionally calculated to examine the relationships among the variables.

Sample Characteristics

The characteristics of the total sample (N = 27) at pre-intervention are described in Table 3. The study sample (N = 27 youth/caregiver dyads) consisted predominantly of male youth (n = 25; 93%) and female caregivers (n = 23; 85%). The mean age of the youth was 12.2 years (ranging from 6.25 to 16.75 years). Nineteen (70%) of the caregiver participants were parents (including biological and adoptive parents), 5 (19%) were other relatives or legal guardians, 2 (7%) were foster parents, and 1 (4%) was a child and youth worker. The youth were referred by a variety of sources, including mental health agencies (37%), child welfare agencies (26%), family physicians (19%), schools (7%), probation services (7%), and hospitals (4%). The youth were referred for fire involvement as follows: 5 (19%) youth were referred for match/lighter play, 18 (67%) youth were referred for burning small object(s), 3 (11%) youth were referred for burning large object(s), and 1 (4%) youth was referred for burning themselves or another person. When grouped by age, the youngest group of youth (ages 6 to 9) were only referred for match/lighter play (2 youth, 29%) and for burning small object(s) (5 youth, 71%). The middle age group (ages 10-12) were also only referred for match/lighter play (2 youth, 33%) and for burning small object(s) (4 youth, 67%). However, the oldest youth (ages 13 to 16) were referred for more diverse (including more severe) fire involvement, including match/lighter play (2 youth, 12%), burning small object(s) (11 youth, 65%), burning large

object(s) (3 youth, 18%), and burning themselves or another person (1 youth, 6%). In terms of the reported (i.e., by caregivers) ethnic background of the youth, 12 youth (44%) were White (included European backgrounds), 3 youth (11%) were Black (i.e., Canadian, American, Caribbean, and African backgrounds), 2 youth (7 %) were Latin American, 3 youth (11 %) were South (e.g., East Indian or Sri Lankan) or Southeast (e.g. Vietnamese, Cambodian) Asian, 1 youth (4%) was Aboriginal, 1 youth (4%) was Filipino, and 5 youth (19%) were biracial. A majority of the youth were reported to speak English as their first language (89%) and to have been born in Canada (82%).

In terms of academic characteristics, a majority of the youth were reported to have academic accommodations in place at school (78%), and over half (56%) had been diagnosed with a learning disability. Almost half of the youth were reported to attend specialized classrooms either exclusively or for part of their school day (48%). The mean WASI Full Scale IQ of the youth was 92.96 (n = 25), with a standard deviation of 12.35 (range = 63-109); WASI Full Scale IQ was not collected for 2 youth. The highest level of education completed reported for mothers was as follows: 10 (37%) had completed high school education or less, 8 (30%) had completed some college or university education (but did not graduate), and 6 (22%) had completed a college or university education. The highest level of education completed reported for fathers was as follows: 8 (30%) had completed high school education or less, 3 (11%) had completed some college or university education (but did not graduate), and 7 (26%) had completed a college or university education.

In terms of mental health characteristics, 12 (44%) of the youth were receiving concurrent individual mental health services, 5 (19%) had a parent receiving mental

health services, and 5 (19%) were participating in family mental health services; 11 (41%) were reported to have no one in their family (including the youth) currently receiving mental health services. Almost three-quarters of the youth (n = 20; 74%) were reported to have received mental health services in the past. Only 3 (11%) of the youth were reported to have no mental health diagnoses; 16 (59%) had one diagnosis, 5 (19%) had two diagnoses, and 2 (7%) had three or more diagnoses; for 1 youth the number of mental health diagnoses was not specified. The most common diagnosis reported was ADHD (n = 14; 52%), followed by Autism Spectrum Disorder (ASD; n = 4; 15%), Oppositional Defiant Disorder (ODD; n = 3, 11%), conduct disorder (n = 2; 7%), anxiety (n = 2; 7%), and Post-Traumatic Stress Disorder (PTSD; n = 1; 4%); 3 were reported to have "other" diagnoses, and for 2 youth a diagnosis was not specified. Thirty-seven percent (n = 10) of the youth were reported to be currently taking medication for a mental health purpose.

In terms of family characteristics, sixteen youth (59%) lived with their parent(s), 5 (19%) with another relative or guardian, 5 (19%) lived in a foster or group home, and 1 (4%) lived in a residential treatment facility. Eleven (41%) of the youth resided in a single parent household. Of those youth living in foster care, group home, or residential treatment settings, the mean reported length of time in such care was approximately 10 months, with a large range (i.e., 3 to 24 months). Eight (30%) of the youth's families were reported to be currently involved with a child welfare agency (CWA), and 22 (82%) were reported to have "ever" had involvement with a CWA. For a breakdown of the sample characteristics for each of the condition groups at pre-intervention, please see Table 3.

Table 3. *Sample Characteristics of the Condition Groups*

Sample Characteristics	Entire Sample (N = 27)	Modified TAPP-C (n = 14)	Fire Safety Education (n = 13)
Gender Youth (male/female)	25/2	13/1	12/1
Age Youth: Mean ± SD (Range), years	12.21 ± 2.73 (6.25-16.57)	12.23 ± 2.85 (6.25-16.75)	12.19 ± 2.72 (7.42-15.67)
Youth WASI FSIQ: N/Mean ± SD (Range)	25/92.96 ± 12.35 (63-109)	13/94.46 ± 13.16 (63-109)	12/91.33 ± 11.76 (72-109)
Ethnicity Youth: (N/%)			
Aboriginal	1/3.7	1/7.1	--
South Asian	2/7.4	2/14.3	--
Southeast Asian	1/3.7	1/7.1	--
Bi-racial	5/18.5	1/7.1	4/30.8
Black	3/11.1	1/7.1	2/15.4
Latin American	2/7.4	--	2/15.4
White/European	12/44.4	7/50.0	5/38.5
Filipino	1/3.7	1/7.1	--
English First Language (N/%)			
Yes	24/88.9	14/100.0	10/76.9
No	3/11.1	--	3/23.1
Youth Born Canada (N/%)	22/81.5	11/78.6	11/84.6
Classroom Type: (N/%)			
Regular	14/51.9	8/57.1	6/46.2
Specialized	11/40.7	5/35.7	6/46.2
Both	2/7.4	1/7.1	1/7.7
Academic Accommodation (N/%)			
Yes	21/77.8	11/78.6	10/76.9
No	5/18.5	2/14.3	3/23.1
Learning Disability (N/%)			
Yes	15/55.6	8/57.1	7/53.8
No	12/44.4	6/42.9	6/46.2
Current MH Services: (N/%)			
Youth	12/44.4	6/42.9	6/46.2
Mother	3/11.1	--	3/23.1
Father	2/7.4	--	2/15.4
Family	5/18.5	2/14.3	3/23.1
No One	11/40.7	7/50.0	4/30.8
Youth History MH Services	20/74.1	10/71.4	10/76.9
MH Diagnoses Youth: (N/%)			
0 Diagnoses	3/11.1	2/14.3	1/7.7
1 Diagnosis	16/59.3	9/64.3	7/53.8
2 Diagnoses	5/18.5	1/7.1	4/30.8
3 Diagnoses	1/3.7	1/7.1	--
4 Diagnoses	1/3.7	--	1/7.7
Youth Diagnoses: (N/%)			
ADHD	14/51.9	6/42.9	8/61.5
ASD	4/14.8	2/14.3	2/15.4
ODD	3/11.1	1/7.1	2/15.4
Conduct Disorder	2/7.4	1/7.1	1/7.7

Anxiety	2/7.4	--	2/15.4
PTSD	1/3.7	--	1/7.7
Other	3/11.1	2/14.2	1/7.7
Not Specified	2/7.4	1/7.1	1/7.7
Youth Current MH Medication (N/%)			
Yes	10/37.0	4/28.6	6/46.2
No	16/59.3	9/64.3	7/53.8
Gender Caregiver (male/female)	4/23	2/12	2/11
Caregiver Relationship: (N/%)			
Biological Mother	14/51.9	7/50.0	7/53.8
Biological Father	1/3.7	1/7.1	--
Adoptive Mother	3/11.1	3/21.4	--
Adoptive Father	1/3.7	--	1/7.7
Foster Mother	1/3.7	1/7.1	--
Foster Father	1/3.7	1/7.1	--
Grandparent	2/7.4	1/7.1	1/7.7
Other Relative	2/7.4	--	2/15.4
Child/Youth Worker	1/3.7	--	1/7.7
Other Legal Guardian	1/3.7	--	1/7.7
Youth Living Situation: (N/%)			
With Parent(s)	16/59.3	10/71.4	6/46.2
Other Relative	4/14.8	1/7.1	3/23.1
Foster Home	3/11.1	2/14.3	1/7.7
Group Home	2/7.4	--	2/15.4
Residential Treatment	1/3.7	1/7.1	--
Other Guardian	1/3.7	--	1/7.7
Time in CWA/Treatment Care: Mean ± SD (Range), months	10.4 ± 8.26 (3-24)	15.5 ± 12.02 (7-24)	7 ± 4.58 (3-12)
Single Parent Home (N/%)			
Yes	11/40.7	6/42.9	5/38.5
No	12/44.4	7/50.0	5/38.5
N/A	3/11.1	1/7.1	2/15.4
Parental Education: (N/%)			
Mother Incomplete HS	6/22.2	1/7.1	5/38.5
Completed HS	4/14.8	2/14.3	2/15.4
Some C or U	8/29.6	7/50.0	2/15.4
Completed C or U	6/22.2	2/14.3	3/23.1
Father Incomplete HS	4/14.8	1/7.1	3/23.1
Completed HS	4/14.8	2/14.3	2/15.4
Some C or U	3/11.1	4/28.6	1/7.7
Completed C or U	7/25.9	3/21.4	2/15.4
Not Applicable/Youth in Care	6/22.2	4/28.8	2/15.4
Unknown	6/22.2	2/14.3	4/30.8
Family CWA Contact: (N/%)			
Current Contact	8/29.6	3/21.4	5/38.5
Contact At Any Point In Time	22/81.5	10/71.4	12/92.3
Referral Source: (N/%)			
MH Agency	10/37	6/42.9	4/30.8
CWA	7/25.9	3/21.4	4/30.8

Family Doctor	5/18.5	3/21.4	2/15.4
School	2/7.4	1/7.1	1/7.7
Probation Officer	2/7.4	1/7.7	1/7.7
Hospital	1/3.7	--	1/7.7
Referral Fire (N/%)			
Match/Lighter Play	5/18.5	4/28.6	1/7.7
Burn Small Object(s)	18/66.7	8/57.1	10/76.9
Burn Large Object(s)	3/11.1	2/14.3	1/7.7
Burn Self/Other	1/3.7	--	1/7.7

SD= Standard Deviation; WASI FSIQ = Wechsler Abbreviated Scale of Intelligence, Full Scale IQ; MH = Mental Health; ADHD = Attention-deficit/Hyperactivity Disorder; ODD = Oppositional Defiant Disorder; ASD = Autism Spectrum Disorder; PTSD = Post-Traumatic Stress Disorder; HS = High School; C = College; U = University; CWA = Child Welfare Agency

Table 4. *Youth's Current Living Situation Across Time*

Youth Current Living Setting	Entire Sample	Modified TAPP-C	Fire Safety Education
Pre			
Parents (N/%)	14/51.9	9/64.3	5/38.5
Other Family (N/%)	3/11.1	1/7.1	2/15.4
Foster (N/%)	2/7.4	1/7.1	1/7.7
Missing (N/%)	8/29.6	3/21.4	5/38.5
Post			
Parents (N/%)	12/54.55	7/58.3	5/50.0
Other Family (N/%)	4/18.2	1/8.3	3/30.0
Foster (N/%)	2/9.1	1/8.3	1/10.0
Missing (N/%)	4/18.2	3/25.0	1/10.0
Follow-Up			
Parents (N/%)	11/57.9	7/63.6	4/50.0
Other Family (N/%)	5/26.3	1/9.1	4/50.0
Foster (N/%)	1/5.3	1/9.1	--
Missing (N/%)	2/10.5	2/18.2	--

FU = Follow-Up

In terms of the current living situation of the youth participants at the three data collection time points, the majority resided with their parents (52-58% across the time points). This was followed by youth residing with other family members (11-26% across the time points) and foster parents (5-7% across the time points). Of note, this data was not collected for all participants due to this variable been added after the study commenced. Additionally, participant attrition over the course of the study contributed to

missing data. In many cases, such attrition occurred due to the transient living arrangements of the youth, which this variable does not capture. For a breakdown of the youth participants' current living situation at the three data collection time points, please see Table 4.

Fire-Specific Variables

To measure age of onset for fire involvement, participants responded to two questions on the FIQ at pre-intervention: "How old were/was you/your child the first time you/he/she played with matches of lighters?" (response options included 'Never played with matches or lighters,' '5 years old or younger,' 'Between 6 and 9 years old,' and '10 years old or older'), and "How old were you the first time you burned something that you weren't supposed to?" (response options included 'Never burned something that I/he/she wasn't supposed to,' '5 years old or younger,' 'Between 6 and 9 years old,' and '10 years old or older'). The caregiver and youth reports were fairly consistent. Caregivers reported only 7.4% of youth engaging in match or lighter play at or before the age of 5. The rest of the sample was split equally, with reports of 44.4% of youth engaging in match or lighter play between the ages of 6 and 9, and 48.1% engaging in these behaviours at or after the age of 10. A similar distribution was reported by youth participants; 15.4% reported engaging in match or lighter play at or before the age of 5, 46.2% between the ages of 6 and 9, and 38.5% at or after the age of 10.

The reported age of onset of unsanctioned burning followed a similar pattern, with 3.7% of caregivers reporting their youth engaging in this behaviour at or before the age of 5, 44.4% between the ages of 6 and 9, and 48.1% at or after the age of 10. Approximately 8% of youth participants reported engaging in unsanctioned burning at or

before the age of 5, 38.5% between the ages of 6 and 9, and 38.5% at or after the age of 10. Approximately 4% of caregivers and 15% of youth reported never engaging in unsanctioned burning. Tables 5 and 6 summarize the caregiver and youth reported age of onset for fire involvement.

Table 5. *Caregiver Reported Age of Onset Match/Lighter Play, Unsanctioned Burning for Entire Sample*

Type Fire Involvement	Response	Frequency	Percent
Match/lighter Play	Never	0	-
	≤ 5 years	2	7.4
	6 - 9 years	12	44.4
	10 + years	13	48.1
Unsanctioned Burning	Never	1	3.7
	≤ 5 years	1	3.7
	6 - 9 years	12	44.4
	10 + years	13	48.1

Table 6. *Youth Reported Age of Onset Match/Lighter Play, Unsanctioned Burning for Entire Sample*

Type Fire Involvement	Response	Frequency	Percent
Match/lighter Play	Never	0	-
	≤ 5 years	4	15.4
	6 - 9 years	12	46.2
	10 + years	10	38.5
Unsanctioned Burning	Never	4	15.4
	≤ 5 years	2	7.7
	6 - 9 years	10	38.5
	10 + years	10	38.5

Hypothesis 1

To measure fire involvement recidivism, participants responded to two questions on the FIQ that measured frequency at post-intervention and follow-up: "Since your/their

last visit with the TAPP-C program, how often did you/your child carry matches or lighters in your/his/her pockets, purse or bag?" (response options included 'Never,' 'Rarely,' 'Sometimes,' 'Often,' and 'Always'), and "Since your/their last visit with the TAPP-C program, how many times have/has you/your child set something on fire that you/they weren't supposed to?" (an open-ended count question). It was anticipated that caregivers and youth in both condition groups would report, on average, a lower frequency of fire involvement post-intervention and at follow-up compared with their pre-intervention scores; however, greater improvements were expected for caregivers and youth in modified TAPP-C intervention condition group, compared with caregivers and youth in the FSE intervention condition group.

As expected, caregivers and youth in both condition groups reported a lower frequency of fire involvement post-intervention and at follow-up compared with their pre-intervention scores. In fact, there was no recidivism reported in either condition group; all caregiver and youth participants reported no unsanctioned youth firesetting post-intervention and at follow-up. This represents a substantial reduction in firesetting, as 85.2% of caregivers reported between 1 and 25 instances of firesetting occurring within the 12 months prior to completing their pre-intervention visit, and 88.5% of youth reported between 1 and 9 instances of firesetting occurring within the 12 months prior to completing their pre-intervention visit (see Tables 7 and 8).

Table 7. *Caregiver Reported Frequency of Unsanctioned Firesetting Over Time for Entire Sample*

Time	Response: # Fires	Frequency	Percent
Pre-Intervention	0	4	14.8
	1	10	37
	2	5	18.5
	3	4	14.8
	4	2	7.4
	5	1	3.7
	25	1	3.7
Post-Intervention	0	22	100
Follow-Up	0	19	100

Table 8. *Youth Reported Frequency of Unsanctioned Firesetting Over Time for Entire Sample*

Time	Response: # Fires	Frequency	Percent
Pre-Intervention	0	3	11.5
	1	14	53.8
	2	2	7.7
	3	1	3.8
	4	1	3.8
	5	3	11.5
	7	1	3.8
	9	1	3.8
Post-Intervention	0	22	100
Follow-Up	0	21	100

Reduced frequency of carrying matches and lighters also was reported post-intervention and at follow-up by both caregivers and youth. Whereas 69.2% of caregivers reported that their youth carried matches or a lighter within the 12 months prior to completing their pre-intervention visit, this dropped to 4.5% at post-intervention, and at follow-up no caregivers reported this behaviour (see Table 9, and Figures 2 and 3). Youth participants also reported a reduction; whereas 40.7% of youth reported that they carried

matches or a lighter within the 12 months prior to completing their pre-intervention visit, this dropped to 18.2% at post-intervention, and 14.3% at follow-up (see Table 10, and Figures 4-6).

Table 9. *Caregiver Reported Frequency of Carrying Matches or Lighter Over Time for Entire Sample*

Time	Response	Frequency	Percent
Pre-Intervention	Never	8	30.8
	Rarely	8	30.8
	Sometimes	6	23.1
	Often	4	15.4
	Always	0	-
Post-Intervention	Never	21	95.5
	Rarely	1	4.5
	Sometimes	0	-
	Often	0	-
	Always	0	-
Follow-Up	Never	19	100
	Rarely	0	-
	Sometimes	0	-
	Often	0	-
	Always	0	-

Table 10. *Youth Reported Frequency of Carrying Matches or Lighter Over Time for Entire Sample*

Time	Response	Frequency	Percent
Pre-Intervention	Never	16	59.3
	Rarely	6	22.2
	Sometimes	2	7.4
	Often	3	11.1
	Always	0	-
Post-Intervention	Never	18	81.8
	Rarely	1	4.5
	Sometimes	3	13.6
	Often	0	-
	Always	0	-
Follow-Up	Never	18	85.7
	Rarely	0	-
	Sometimes	1	4.8
	Often	1	4.8
	Always	1	4.8

Figure 2. *Caregiver Reported Match/Lighter Carrying Pre-Intervention for Entire Sample*

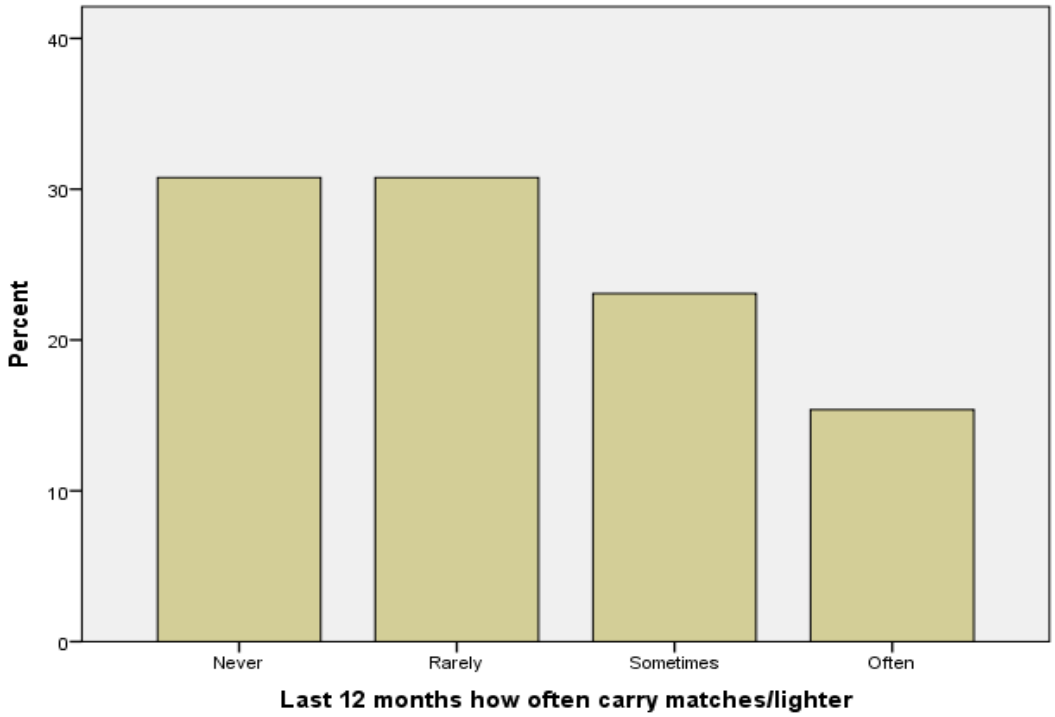


Figure 3. *Caregiver Reported Match/Lighter Carrying Post-Intervention for Entire Sample*

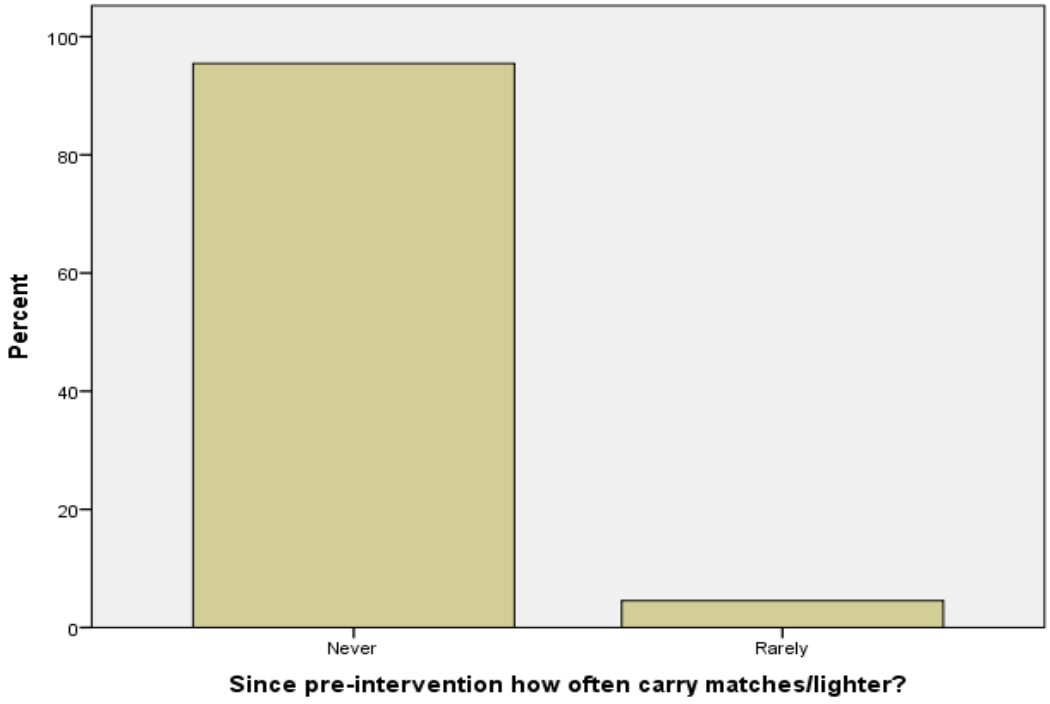


Figure 4. *Youth Reported Match/Lighter Carrying Pre-Intervention for Entire Sample*

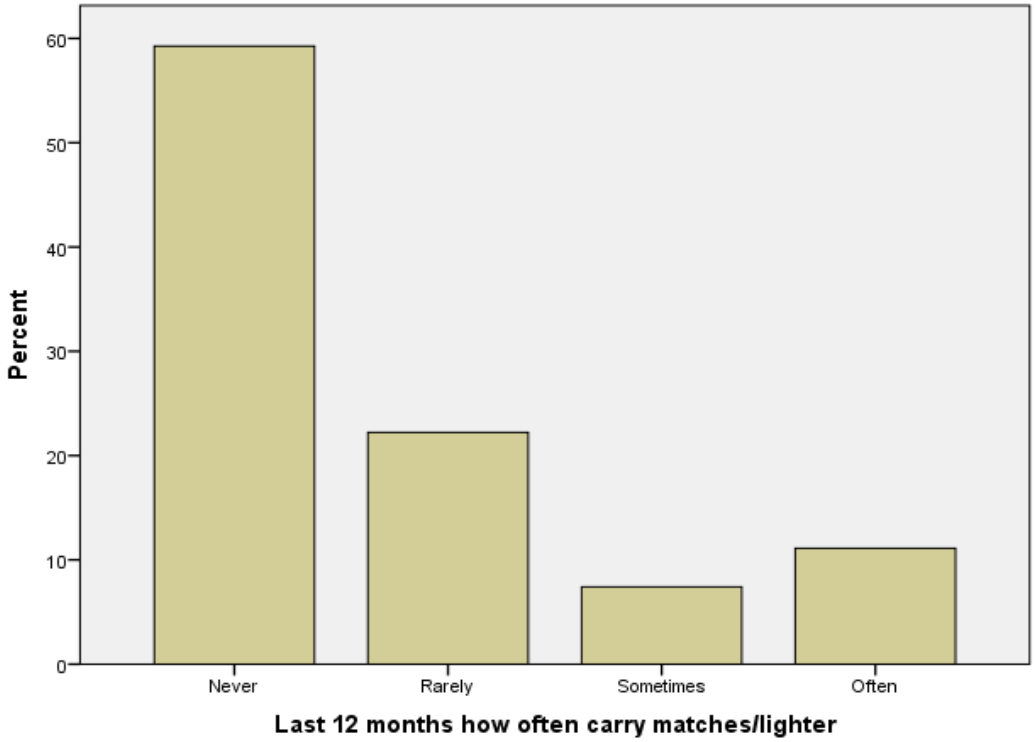


Figure 5. *Youth Reported Match/Lighter Carrying Post-Intervention for Entire Sample*

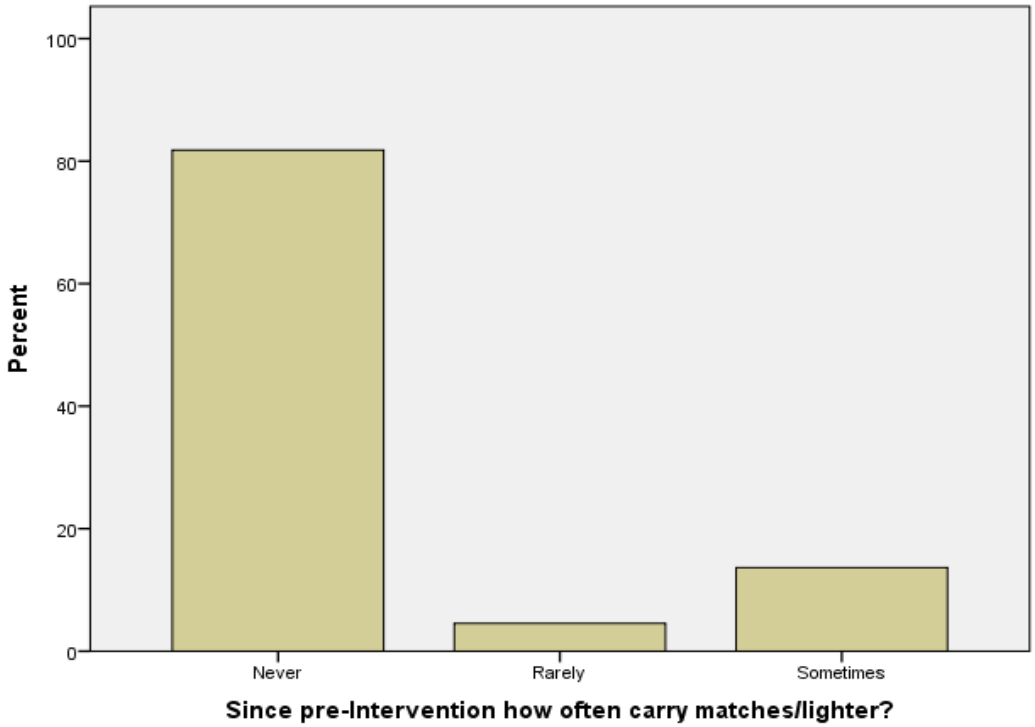
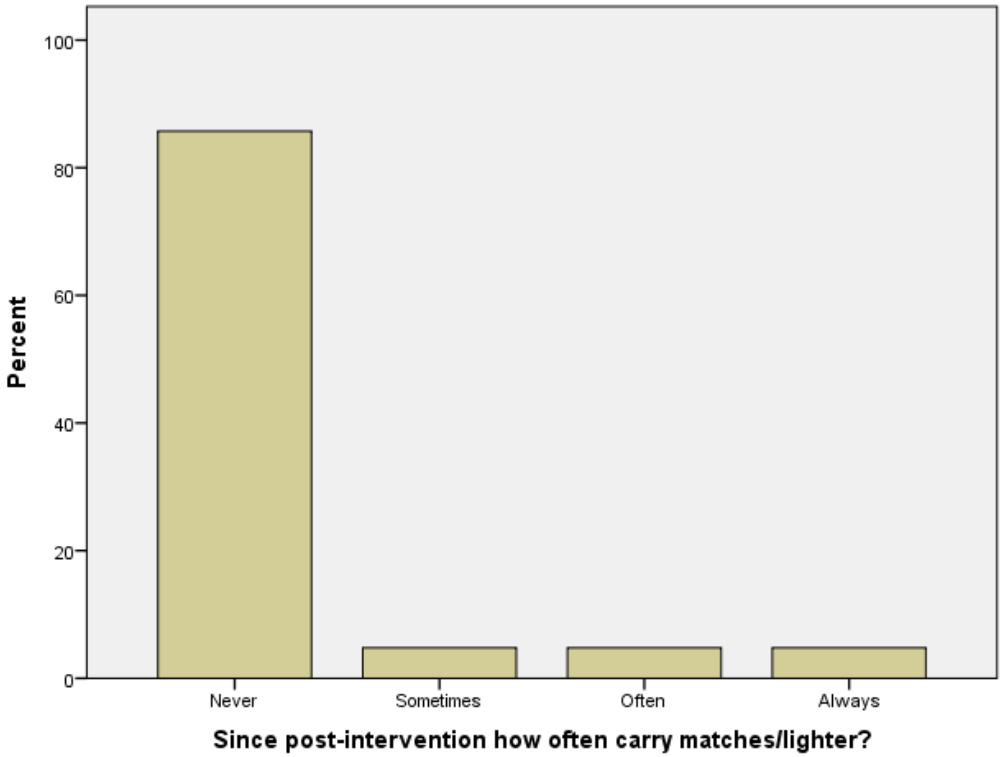


Figure 6. *Youth Reported Match/Lighter Carrying at Follow-Up for Entire Sample*



To investigate the fire interest variables, two mixed ANOVAs were performed, one for the Caregiver Total Fire Interest variable (from the FIQ Parent-Report) and one for the Youth Total Fire Interest variable (from the FIQ Self-Report), to examine within-group differences across the three time points as well as between-group differences post-intervention and at follow-up on these variables. It was anticipated that caregivers and youth in both condition groups would show improvement (i.e., lower scores) in their reported Total Fire Interest scores post-intervention and at follow-up compared with their pre-intervention scores; however, greater improvements were expected for caregivers and youth in modified TAPP-C intervention condition group, compared with caregivers and

youth in the FSE intervention condition group (see Tables 11 and 12 for mean caregiver and youth Total Fire Interest scores over time).

Table 11. *Caregiver Mean Total Fire Interest Scores by Condition Group over Time*

Treatment Group	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	Pre-Intervention	47.45	29.76 — 65.15
	Post-Intervention	22.64	15.53 — 29.74
	Follow-up	16.73	11.66 — 21.79
Fire Safety Education Intervention	Pre-Intervention	36.13	15.38 — 56.87
	Post-Intervention	15.88	7.54 — 24.21
	Follow-up	11.50	5.56 — 17.44

Table 12. *Youth Mean Total Fire Interest Scores by Condition Group over Time*

Treatment Group	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	Pre-Intervention	44.91	28.26 — 61.56
	Post-Intervention	26.09	17.88 — 34.31
	Follow-up	17.91	11.28 — 24.54
Fire Safety Education Intervention	Pre-Intervention	48.00	30.54 — 65.46
	Post-Intervention	23.00	14.39 — 31.62
	Follow-up	22.90	15.95 — 29.86

Median row substitution was used for any missing items on the FIQ questionnaires, to enable calculation of the caregiver and youth Total Fire Interest scores. Data were first tested for estimates of covariance and sphericity. Box`s M Test of Equality of Covariance Matrices and Levene`s Test of Equality of Error Variances both produced non-significant results ($p > .05$), thus the equal variances assumption was not violated for the caregiver or youth Total Fire Interest variables. However, Mauchley`s Test of Sphericity did produce a significant result for both the caregiver ($W[2] = .263$, $p < .001$) and youth ($W[2] = .391$, $p < .001$) Total Fire Interest variables, indicating that the

sphericity assumption was violated for these variables and thus, that the caregiver and youth Total Fire Interest data was skewed.

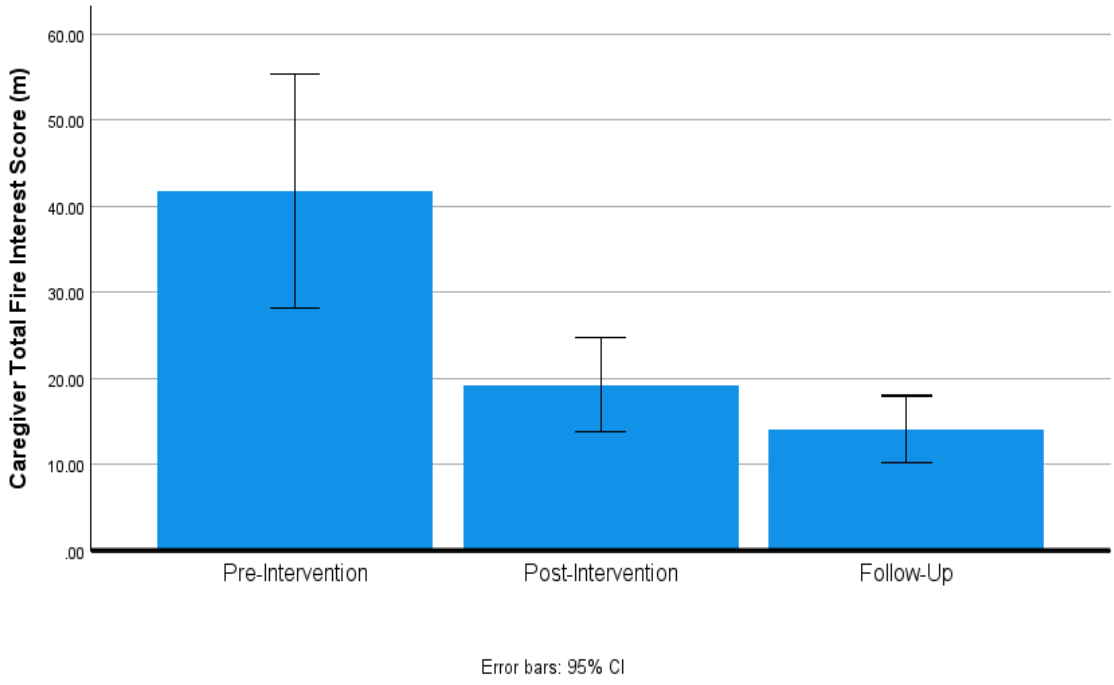
For caregivers, the results of a mixed 3 x 2 ANOVA revealed a significant main effect of Time, $F(1.15, 19.57) = 18.35$, $p < .001$, such that the Caregiver Total Fire Interest scores (i.e., measured fire interest of youth as reported by their caregiver) were significantly different pre-intervention, post-intervention, and at follow-up. Since Mauchley`s Test of Sphericity was violated, the Greenhouse-Geisser correction was used. Partial Eta² effect size ($\eta^2 = .52$) indicated that the main effect of Time was substantial. As predicted, the Caregiver Total Fire Interest scores significantly decreased over time. The pairwise comparisons for the main effect of Time, corrected using a Bonferroni adjustment, indicated that the significant main effect reflected a significant difference between pre-intervention ($M = 42.68$) and post-intervention ($M = 19.79$) Caregiver Total Fire Interest scores ($p = .005$), pre-intervention and follow-up ($M = 14.53$) Caregiver Total Fire Interest scores ($p < .001$), and post-intervention and follow-up Caregiver Total Fire Interest scores ($p = .043$) (see Table 13 for the pairwise comparisons for the Caregiver Total Fire Interest scores over time). There were no significant differences found in the Caregiver Total Fire Interest scores between the two condition groups at post-intervention and follow-up ($p = .223$); regardless of condition group, Caregiver Total Fire Interest scores improved (reflected by a decrease in scores) over time (see Figure 7).

Table 13. *Pairwise Comparisons for Caregiver Total Fire Interest Score Over Time for Entire Sample*

Time		Mean Difference	Standard Error	95% Confidence Interval
Pre-Intervention	Post-Intervention	22.53**	6.02	6.5 — 38.53
	Follow-Up	27.68**	5.57	12.89 — 42.47
Post-Intervention	Pre-Intervention	-22.53**	6.02	-38.53 — -6.54
	Follow-Up	5.14*	1.89	0.13 — 10.16
Follow-Up	Pre-Intervention	-27.68**	5.57	-42.47 — -12.89
	Post-Intervention	-5.14*	1.89	-10.16 — -0.13

* denotes p < .05, for mean difference
** denotes p < .01, for mean difference

Figure 7. *Caregiver Total Fire Interest Over Time for Entire Sample*



For youth, the results of a mixed 3 x 2 ANOVA also revealed a significant main effect of Time, $F(1.24, 23.62) = 22.04$, $p < .001$, such that the Youth Total Fire Interest scores were significantly different pre-intervention, post-intervention, and at follow-up. As Mauchley`s Test of Sphericity was violated, the Greenhouse-Geisser correction was used. Partial Eta² effect size ($\eta^2 = .54$) indicated that the main effect of Time was

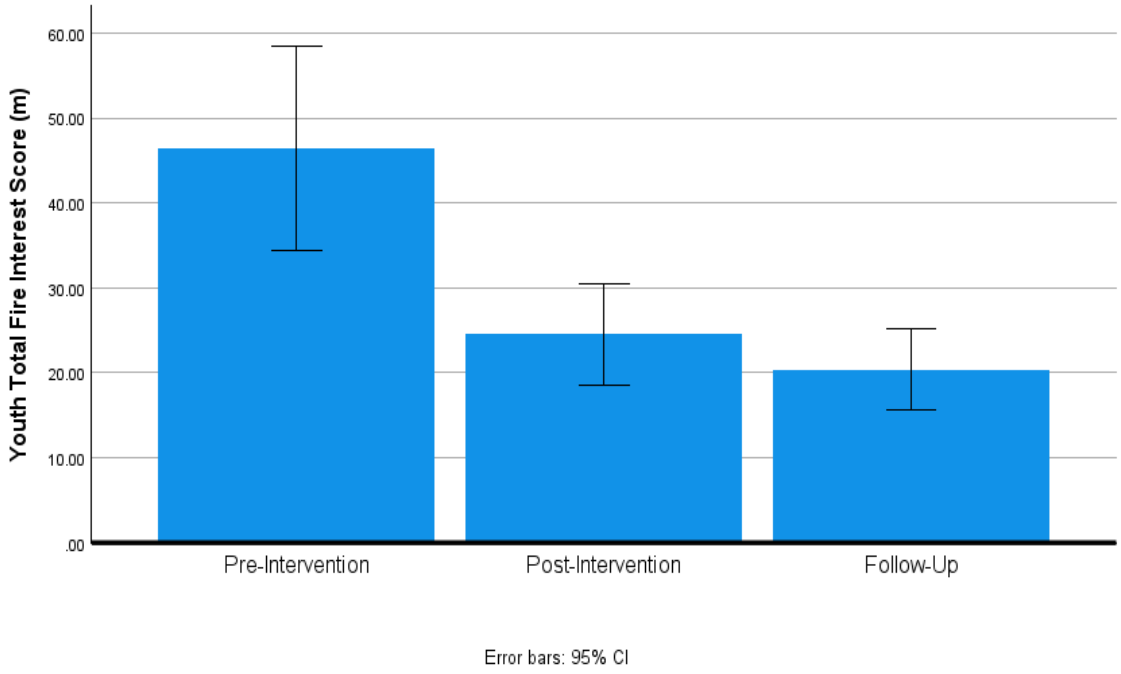
substantial. As predicted, the Youth Total Fire Interest scores significantly decreased over time between pre- and post-intervention; however, there was no significant difference between the scores at post-intervention and follow-up. The pairwise comparisons for the main effect of Time, corrected using a Bonferroni adjustment, indicated that the significant main effect reflected a significant difference between pre-intervention (M = 46.38) and post-intervention (M = 24.62) Youth Total Fire Interest scores ($p < .001$), and pre-intervention and follow-up (M = 20.29) Youth Total Fire Interest scores ($p < .001$). There was no significant difference found between post-intervention and follow-up Youth Total Fire Interest scores ($p = .15$) (see Table 14 for the pairwise comparisons for the Youth Total Fire Interest scores over time). There also were no significant differences found in the Youth Total Fire Interest scores between the two condition groups at post-intervention and follow-up ($p = .791$); regardless of condition group, Youth Total Fire Interest scores improved (reflected by a decrease in scores) between pre- and post-intervention, but showed no significant further improvement at follow-up (see Figure 8).

Table 14. *Pairwise Comparisons for Youth Total Fire Interest Score Over Time for Entire Sample*

Time		Mean Difference	Standard Error	95% Confidence Interval
Pre-Intervention	Post-Intervention	21.91**	4.99	8.81 — 35.00
	Follow-Up	26.05**	4.96	13.04 — 39.06
Post-Intervention	Pre-Intervention	-21.91**	4.99	-35.00 — -8.81
	Follow-Up	4.14	1.98	-1.05 — 9.33
Follow-Up	Pre-Intervention	-26.05**	4.96	-39.06 — -13.04
	Post-Intervention	-4.14	1.98	-9.33 — 1.05

* denotes $p < .05$, for mean difference
** denotes $p < .01$, for mean difference

Figure 8. *Youth Total Fire Interest Over Time for Entire Sample*



Pearson's correlations (Pearson's r) were computed to assess the relationship between the caregiver and youth Total Fire Interest scores at pre-intervention, post-intervention and follow-up. Overall, there was a positive correlation between the caregiver and youth Total Fire Interest scores at pre-intervention ($r = 0.66$, $n = 27$, $p < .01$, two-tailed). Within the condition groups, significant positive correlations were found at pre-intervention between the caregiver and youth Total Fire Interest scores in the modified TAPP-C intervention condition group ($r = 0.92$, $n = 14$, $p < .01$, two-tailed), and at follow-up between the caregiver and youth Total Fire Interest scores in the FSE intervention condition group ($r = 0.76$, $n = 8$, $p < .05$, two-tailed). No other significant correlations were found.

Change scores were calculated to measure the overall change in Total Fire Interest scores for caregivers and youth between pre- and post-intervention, as well as between

post-intervention and follow-up. Pearson's correlations (Pearson's r) were then computed to assess the relationship between the caregiver and youth Total Fire Interest Change scores. Overall, there was a positive correlation between the caregiver and youth Pre/Post Intervention Change scores ($r = 0.56$, $n = 22$, $p < .01$, two-tailed); the caregiver and youth Post/Follow-up Intervention Change scores were not significantly correlated.

Generalized Behavioural Variables

Hypothesis 2

To investigate the generalized behavioural variables, mixed ANOVAs were performed to examine within-group differences across the three time points, as well as between-group differences post-intervention and at follow-up on these variables.

Caregiver-Reported Variables. For caregivers, mixed ANOVAs were performed on the Behavioural Symptoms Index (BSI) score (T-Scores) and on the Externalizing Problems Composite (EPC) score (T-Scores), from the BASC-2 Parent Rating Scales (PRS). It was anticipated that at post-treatment and follow-up (3 months), caregivers in the modified TAPP-C intervention condition group would report, on average, fewer youth emotional and behavioural difficulties (i.e., lower scores), compared with their pre-intervention reports, and compared with the post-treatment and follow-up reports of participants in the FSE condition group (see Tables 15 and 16 for mean BSI T-Scores and mean EPC T-Scores, over time). In the modified TAPP-C intervention condition group, 5 caregivers (35.7%) completed the PRS-Child Form (PRS-C; ages 6-11) and 9 caregivers (64.3%) completed the PRS-Adolescent Form (PRS-A; ages 12-21) at pre-intervention; all youth in this condition group met age criteria for the same versions of the forms to be administered at post-intervention and follow-up data

collection time points. In the FSE condition group, 4 caregivers (30.8%) completed the PRS-C and 9 caregivers (69.2%) completed the PRS-A at pre-intervention; all youth in this condition group met age criteria for the same versions of the forms to be administered at post-intervention and follow-up data collection time points.

Table 15. *BASC-2 SRP Mean Behavioural Symptoms Index (BSI) T-Scores by Condition Group over Time*

Treatment Group	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	Pre-Intervention	63.82	56.60 — 71.03
	Post-Intervention	58.00	51.06 — 64.94
	Follow-up	56.09	48.84 — 63.35
Fire Safety Education Intervention	Pre-Intervention	65.88	57.42 — 74.34
	Post-Intervention	58.88	50.73 — 67.02
	Follow-up	56.50	47.99 — 65.01

Table 16. *BASC-2 SRP Mean Externalizing Problems Composite (EPC) T-Scores by Condition Group over Time*

Treatment Group	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	Pre-Intervention	66.91	58.79 — 75.03
	Post-Intervention	59.82	51.42 — 68.22
	Follow-up	57.91	49.04 — 66.78
Fire Safety Education Intervention	Pre-Intervention	69.75	60.23 — 79.27
	Post-Intervention	59.25	49.40 — 69.10
	Follow-up	57.75	47.35 — 68.15

Caregiver data were first tested for estimates of covariance and sphericity. Box`s M Test of Equality of Covariance Matrices and Levene`s Test of Equality of Error Variances both produced non-significant results ($p > .05$); thus, the equal variances assumption was not violated for the BSI or EPC variables. Mauchley`s Test of Sphericity also produced a non-significant result ($p > .05$) for both the BSI and EPC variables; thus, the sphericity assumption was not violated for these variables.

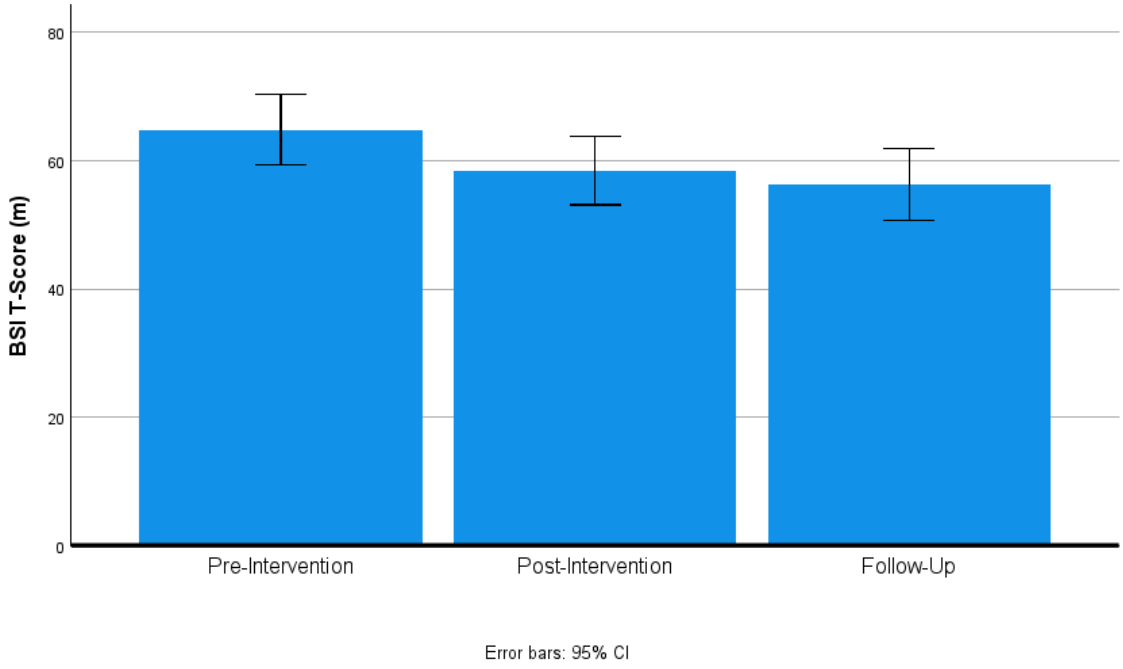
For the BSI scores, the results of a mixed 3 x 2 ANOVA revealed a significant main effect of Time, $F(2, 34) = 18.37$, $p < .001$, such that the BSI scores were significantly different pre-intervention, post-intervention, and at follow-up. Partial Eta^2 effect size ($\eta^2 = .52$) indicated that the main effect of Time was substantial. As predicted, the BSI scores significantly decreased over time. The pairwise comparisons for the main effect of Time, corrected using a Bonferroni adjustment, indicated that the significant main effect reflected a significant difference between pre-intervention (M = 64.68) and post-intervention (M = 58.37) BSI scores ($p < .001$), and pre-intervention and follow-up (M = 56.26) BSI scores ($p < .001$) (see Table 17 for the pairwise comparisons for the BSI scores over time). No significant difference was found between post-intervention and follow-up BSI scores ($p = .565$) (see Table 17). There also were no significant differences found in the BSI scores between the two condition groups at post-intervention and follow-up ($p = .824$); regardless of condition group, BSI scores improved (reflected by a decrease in scores) between pre- and post-intervention, but showed no significant further improvement at follow-up, suggesting that these improvements were maintained at follow-up (see Figure 9).

Table 17. *Pairwise Comparisons for BASC-2 PRS Behavioural Symptoms Index (BSI) T-Scores Over Time for Entire Sample*

Time		Mean Difference	Standard Error	95% Confidence Interval
Pre-Intervention	Post-Intervention	6.41**	1.31	2.94 — 9.88
	Follow-Up	8.55**	1.52	4.51 — 12.59
Post-Intervention	Pre-Intervention	-6.41**	1.31	-9.88 — -2.94
	Follow-Up	2.14	1.56	-2.01 — 6.29
Follow-Up	Pre-Intervention	-8.55**	1.52	-12.59 — -4.51
	Post-Intervention	-2.14	1.56	-6.29 — 2.01

** denotes $p < .01$, for mean difference

Figure 9. *BASC-2 PRS Mean Behavioural Symptoms Index (BSI) T-Scores Over Time for Entire Sample*



For the EPC scores, the results of a mixed 3 x 2 ANOVA revealed a significant main effect of Time, $F(2, 34) = 13.25$, $p < .001$, such that the EPC scores were significantly different pre-intervention, post-intervention, and at follow-up. Partial Eta^2 effect size ($\eta^2 = .44$) indicated that the main effect of Time was substantial. As predicted, the EPC scores significantly decreased over time. The pairwise comparisons for the main effect of Time, corrected using a Bonferroni adjustment, indicated that the significant main effect reflected a significant difference between pre-intervention ($M = 68.11$) and post-intervention ($M = 59.58$) EPC scores ($p = .002$), and pre-intervention and follow-up ($M = 57.84$) EPC scores ($p = .002$) (see Table 18 for the pairwise comparisons for the EPC scores over time). No significant difference was found between post-intervention and follow-up EPC scores ($p = 1.00$) (see Table 18). There also were no significant differences found in the EPC scores between the two condition groups at post-

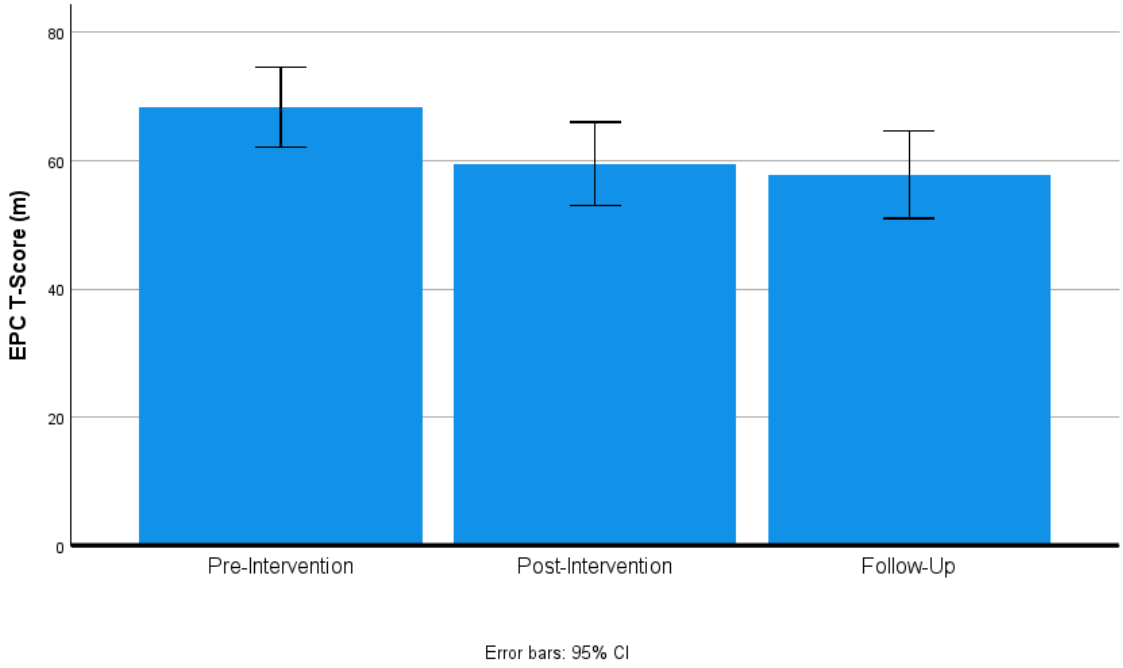
intervention and follow-up (p = .902); regardless of condition group, EPC scores improved (reflected by a decrease in scores) between pre- and post-intervention, but showed no significant further improvement at follow-up, suggesting that these improvements were maintained at follow-up (see Figure 10).

Table 18. *Pairwise Comparisons for BASC-2 PRS Externalizing Problems Composite (EPC) T-Scores Over Time for Entire Sample*

Time		Mean Difference	Standard Error	95% Confidence Interval
Pre-Intervention	Post-Intervention	8.80**	2.08	3.27 — 14.32
	Follow-Up	10.50**	2.59	3.64 — 17.36
Post-Intervention	Pre-Intervention	-8.80**	2.08	-14.32 — -3.27
	Follow-Up	1.71	1.83	-3.16 — 6.57
Follow-Up	Pre-Intervention	-10.50**	2.59	-17.36 — -3.64
	Post-Intervention	-1.71	1.83	-6.57 — 3.16

** denotes p < .01, for mean difference

Figure 10. *BASC-2 PRS Mean Externalizing Problems Composite (EPC) T-Scores Over Time for Entire Sample*



Youth-Reported Variables. For youth, mixed ANOVAs were performed on the Emotional Symptoms Index (ESI) score (T-Scores) and on the Inattention/Hyperactivity Composite (IHC) score (T-Scores), from the BASC-2 Self-Report of Personality (SRP). It was anticipated that at post-treatment and follow-up (3 months), youth in the modified TAPP-C intervention condition group would report, on average, fewer youth emotional and behavioural difficulties (i.e., lower scores), compared with their pre-intervention reports, and compared with the post-treatment and follow-up reports of participants in the FSE condition group (see Tables 19 and 20 for mean ESI T-Scores and mean IHC T-Scores, over time). In the modified TAPP-C intervention condition group, 2 youth (14.3%) completed the SRP-Interview Form (SRP-I; ages 6-7), 3 youth (21.4%) completed the SRP-Child Form (SRP-C; ages 8-11), and 9 youth (64.3%) completed the SRP-Adolescent Form (SRP-A; ages 12-16) at pre-intervention; all youth in this condition group met age criteria for the same versions of the forms to be administered at post-intervention and follow-up data collection time points. In the FSE condition group, 1 youth (7.7%) completed the SRP-I, 3 youth (23.1%) completed the SRP-C, and 8 youth (61.5%) completed the SRP-A at pre-intervention; all youth in this condition group met age criteria for the same versions of the forms to be administered at post-intervention and follow-up data collection time points.

Youth data were first tested for estimates of covariance and sphericity. Box`s M Test of Equality of Covariance Matrices produced a significant result for the ESI data (Box's $M[6,2018.60] = 19.59$, $p < .05$). Levene`s Test of Equality of Error Variances also produced a significant result for the ESI post-intervention data ($F[1,17] = 4.81$, $p < .05$); non-significant results were produced for the ESI pre-intervention and follow-up data (p

> .05). Thus, the equal variances assumption was violated in these cases. Box`s M Test of Equality of Covariance Matrices and Levene`s Test of Equality of Error Variances produced non-significant results for the IHC data ($p > .05$). Mauchley`s Test of Sphericity produced a non-significant result ($p > .05$) for both the ESI and IHC variables; thus, the sphericity assumption was not violated for these variables.

For ESI scores, the results of a mixed 3 x 2 ANOVA revealed a significant main effect of Time, $F(2, 34) = 4.29$, $p = .022$, such that the ESI scores were significantly different pre-intervention, post-intervention, and at follow-up. Partial Eta² effect size ($\eta^2 = .20$) indicated that the main effect of Time was substantial. As predicted, the ESI scores showed a significant decrease over time. The pairwise comparisons for the main effect of Time, corrected using a Bonferroni adjustment, indicated that the significant main effect reflected a significant difference between pre-intervention ($M = 49.53$) and post-intervention ($M = 46.05$) ESI scores ($p = .047$) (see Table 21 for the pairwise comparisons for the ESI scores over time). No significant differences were found between pre-intervention and follow-up ($M = 46.37$) ESI scores ($p = .187$), or between post-intervention and follow-up ESI scores ($p = 1.00$) (see Table 21). There also were no significant differences found in the ESI scores between the two condition groups at post-intervention and follow-up ($p = .215$). All youth, regardless of condition group, showed significantly improved ESI scores (reflected by a decrease in scores) at post-intervention compared with their pre-intervention scores. The ESI scores did not show significant improvements at follow-up compared to pre-intervention scores, suggesting that a significant improvement was not maintained at follow-up (see Figure 11).

Table 19. *BASC-2 SRP Mean Emotional Symptoms Index (ESI) T-Scores Scores by Condition Group over Time*

Treatment Group	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	Pre-Intervention	50.40	42.83 — 57.97
	Post-Intervention	49.60	43.77 — 55.43
	Follow-up	50.10	43.02 — 57.18
Fire Safety Education Intervention	Pre-Intervention	48.56	40.57 — 56.54
	Post-Intervention	42.11	35.97 — 48.26
	Follow-up	42.22	34.76 — 49.69

Table 20. *BASC-2 SRP Mean Inattention/Hyperactivity Composite (IHC) T-Scores by Condition Group over Time*

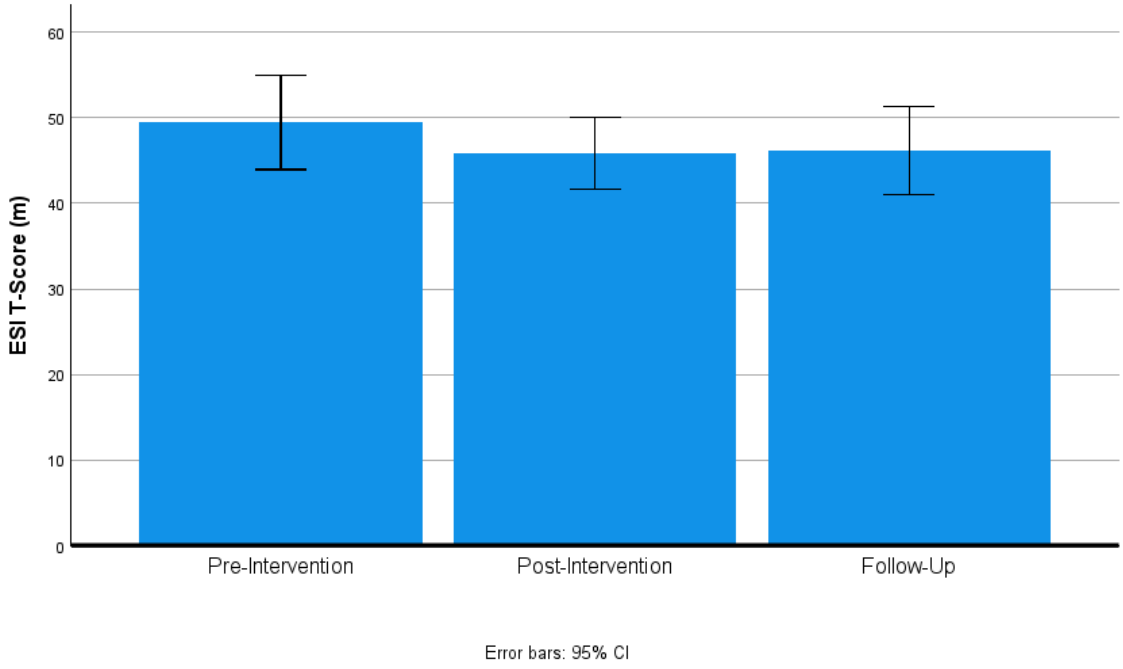
Treatment Group	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	Pre-Intervention	59.88	53.15 — 66.60
	Post-Intervention	55.88	48.70 — 63.05
	Follow-up	55.13	45.61 — 64.64
Fire Safety Education Intervention	Pre-Intervention	54.25	47.52 — 60.98
	Post-Intervention	47.50	40.33 — 54.67
	Follow-up	46.88	37.36 — 56.39

Table 21. *Pairwise Comparisons for BASC-2 SRP Emotional Symptoms Index (ESI) T-Scores Over Time for Entire Sample*

Time		Mean Difference	Standard Error	95% Confidence Interval
Pre-Intervention	Post-Intervention	3.62*	1.35	0.04 — 7.20
	Follow-Up	3.32	1.66	-1.10 — 7.73
Post-Intervention	Pre-Intervention	-3.62*	1.35	-7.20 — -0.04
	Follow-Up	-0.31	1.03	-3.04 — 2.43
Follow-Up	Pre-Intervention	-3.32	1.66	-7.73 — 1.10
	Post-Intervention	0.31	1.03	-2.43 — 3.04

* denotes $p < .05$, for mean difference

Figure 11. *BASC-2 SRP Mean Emotional Symptoms Index (ESI) T-Scores Over Time for Entire Sample*



For the IHC T-Scores, the results of a mixed 3 x 2 ANOVA were non-significant ($p > .05$). The main effect of Time revealed a trend in the expected direction, as it approached significance, $F(2, 28) = 3.25$, $p = .054$, although all pairwise comparisons produced non-significant results ($p > .05$). Thus, the IHC scores were not significantly different between pre-intervention ($M = 57.06$), post-intervention ($M = 51.69$), and follow-up ($M = 51.00$). There also were no significant differences found in the IHC scores between the two condition groups at post-intervention and follow-up ($p = .103$). Contrary to predictions, the IHC scores did not show statistically significant improvements (reflected by a decrease in scores) over time, nor did they significantly differ between the two condition groups at post-intervention or follow-up; however,

results did show that scores trended in the expected direction and approached a statistically significant improvement, with mean scores showing a decrease over time.

Parenting Variables

To investigate the parenting variables, descriptive statistics were used to measure the caregivers' parental locus of control (PLOC) and parental self-efficacy, as well as to determine if caregivers reported problematic perceptions of the child/adolescent-caregiver relationship (i.e., hypothesis 3a), all at pre-intervention. Additionally, correlations were calculated to examine the relationship both among these parenting variables (i.e., hypothesis 3b) at pre-intervention, as well as between them and the youth fire-specific and generalized behavioural variables at pre-intervention (i.e., hypothesis 3c). Finally, mixed ANOVAs were performed to examine within-group differences on the caregiver PLOC and parental self-efficacy variables across the three time points, as well as between-group differences post-intervention and at follow-up on these variables (i.e., hypothesis 3d).

For caregivers, mean, standard deviation and range were calculated for pre-intervention data for the Total PLOC Score and the 5 Subscale Scores (i.e., parental efficacy, parental responsibility, child control over parent's life, parental belief in fate/chance, and parental control of child's behaviour) from the Parental Locus of Control Scale (PLOC), for the Total PSOC Score and the Efficacy and Satisfaction Factor Scores from the Parenting Sense of Competence Scale (PSOC), and for the 7 Scale Scores (T-Scores) from the Parenting Relationship Questionnaire- Child/Adolescent (PRQ-CA) (i.e., Attachment, Communication, Discipline Practices, Involvement, Parenting

Confidence, Satisfaction With School, and Relational Frustration). The descriptive data for the caregiver parenting variables at pre-intervention is presented in Table 22.

Table 22. *Descriptive Statistics for Caregiver Parenting Variables at Pre-Intervention for Entire Sample*

Measure	Variable	N	Mean	SD	Range
PLOC	Total PLOC Score	23	124.39	16.41	97 - 159
	Parental Efficacy Scale	23	22.96	4.53	15 - 32
	Parental Responsibility Scale	23	29.91	3.46	21 - 37
	Child Control Over Parent's Life Scale	23	15.57	3.65	10 - 22
	Parental Belief in Fate/Chance Scale	23	27.70	4.84	18 - 36
	Parental Control of Child's Behaviour Scale	23	28.26	8.31	14 - 48
PSOC	Total PSOC Score	22	64.77	9.12	47 - 83
	Efficacy Factor Score	24	29.38	5.07	20 - 40
	Satisfaction Factor Score	22	35.00	6.94	19 - 49
PRQ-CA	Attachment T-Score	25	41.00	7.94	24 - 55
	Communication T-Score	25	37.44*	12.55	14 - 60
	Discipline Practices T-Score	25	42.92	11.23	24 - 64
	Involvement T-Score	25	46.52	12.08	24 - 79
	Parenting Confidence T-Score	25	40.72*	9.39	22 - 57
	Satisfaction With School T-Score	25	46.48	14.41	13 - 67
	Relational Frustration T-Score	25	60.36*	13.88	40 - 86

PLOC = Parental Locus of Control Scale; PSOC = Parenting Sense of Competence Scale; PRQ-CA = Parenting Relationship Questionnaire- Child/Adolescent; * = elevated T-score

Although normative data is not available for the PLOC Scale, subscale means are reported by the PLOC measure developers for a group of 60 parents who did not report difficulties in their parenting role (Group A), and a group of 45 parents who requested counselling services for parenting difficulties (Group B) (Campis, Lyman, & Prentice-Dunn, 1986). Table 23 presents the significantly different subscale means for Groups A and B as reported by developers of the PLOC measure, along with the PLOC subscale means of caregivers in the present study at pre-intervention. While statistical comparisons cannot be made in comparing the means of caregivers in the present study to Groups A and B, these results show that caregivers in the present study reported means that were

higher (suggesting a more external locus of control) than Group A, with the exception of the Parental Responsibility subscale where the mean was marginally higher for Group A. The means were also higher (suggesting a more external locus of control) for caregivers in the present study when compared to Group B on the parental efficacy and fate/chance subscales. Although statistical comparisons were not conducted between the current study sample and these other parent groups, these results nonetheless suggest that the caregivers of fire-involved youth might have a more external locus of control compared with a group of parents reporting no difficulties on many dimensions related to the concept of parental locus of control, as well as a more external locus of control compared with a group of parents reporting parenting difficulties, specifically in terms of how effective they feel in their parenting role and in their belief that parenting and child behaviour is influenced by external factors such as fate or chance.

Table 23. *Mean Scores on the PLOC Subscales of the Study Sample at Pre-Intervention Compared with Experimental Norms**

PLOC Subscale	Parent Group A: No Parenting Difficulties	Parent Group B: Parenting Difficulties	Caregivers of Fire-Involved Youth: Present Study
Parental Efficacy	17.62	19.27	22.96
Parental Responsibility	30.43	32.60	29.91
Child Control	14.37	16.29	15.57
Fate/Chance	21.55	22.51	27.70
Parental Control	26.63	31.44	28.26

PLOC = Parental Locus of Control Scale
*Experimental norms for Parent Groups A and B are from Campis, Lyman, and Prentice-Dunn (1986)

Hypothesis 3a

Mean T-Scores were calculated to investigate if caregivers reported problematic perceptions of the child/adolescent-caregiver relationship at pre-intervention (N = 25).

On the PRQ-CA, it was anticipated that at pre-intervention, caregivers would have high T-scores (≥60) on the Relational Frustration Scale (indicating a relatively high level of parental frustration) as well as low T-Scores (≤40) on the remaining 6 PRQ-CA scales (all indicating relationship problems). Mean T-Scores for caregivers fell in the problematic range for 3 of the 7 PRQ-CA scales. Consistent with expectations, the mean T-score for caregivers on the Relational Frustration Scale fell within the high range (M = 60.36), indicating that caregivers reported a high level of stress/distress in relating to and controlling their youth's behaviour, as well as a tendency to be overreactive and frustrated in common parenting situations. The mean T-score for caregivers on the Communication Scale fell within the low range (M = 37.44) as expected, indicating that caregivers reported difficulties regarding the quality of information exchanged with their youth as well as the parent's listening skills, which promote trust in the relationship. Finally, the mean T-score for caregivers on the Parenting Confidence Scale also fell within the low range (M = 40.72) as expected, indicating that caregivers reported difficulties regarding their comfort, control and confidence in their parental role and making parenting decisions. Contrary to expectations, the mean T-Scores for caregivers for the remaining scales all fell within the normal range of functioning. Table 24 presents the frequencies and percentages of caregiver T-Scores on the PRQ-CA that fell within the normal range (T-Scores ≥ 41; T-Score ≤ 59, for Relational Frustration Scale), problematic range (T-Scores 31- 40; T-Score 60-69, for Relational Frustration Scale) and significantly problematic range (T-Scores ≤ 30; T-Score ≥ 70, for Relational Frustration Scale) at pre-intervention. Of note, almost half (48%) of the caregivers reported that attachment, as well as parenting confidence, was either problematic or significantly

problematic in their relationship with their youth, and a majority (52%) reported that implementing discipline practices with their youth was either problematic or significantly problematic. A majority (68%) of caregivers additionally reported that communication was either problematic or significantly problematic with their youth. Only 28% of caregivers reported problems or significant problems with their level of involvement with their youth. Slightly more than a third (36%) of caregivers reported problems or significant problems with relational frustration, as well as with their level of satisfaction that their youth's school is meeting the youth's needs.

Table 24. *Frequencies and Percentages of Caregiver T-Scores on the PRQ-CA by Range at Pre-Intervention for Entire Sample*

PRQ-CA Scale T-Scores	Normal Range	Problematic Range	Significantly Problematic Range
Attachment (N/%)	13/52.0	9/36.0	3/12.0
Communication (N/%)	8/32.0	10/40.0	7/28.0
Discipline Practices (N/%)	12/48.0	9/36.0	4/16.0
Involvement (N/%)	18/72.0	5/20.0	2/8.0
Parenting Confidence (N/%)	13/52.0	9/36.0	3/12.0
Satisfaction With School (N/%)	16/64.0	4/16.0	5/20.0
Relational Frustration (N/%)	16/64.0	2/8.0	7/28.0

PRQ-CA = Parenting Relationship Questionnaire- Child/Adolescent

Hypothesis 3b

Pearson's correlations (Pearson's r) were computed to assess the relationship between the PLOC Total Score, PSOC Total Score, and PRQ-CA Scale Score variables at pre-intervention. Specifically, it was anticipated that a higher PLOC Total Score (suggesting a more external locus of control) would be associated (i.e., a negative correlation) with a lower PSOC Total Score (suggesting poorer parental self-efficacy), and associated with more negative perceptions of the child/adolescent-caregiver

relationship on the PRQ-CA (i.e., lower scores on all the scale scores [a negative correlation], with the exception of higher scores on the Relational Frustration Scale [a positive correlation]), and vice versa. It also was anticipated that a lower PSOC Total Score would be associated (i.e., a positive correlation) with lower scores on the parenting confidence subscale of the PRQ-CA, and vice versa.

The PLOC Total Score, PSOC Total Score, and PRQ-CA Scale Score variables at pre-intervention were first tested for the assumptions of the Pearson's r correlation, which were all met. Descriptive statistics for skewness fell within the acceptable range, between -1.0 and +1.0 (Mishra, Pandey, Singh, Gupta, Sahu, & Keshri, 2019), for the PLOC Total Score, PSOC Total Score, and PRQ-CA Scale Scores; thus, the data was not highly skewed. The Shapiro-Wilk test of normality produced a non-significant result ($p > .05$) for these variables; thus, the assumption of normality was not violated. Boxplots of these variables revealed 1 outlier in the PRQ-CA Attachment Scale T-Score data, and 1 outlier in the PRQ-CA Involvement Scale T-Score data; as these outliers represent natural variation in the sample, they were included in subsequent analyses.

The Pearson's correlation results were partially consistent with expectations. As expected, at pre-intervention there was a large negative correlation between the PLOC Total Score and the PSOC Total Score ($r = -.58$, $n = 20$, $p < .01$, two-tailed). Large negative correlations were additionally found at pre-intervention between the PLOC Total Score and the PRQ-CA Attachment Scale T-Score ($r = -.65$, $n = 23$, $p < .01$, two-tailed), the PRQ-CA Communication Scale T-Score ($r = -.60$, $n = 23$, $p < .01$, two-tailed), and the PRQ-CA Parenting Confidence Scale T-Score ($r = -.71$, $n = 23$, $p < .01$, two-tailed). A medium positive correlation was found between the PLOC Total Score and

PRQ-CA Relational Frustration Scale T-Score ($r = .49$, $n = 23$, $p < .05$, two-tailed). Contrary to expectations, significant correlations were not found between the PLOC Total Score and the remaining 3 PRQ-CA Scale T-Scores; however, the direction of these correlations was as expected (i.e., a negative relationship). Finally, as expected a large positive correlation was found between the PSOC Total Score and the PRQ-CA Parenting Confidence Scale T-Score ($r = .54$, $n = 22$, $p < .01$, two-tailed). Table 25 presents the Pearson's correlations results for the parenting variables at pre-intervention.

Table 25. *Pearson's Correlations for the Parenting Variables at Pre-Intervention for Entire Sample*

Variables	1	2	3	4	5	6	7	8	9
1. PLOC Total	--								
2. PSOC Total	-.58**	--							
3. PRQ Attachment	-.65**	.39	--						
4. PRQ Communicat.	-.60**	.25	.59**	--					
5. PRQ Discipline	-.23	-.29	.29	.36	--				
6. PRQ Involvement	-.38	.01	.21	.58**	.19	--			
7. PRQ Parent Confidence	-.71**	.54**	.62**	.47**	.20	.17	--		
8. PRQ Satisfaction School	-.18	.13	.30	.07	.28	-.15	.47*	--	
9. PRQ Relational Frustration	.49*	-.41	-.22	-.22	.29	-.05	-.51**	-.07	--

PLOC = Parental Locus of Control Scale; PSOC = Parenting Sense of Competence Scale; PRQ = Parenting Relationship Questionnaire- Child/Adolescent
** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Hypothesis 3c

Pearson's (Pearson's r) correlations were planned to assess the relationship between the parenting variables and the youth- and caregiver-reported fire-specific and generalized behavioural variables at pre-intervention. It was anticipated that a more external locus of control, lower levels of parental self-efficacy, and a more negatively perceived child/adolescent-caregiver relationship, would be associated with greater youth- and caregiver-reported fire-specific and generalized behavioural difficulties, and vice versa (i.e., a more internal locus of control, higher parental self-efficacy, and a more positively perceived child/adolescent-caregiver relationship would be associated with fewer fire-specific and generalized behavioural difficulties). Specifically, it was anticipated that a higher PLOC Total Score (suggesting a more external locus of control), a lower PSOC Total Score (suggesting lower levels of parental self-efficacy), and lower PRQ-CA Scale T-Scores (suggesting a more negatively perceived child/adolescent-caregiver relationship, with the exception of a higher score on the Relational Frustration Scale indicating a more negative perception), would be associated with higher caregiver and youth FIQ Total Scores (reflecting greater interest in, or curiosity about, fire and fire-related materials), higher caregiver- and youth-reported frequency of unsanctioned firesetting (number of times youth engaged in unsanctioned firesetting in the 12 months prior to pre-intervention visit), and higher T-Scores (i.e., a T-Score between 60-69 is an elevated score indicating higher levels of maladaptive behaviours; a T-Score of 70 or more represents an abnormally elevated score that is clinically significant) on the BASC-2 variables (including the Emotional Symptoms Index [ESI] and Inattention/Hyperactivity Composite [IHC] T-Scores from the Self Report of Personality

[SRP], and the Behavioural Symptoms Index [BSI] and Externalizing Problems Composite [EPC] T-Scores from the Parent Rating Scales [PRS]), and vice versa.

The fire-specific variables at pre-intervention, including the caregiver and youth FIQ Total Scores, and caregiver- and youth-reported frequency of unsanctioned firesetting, were first tested for the assumptions of the Pearson's r correlation. Descriptive statistics for skewness fell within the acceptable range (i.e., between -1.0 and +1.0) for the caregiver and youth FIQ Total Scores; thus, this data was not highly skewed. However, descriptive statistics for skewness fell outside of the acceptable range for the caregiver-reported (Skewness = 4.47) and youth-reported (Skewness = 1.65) frequency of unsanctioned firesetting variables; thus the data was highly positively skewed for these variables. The Shapiro-Wilk test of normality produced significant results for both the caregiver-reported ($W = .44$, $p < .001$) and youth-reported ($W = .74$, $p < .001$) frequency of unsanctioned firesetting variables, as well as the caregiver FIQ Total Score ($W = .91$, $p < .05$); thus, the distribution of these variables departed significantly from normality and the assumption of normality was therefore violated. Boxplots of these variables additionally revealed 1 outlier in the caregiver-reported frequency of unsanctioned firesetting variable data, and 2 outliers in the youth-reported frequency of unsanctioned firesetting variable data. The Shapiro-Wilk test of normality produced a non-significant result ($p > .05$) for the youth FIQ Total Score variable. This outcome, as well as visual examination of the histogram and the QQ plot for this variable, provided no evidence of non-normality; thus, a Pearson's correlation was calculated using this variable. Given that the assumptions for Pearson's r correlations were not met for the caregiver-reported and youth-reported frequency of unsanctioned firesetting variables, as well as the caregiver

FIQ Total Score variable, with extreme non-normality found for these variables, correlations were not calculated. Figures 12, 13 and 14 present histograms summarizing the distribution and descriptive statistics for these variables.

Figure 12. *Caregiver-Reported Firesetting Frequency at Pre-Intervention for Entire Sample*

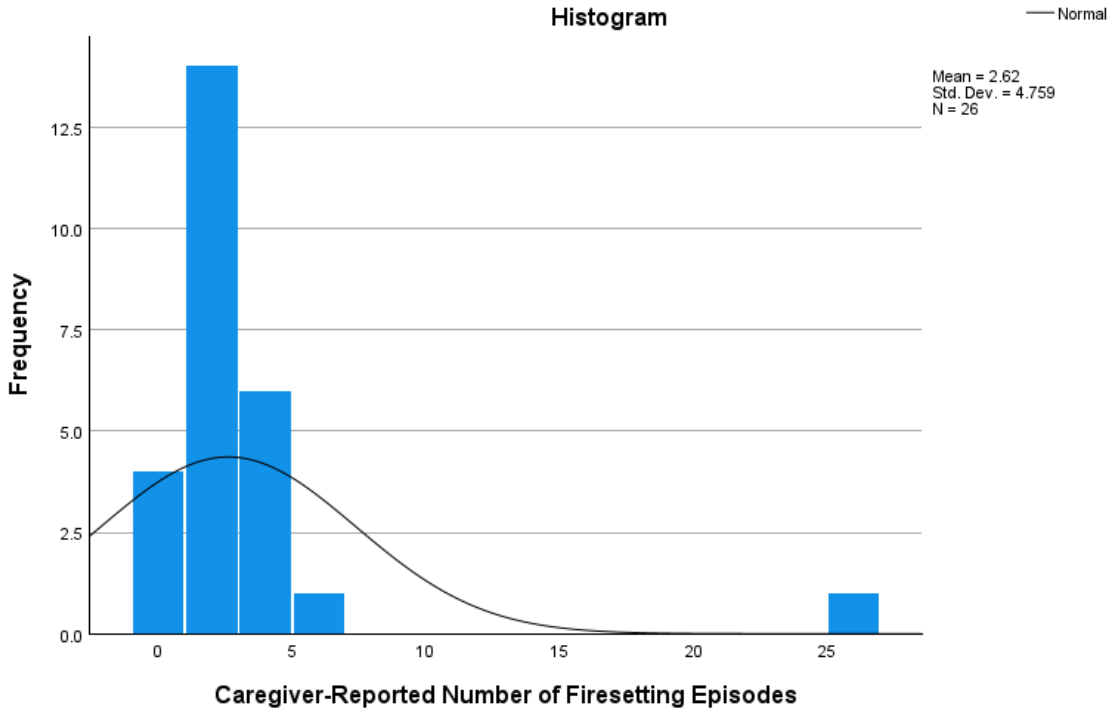


Figure 13. *Youth-Reported Firesetting Frequency at Pre-Intervention for Entire Sample*

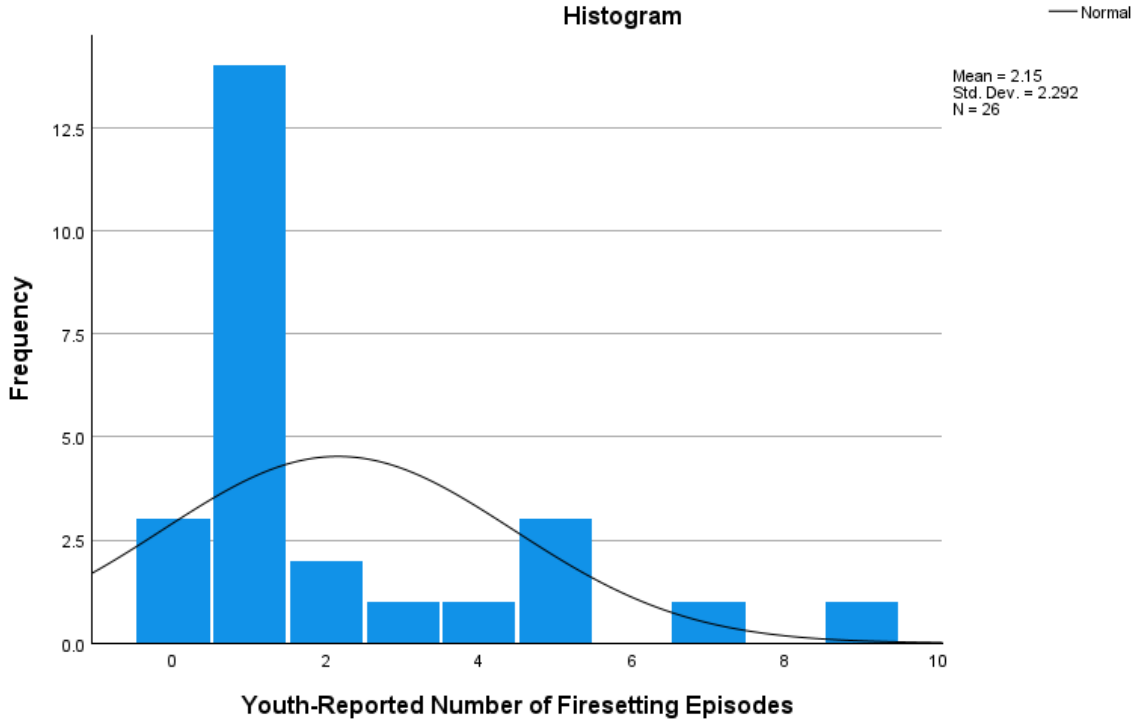
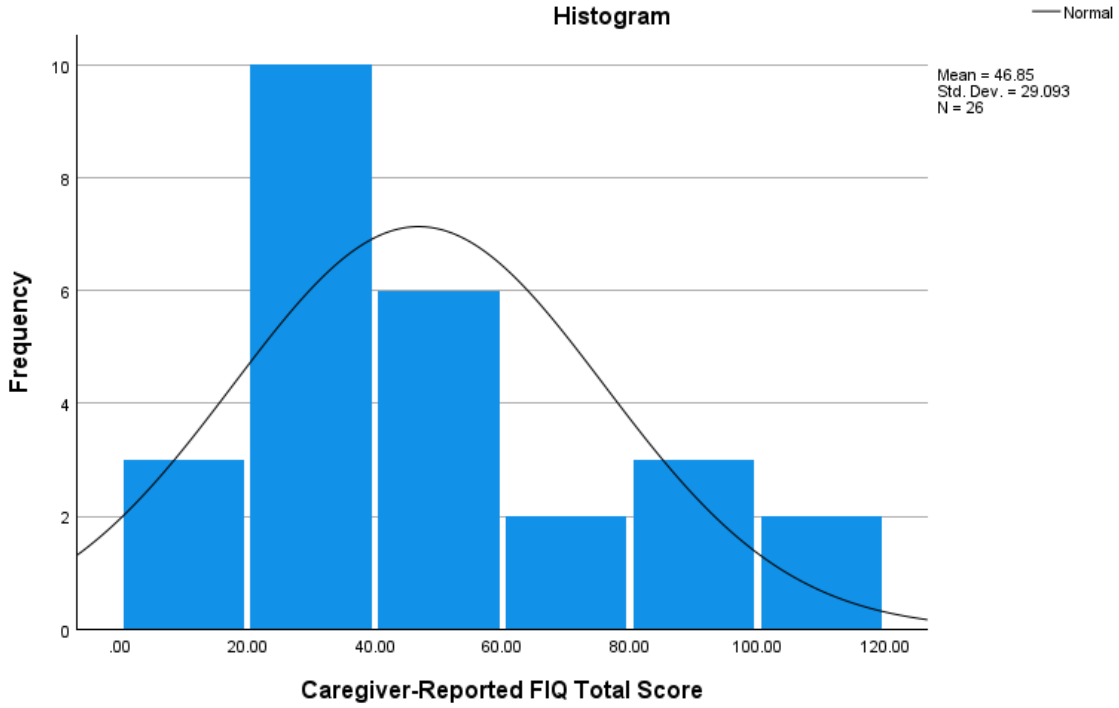


Figure 14. *Caregiver-Reported Fire Interest at Pre-Intervention for Entire Sample*



The generalized behavioural variables at pre-intervention, including the BASC-2 ESI and IHC T-Scores (both youth-reported), and the BSI and EPC T-Scores (both caregiver-reported), were also first tested for the assumptions of the Pearson's r correlation. Descriptive statistics for skewness fell within the acceptable range for all of these variables; thus, this data was not highly skewed. The Shapiro-Wilk test of normality produced a significant result for the ESI T-Score ($W = .89$, $p < .05$); thus, the distribution of this variable departed significantly from normality and the assumption of normality was therefore violated. Boxplots of these variables additionally revealed 1 outlier in the ESI T-Score variable data. The Shapiro-Wilk test of normality produced a non-significant result ($p > .05$) for the IHC T-Score, BSI T-Score and EPC T-Score variables. This outcome, as well as visual examination of the histograms and the QQ plots for these variables, provided no evidence of non-normality; thus, Pearson's correlations were calculated using these variables. Given that the assumptions for the Pearson's r correlation were not met for the ESI T-Score variable, with extreme non-normality found, a correlation was not calculated. Figure 15 presents a histogram summarizing the distribution and descriptive statistics for the ESI T-Score variable.

Pearson's correlations were calculated between the parenting variables (i.e., PLOC Total Score, PSOC Total Score and PRQ-CA Scale T-Scores) and the youth FIQ Total Score at pre-intervention. Contrary to expectations, no significant correlations ($p > .05$) were found between any of the parenting variables and the youth FIQ Total Score at pre-intervention; thus, parental locus of control, parental self-efficacy, and parental perceptions of the child/adolescent-caregiver relationship were not significantly related to youth-reported fire interest at pre-intervention. The Pearson's correlation results for the

parenting variables and the youth FIQ Total Score variable at pre-intervention are presented in Table 26.

Table 26. *Pearson's Correlations for the Parenting and Youth FIQ Total Score Variables at Pre-Intervention for Entire Sample*

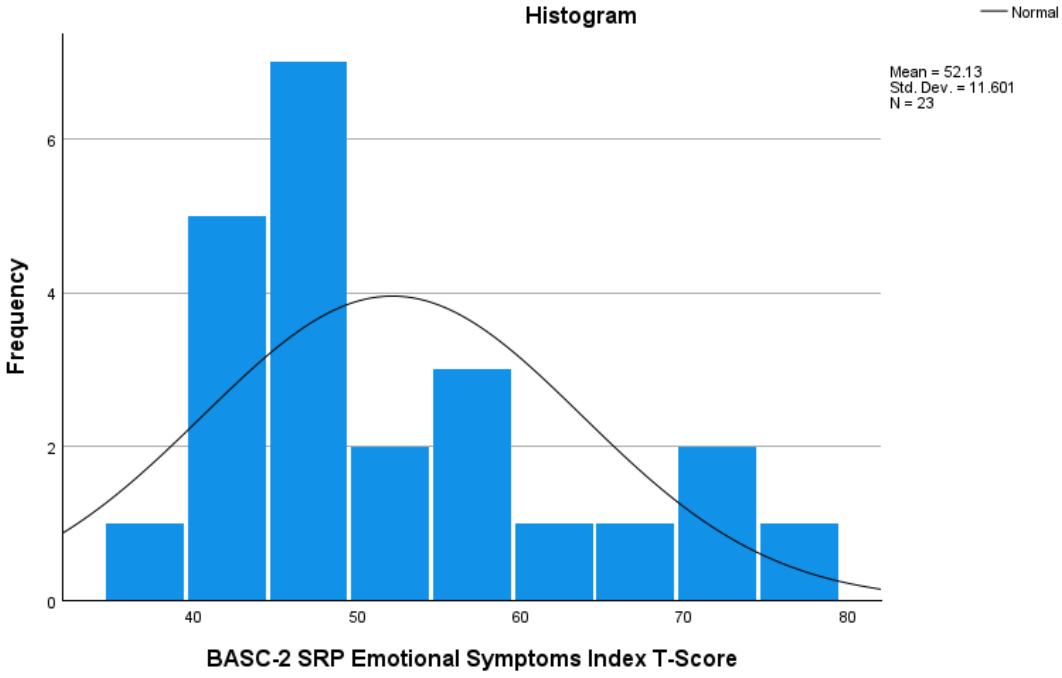
Variables	1	2	3	4	5	6	7	8	9
1. PLOC Total	--								
2. PSOC Total	-.58**	--							
3. PRQ Attachment	-.65**	.39	--						
4. PRQ Communicat.	-.60**	.25	.59**	--					
5. PRQ Discipline	-.23	-.29	.29	.36	--				
6. PRQ Involvement	-.38	.01	.21	.58**	.19	--			
7. PRQ Parent Confidence	-.71**	.54**	.62**	.47**	.20	.17	--		
8. PRQ Satisfaction School	-.18	.13	.30	.07	.28	-.15	.47*	--	
9. PRQ Relational Frustration	.49*	-.41	-.22	-.22	.29	-.05	-.51**	-.07	--
10. Youth Total FIQ	-.09	.27	.07	.18	.14	-.03	.01	-.15	.19

PLOC = Parental Locus of Control Scale; PSOC = Parenting Sense of Competence Scale; PRQ = Parenting Relationship Questionnaire- Child/Adolescent; FIQ = Fire Interest Questionnaire
** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)

Pearson's correlations were additionally calculated between the parenting variables (i.e., PLOC Total Score, PSOC Total Score and PRQ-CA Scale T-Scores) and the IHC, BSI and EPC T-Scores at pre-intervention. Contrary to expectations, no significant correlations ($p > .05$) were found between PLOC Total Score and PSOC Total Score, and any of these generalized behavioural variables; thus, parental locus of control and parental self-efficacy were not significantly related to generalized behavioural

difficulties in the youth at pre-intervention. However, as anticipated there were medium negative correlations between the BSI T-Score and the PRQ-CA Attachment Scale T-Score ($r = -.42$, $n = 25$, $p < .05$, two-tailed) and Parenting Confidence Scale T-Score ($r = -.44$, $n = 25$, $p < .05$, two-tailed), and a large positive correlation between the BSI T-Score and the PRQ-CA Relational Frustration Scale T-Score ($r = .53$, $n = 25$, $p < .01$, two-tailed).

Figure 15. *Emotional Symptoms Index T-Score at Pre-Intervention for Entire Sample*



Thus, poorer attachment and parenting confidence, and increased relational frustration within the context of the caregiver-youth relationship (as reported by caregivers) were significantly related to greater youth behavioural symptoms (as reported by caregivers) at pre-intervention. A medium positive correlation was additionally found, as anticipated, between the EPC T-Score and the PRQ-CA Relational Frustration Scale T-Score ($r = .47$,

n = 25, p < .05, two-tailed); thus, increased relational frustration within the context of the caregiver-youth relationship (as reported by caregivers) was significantly related to greater youth externalizing problems (as reported by caregivers) at pre-intervention. No other significant correlations were found between the PRQ-CA Scale T-Scores and the generalized behavioural variables at pre-intervention. The Pearson's correlation results for the parenting variables and generalized behavioural variables at pre-intervention are presented in Table 27.

Table 27. *Pearson's Correlations for the Parenting and Generalized Behavioural Variables at Pre-Intervention for Entire Sample*

Variables	1	2	3	4	5	6	7	8	9
1. PLOC Total	--								
2. PSOC Total	-.58**	--							
3. PRQ Attachment	-.65**	.39	--						
4. PRQ Communicat.	-.60**	.25	.59**	--					
5. PRQ Discipline	-.23	-.29	.29	.36	--				
6. PRQ Involvement	-.38	.01	.21	.58**	.19	--			
7. PRQ Parent Confidence	-.71**	.54**	.62**	.47**	.20	.17	--		
8. PRQ Satisfaction School	-.18	.13	.30	.07	.28	-.15	.47*	--	
9. PRQ Relational Frustration	.49*	-.41	-.22	-.22	.29	-.05	-.51**	-.07	--
10. PRS BSI	.27	-.15	-.42*	-.22	-.16	-.04	-.44*	-.36	.53**
11. SRP IHC	-.04	-.01	-.23	.04	.13	-.02	-.28	-.24	.24
12. PRS EPC	.04	-.10	-.06	-.02	.21	.12	.02	-.05	.47*

PLOC = Parental Locus of Control Scale; PSOC = Parenting Sense of Competence Scale; PRQ = Parenting Relationship Questionnaire- Child/Adolescent; PRS = Parent Rating Scales; SRP = Self Report of Personality; BSI = Behavioural Symptoms Index; IHC = Inattention/Hyperactivity Composite; EPC = Externalizing Problems Composite

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Hypothesis 3d

Mixed ANOVAs were performed on the Total PLOC Score and Total PSOC Score parenting variables. It was anticipated that parental self-efficacy and parental locus of control (PLOC) would benefit from treatment; that is, that parental self-efficacy would be higher and PLOC would be more internal (i.e., reflected by lower scores) in the study sample at post-intervention and follow-up, compared with pre-intervention. Greater benefits were expected for caregivers in the modified TAPP-C intervention condition group, given that these participants received PMT as part of the mental health component, compared with caregivers in the FSE condition group. Specifically, it was anticipated that at post-treatment and follow-up (3 months), caregivers in the modified TAPP-C intervention condition group would report, on average, greater parenting self-efficacy (reflected by a higher Total PSOC Score) and a more internalized parental locus of control (reflected by a lower Total PLOC Score) post-intervention and at follow-up, compared with their pre-intervention reports and compared with caregivers in the FSE condition group (see Tables 28 and 29 for mean Total PLOC Scores and mean Total PSOC Scores for the condition groups, over time).

Table 28. *Mean Parental Locus of Control Scale (PLOC) Total by Condition Group over Time*

Treatment Group	N	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	8	Pre-Intervention	120.63	108.43 – 132.82
		Post-Intervention	116.75	104.48 – 129.02
		Follow-up	119.87	107.79 – 131.96
Fire Safety Education Intervention	7	Pre-Intervention	124.00	110.96 – 137.04
		Post-Intervention	120.57	107.45 – 133.69
		Follow-up	128.86	115.94 – 141.78

Table 29. *Mean Parenting Sense of Competence Scale (PSOC) Total by Condition Group over Time*

Treatment Group	N	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	10	Pre-Intervention	65.50	59.39 – 71.61
		Post-Intervention	69.50	63.56 – 75.44
		Follow-up	68.00	61.98 – 74.02
Fire Safety Education Intervention	7	Pre-Intervention	62.86	55.55 – 70.16
		Post-Intervention	64.57	57.47 – 71.67
		Follow-up	65.14	57.95 – 72.34

The Total PLOC Score and Total PSOC Score variables were first tested for estimates of covariance and sphericity. Box`s M Test of Equality of Covariance Matrices and Levene`s Test of Equality of Error Variances both produced non-significant results ($p > .05$); thus, the equal variances assumption was not violated for the Total PLOC Score or the Total PSOC Score variables. Mauchley`s Test of Sphericity also produced a non-significant result ($p > .05$) for both the Total PLOC Score and Total PSOC Score variables; thus, the sphericity assumption was not violated for these variables.

For the Total PLOC Score, the results of a mixed 3 x 2 ANOVA were non-significant ($p > .05$). Thus, the caregiver Total PLOC Scores were not significantly different between pre-intervention ($M = 122.20$), post-intervention ($M = 118.53$), and follow-up ($M = 124.07$) ($p = .279$). There also were no significant differences found in the Total PLOC Scores between the two condition groups at post-intervention and follow-up ($p = .466$). Contrary to predictions, the caregiver Total PLOC Score did not show statistically significant improvement to a more internalized parental locus of control (reflected by a decrease in scores) over time, nor did it significantly differ between the two condition groups at post-intervention or follow-up. However, results did show that

the Total PLOC Score trended in the expected direction, with mean scores showing a decrease at post-intervention compared with pre-intervention. This decrease was not maintained at follow-up, whereby mean scores increased. These results revealed that the PLOC data was significantly quadratic in nature ($p < .05$).

For the Total PSOC Score, the results of a mixed 3 x 2 ANOVA were also non-significant ($p > .05$). Thus, the caregivers' Total PSOC Scores were not significantly different between pre-intervention ($M = 64.41$), post-intervention ($M = 67.47$), and follow-up ($M = 66.82$) ($p = .393$). There also were no significant differences found in the Total PSOC Scores between the two condition groups at post-intervention and follow-up ($p = .348$). Contrary to predictions, the caregiver Total PSOC Score did not show statistically significant improvement over time, nor did it significantly differ between the two condition groups at post-intervention or follow-up. However, results did show that the Total PSOC Score trended in the expected direction over time, with mean scores showing increases at post-intervention and follow-up, compared with pre-intervention.

Exploratory Research Questions

Executive function (EF), impulsivity, and readiness to change were exploratory areas of inquiry in the present study. To investigate these constructs, descriptive statistics were used to measure youth EF via caregiver reports on the BRIEF questionnaire, youth impulsivity via their performance on an impulsivity task (i.e., the Walk, Don't Walk subtest of the TEA-Ch), as well as youth and caregiver readiness to change via the Readiness to Change Ruler. Readiness to change was also measured for youth participants (Adolescent participants only, ages 12 to 16) via the URICA Scale. Descriptive statistics were used to determine if caregivers reported deficits in EF for their

youth, and if youths demonstrated impaired performance on an impulsivity task, at pre-intervention (i.e., hypothesis 4a). Correlations were calculated to examine the relationship between the EF and impulsivity variables, as well as between these variables and the youth fire-specific and generalized behavioural variables, at pre-intervention (i.e., hypothesis 4b). To examine change in performance on the impulsivity task (i.e., the Walk, Don't Walk subtest of the TEA-Ch) from pre-intervention to post-intervention for each condition group, paired samples t-tests were performed (i.e., hypothesis 4c). Finally, mixed ANOVAs were performed to examine within-group differences on the URICA readiness to change variable (i.e., Total Readiness to Change Score on the URICA Scale), and the youth and caregiver Readiness to Change Ruler Score variables, across the three time points, as well as between-group differences post-intervention and at follow-up on these three variables (i.e., hypothesis 4d).

The mean, standard deviation, and range were calculated for pre-intervention data for the following variables: caregiver-reported Global Executive Composite (GEC) T-Score, Metacognition Index (MI) T-score, and Behavioural Regulation Index Score (BRI) T-score from the BRIEF; the Walk, Don't Walk Age-Scaled Score from the TEA-Ch; the Readiness to Change Score from the URICA Scale; and the Youth- and Caregiver-Readiness to Change Ruler Scores. The descriptive data for these variables at pre-intervention is presented in Table 30.

Table 30. *Descriptive Statistics for Exploratory Variables at Pre-Intervention for Entire Sample*

Measure	Variable	N	Mean	SD	Range
BRIEF	Behavioural Regulation Index Score (BRI)	25	69.24	13.58	43-92
	Metacognition Index Score (MI)	25	69.80	9.72	51-87
	Global Executive Composite Score (GEC)	25	70.48	10.56	50-86
TEA-Ch	Walk, Don't Walk Age-Scaled Score	25	4.72	2.65	1-10
Readiness to Change Ruler	Youth Ruler Score	26	7.56	2.74	0-10
	Caregiver Ruler Score	27	8.13	1.76	5-10
URICA	Readiness to Change Score	17	6.87	2.63	1.86-10.71

BRIEF = Behaviour Rating Inventory of Executive Function; TEA-Ch = Test of Everyday Attention for Children; URICA = University of Rhode Island Change Assessment Scale

Hypothesis 4a

It was expected that the youth participants would present with an EF deficit (as reported by their caregivers) on the BRIEF questionnaire, as well as impaired performance on an impulsivity task, both at pre-intervention. Mean T-Scores were calculated to investigate if caregivers reported deficits in EF for their youth at pre-intervention (N = 25). On the BRIEF it was anticipated that at pre-intervention, youth would have high T-scores (≥ 65) on the GEC, MI, and BRI variables (higher T-scores indicate greater degrees of executive dysfunction, with T-scores of 65 or more representing an abnormally elevated score and being clinically significant). Consistent with expectations, mean T-Scores fell in the clinically elevated range for the GEC, MI and BRI variables. The mean T-score for youth on the GEC (a summary composite scale) was in the clinically elevated range (M = 70.48), indicating that the youths exhibited executive dysfunction across the clinical subscales. The mean T-score for youth on the MI was also in the clinically elevated range (M = 69.80), indicating that the youths exhibited dysfunction in their ability to cognitively manage attention and problem solving in a variety of contexts, and to use planning and organization skills while sustaining task

completion in working memory. Finally, the mean T-score for youth on the BRI was additionally in the clinically elevated range (M = 69.24), indicating that the youths exhibited dysfunction in their ability to maintain appropriate regulatory control of their behaviour and emotional responses, which is considered to be a precursor to appropriate metacognitive problem solving by guiding active systematic problem solving as well as supporting self-regulation. Table 31 presents the frequencies and percentages of youth that fell within the non-clinical range (T-scores ≤ 64) and the clinical range (T-scores ≥ 65) on the BRIEF BRI, MI, and GEC variables, at pre-intervention. Of note, more than half (56%) of the youth received scores in the clinical range on the BRI, and a majority (72%) of the youth received scores in the clinical range on the MI. Sixty-four percent of youth received scores in the clinical range on the GEC.

Table 31. *Frequencies and Percentages of T-Scores on the BRIEF by Range at Pre-Intervention for Entire Sample*

BRIEF T-Scores	Non-Clinical Range	Clinical Range
Behavioural Regulation Index-BRI (N/%)	11/44.0	14/56.0
Metacognition Index-MI (N/%)	7/28.0	18/72.0
Global Executive Composite- GEC (N/%)	9/36.0	16/64.0

BRIEF = Behaviour Rating Inventory of Executive Function

Mean age-scaled scores were calculated to determine if youths demonstrated impaired performance on an impulsivity task, at pre-intervention (N = 25). On the TEA-Ch, it was anticipated that at pre-intervention, youth would have low Walk, Don't Walk Age-Scaled Scores. Lower scores on this subtest indicate poorer performance and are reflective of difficulties with sustained attention and impulse control, that is, the ability to inhibit responses to action. The age-scaled scores for the TEA-Ch have a mean of 10, and standard deviation of 3. Consistent with expectations, the mean age-scaled score for

youth was very low (M = 4.72), falling within the 3.3 to 6.7 percentile range, indicating that youths performed the test better than only approximately 3.3 percent of youths of their age and sex. Table 32 presents the frequencies and percentages of the age-scaled scores for youth on the TEA-Ch Walk, Don't Walk subtest, at pre-intervention. Of note, 100 percent of youths performed at or below the 57th percentile, with a majority (76%) performing at or below the 20th percentile. Almost half (44%) of the youths performed only at or below the 1st percentile.

Table 32. *Frequencies and Percentages of Youth Age-Scaled Scores on the TEA-Ch Walk, Don't Walk Subtest at Pre-Intervention for Entire Sample*

Age-Scaled Score	Percentile Band	N	Percent	Cumulative Percent
1	<0.2	3	12.0	12.0
2	0.2 - 0.6	3	12.0	24.0
3	0.6 - 1.5	5	20.0	44.0
4	1.5 - 3.3	-	-	-
5	3.3 - 6.7	5	20.0	64.0
6	6.7 - 12.2	2	8.8	72.0
7	12.2 - 20.2	1	4.0	76.0
8	20.2 - 30.9	5	20.0	96.0
9	30.9 - 43.4	-	-	-
10	43.4 - 56.6	1	4.0	100.0
≥11	56.6 - >99.8	-	-	-

TEA-Ch = Test of Everyday Attention for Children

Hypothesis 4b

Pearson's r correlations were planned to examine the relationship between the EF and impulsivity variables, as well as between these variables and the youth fire-specific and generalized behavioural variables, at pre-intervention. A negative relationship was expected between youth EF (as reported by their caregiver on the BRIEF questionnaire) and their performance on the TEA-Ch Walk, Don't Walk subtest at pre-intervention, such that more impaired EF (reflected by higher T-scores on the GEC, MI, and BRI variables

from the BRIEF) would be associated with poorer performance on the TEA-Ch Walk, Don't Walk subtest (reflected by lower Walk, Don't Walk Age-Scaled Scores), and vice versa. It was also expected that at pre-intervention, EF and impulsivity would be related to the fire-specific and generalized behavioural variables, such that more impaired EF and poorer performance on the TEA-Ch Walk, Don't Walk subtest would be associated with greater youth behavioural difficulties, as well as a higher incidence of fire-specific behaviour, and vice versa. Specifically, it was anticipated that higher GEC, MI, and BRI T-scores, and a lower Walk, Don't Walk Age-Scaled Score, would be associated with higher caregiver and youth FIQ Total Scores (reflecting greater interest in, or curiosity about, fire and fire-related materials), higher caregiver- and youth-reported frequency of unsanctioned firesetting (number of times youth engaged in unsanctioned firesetting in the 12 months prior to pre-intervention visit), and higher T-Scores (i.e., a T-Score between 60-69 is an elevated score indicating higher levels of maladaptive behaviours; a T-Score of 70 or more represents an abnormally elevated score that is clinically significant) on the BASC-2 variables (including the youth-reported Emotional Symptoms Index [ESI] and Inattention/Hyperactivity Composite [IHC] T-Scores, and the caregiver-reported Behavioural Symptoms Index [BSI] and Externalizing Problems Composite [EPC] T-Scores), and vice versa.

The EF, impulsivity, fire-specific and generalized behavioural variables at pre-intervention were first tested for the assumptions of the Pearson's r correlation. In terms of the fire-specific variables at pre-intervention, the assumptions for Pearson's r correlations were not met for the caregiver-reported and youth-reported frequency of unsanctioned firesetting variables, as well as the caregiver FIQ Total Score variable (see

the results section for hypothesis 3c for these results)**.** As extreme non-normality was found for these variables, correlations were not calculated. Correlations were calculated for the youth FIQ Total Score variable, as the assumptions of the Pearson's r correlation were met.

In terms of the generalized behavioural variables at pre-intervention, the assumptions for Pearson's r correlations were not met for the for the ESI T-Score variable (see the results section for hypothesis 3c for these results). As extreme non-normality was found for this variable, correlations were not calculated. Correlations were calculated for the IHC, BSI and EPC T-Score variables, as the assumptions of the Pearson's r correlation were met.

The Walk, Don't Walk Age-Scaled Score variable at pre-intervention was first tested for the assumptions of the Pearson's r correlation, which were all met. Descriptive statistics for skewness fell within the acceptable range (i.e., between -1.0 and +1.0); thus, the data was not highly skewed. The Shapiro-Wilk test of normality produced a non-significant result ($p > .05$) for this variable; thus, the assumption of normality was not violated. A boxplot of this variable revealed no outliers.

The GEC, MI, and BRI T-score variables at pre-intervention were also first tested for the assumptions of the Pearson's r correlation, which were all met. Descriptive statistics for skewness fell within the acceptable range (i.e., between -1.0 and +1.0); thus, the data for these variables was not highly skewed. The Shapiro-Wilk test of normality produced a non-significant result ($p > .05$) for all of these variables; thus, the assumption of normality was not violated. Boxplots of these variables revealed no outliers.

The Pearson's correlation results were partially consistent with expectations. Contrary to expectations, at pre-intervention no significant correlations were found between the EF variables (i.e., the GEC, MI, and BRI T-score variables) and the impulsivity variable (i.e., the Walk, Don't Walk Age-Scaled Score variable). Consistent with expectations, the EF variables were significantly correlated with many of the fire-specific and generalized behaviour variables at pre-intervention. Specifically, large positive correlations were found between the BRI T-score variable and the EPC T-score ($r = .82$, $n = 25$, $p < .01$, two-tailed) and BSI T-score ($r = .78$, $n = 25$, $p < .01$, two-tailed) variables. A medium positive correlation was found between the BRI T-score and the Youth Total FIQ ($r = .46$, $n = 25$, $p < .05$, two-tailed) variables. A large positive correlation was also found between the MI T-score variable and the BSI T-score ($r = .51$, $n = 25$, $p < .01$, two-tailed) variable. Large positive correlations were additionally found between the GEC T-score variable and the EPC T-score ($r = .70$, $n = 25$, $p < .01$, two-tailed) and BSI T-score ($r = .73$, $n = 25$, $p < .01$, two-tailed) variables. A medium positive correlation was found between the GEC T-score and the Youth Total FIQ ($r = .40$, $n = 25$, $p < .05$, two-tailed) variables. Contrary to expectations, the Walk, Don't Walk Age-Scaled Score variable was not significantly correlated with any of the fire-specific or generalized behaviour variables at pre-intervention. Table 33 presents the Pearson's correlations results for EF, impulsivity, fire-specific and generalized behavioural variables at pre-intervention.

Table 33. *Pearson's Correlations for the EF, Impulsivity, Youth Total FIQ, and Generalized Behavioural Variables at Pre-Intervention for Entire Sample*

Variables	1	2	3	4	5	6	7	8
1. BRIEF BRI T-score	--							
2. BRIEF MI T-score	.46*	--						
3. BRIEF GEC T-score	.85**	.71**	--					
4. TEA-Ch Age-Scaled Score	.14	-.05	.11	--				
5. Youth Total FIQ	.46*	.33	.40*	.23	--			
6. EPC T-score	.82**	.39	.70**	.22	.59**	--		
7. BSI T-score	.78**	.51**	.73**	.04	.49**	.76**	--	
8. IHC T-score	.17	.41	.30	.07	-.09	.12	.13	--

BRIEF = Behaviour Rating Inventory of Executive Function; BRI = Behavioural Regulation Index; MI = Metacognition Index; GEC = Global Executive Composite; TEA-Ch = Test of Everyday Attention for Children; FIQ = Fire Interest Questionnaire; EPC = Externalizing Problems Composite; BSI = Behavioural Symptoms Index; IHC = Inattention/Hyperactivity Composite

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Hypothesis 4c

Two paired samples t-tests were performed to compare the youths' pre- and post-intervention age-scaled score variables from the TEA-Ch Walk, Don't Walk subtest, within each of the intervention condition groups. It was expected that post-intervention, youth receiving the modified TAPP-C intervention would show improved performance on the TEA-Ch Walk, Don't Walk subtest (indicated by a higher Walk, Don't Walk Age-Scaled Score), compared with their pre-intervention performance, as the TAPP-C intervention teaches skills to decrease impulsivity and improve problem solving. The performance of youth receiving the FSE intervention was not expected to change on the TEA-Ch Walk, Don't Walk subtest between pre- and post-intervention, as this intervention does not include instruction on these skills. Impulsivity was not measured at

follow-up. Table 34 presents descriptives for the Walk, Don't Walk Age-Scaled Scores for the condition groups over time.

Table 34. *Mean Walk, Don't Walk Age-Scaled Scores by Condition Group over Time*

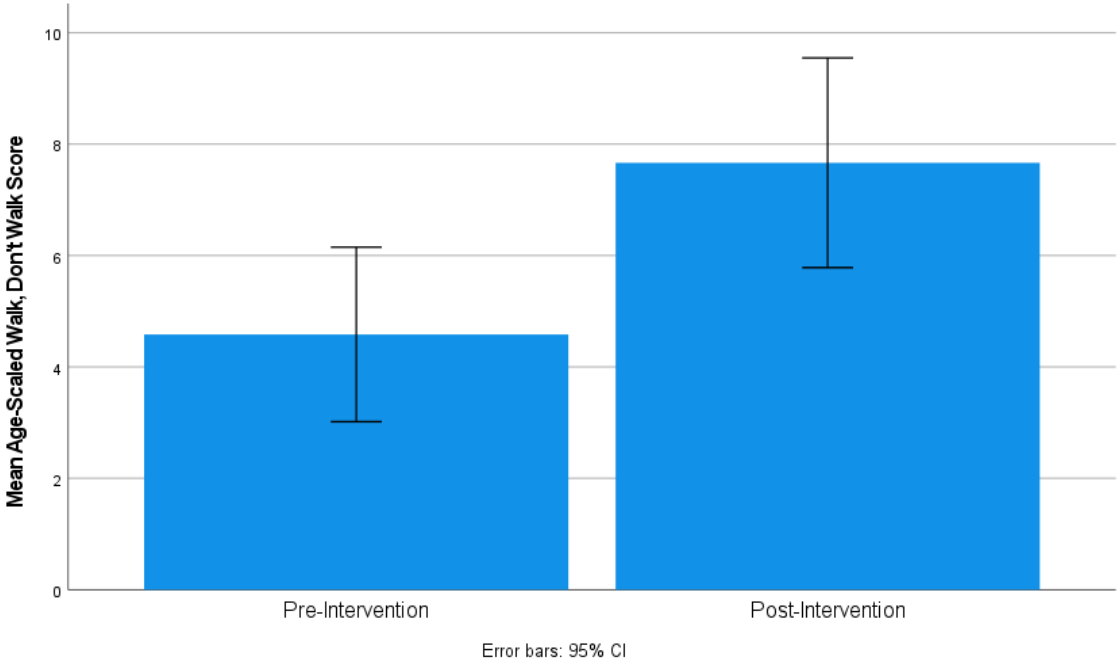
Treatment Group	N	Time	Mean	SD
Modified TAPP-C Intervention	12	Pre-Intervention	4.58	2.47
		Post-Intervention	7.67	2.96
Fire Safety Education Intervention	10	Pre-Intervention	5.10	3.07
		Post-Intervention	7.80	3.58

The Walk, Don't Walk Age-Scaled Score variables (including the pre- and post-intervention variables for each condition group) were first tested for the assumptions of the t-test, which were all met. Descriptive statistics for skewness fell within the acceptable range (i.e., between -1.0 and +1.0) for this variable at pre- and post-intervention for each condition group; thus, the data was not highly skewed. The Shapiro-Wilk test of normality produced a non-significant result ($p > .05$) for all of these variables; thus, the assumption of normality was not violated. Boxplots of these variables revealed no outliers.

A paired samples t-test was performed to compare the pre- and post-intervention mean Walk, Don't Walk Age-Scaled Scores for the modified TAPP-C intervention group. Consistent with expectations, results showed that in the modified TAPP-C intervention group ($N = 12$), the youths' performance on the TEA-Ch Walk, Don't Walk subtest significantly increased from pre-intervention ($M = 4.58$, $SD = 2.47$) to post-intervention ($M = 7.67$, $SD = 2.96$). Results indicated that the mean difference between the pre- and post-intervention Walk, Don't Walk Age-Scaled Scores was significant, $t(11) = -3.25$, $p = .008$ (see Figure 16). The effect size for the difference between the

groups was calculated using Cohen's d, resulting in a value of 0.94, which is considered a large effect.

Figure 16. *Mean Age-Scaled Walk, Don't Walk Score for the Modified TAPP-C Intervention Group at Pre- and Post-Intervention*



A paired samples t-test was also performed to compare the pre- and post-intervention Walk, Don't Walk Age-Scaled Scores for the FSE intervention group. Consistent with expectations, results showed that in the FSE intervention group (N = 10), the youths' performance on the TEA-Ch Walk, Don't Walk subtest did not significantly change from pre-intervention (M = 5.10, SD = 3.07) to post-intervention (M = 7.80, SD = 3.58). Results indicated that the mean difference between the pre- and post-intervention Walk, Don't Walk Age-Scaled Scores was not significant, t(9) = -1.92, p = .09.

Hypothesis 4d

Mixed ANOVAs were performed on the adolescent participants' (aged 12 to 16) Total Readiness to Change Score from the URICA Scale, and on the youth and caregiver Readiness to Change Ruler Score variables, to examine within-group differences across the three time points, as well as between-group differences post-intervention and at follow-up on these three variables. It was anticipated that all participants' readiness to change would benefit from treatment; that is, that readiness to change would be greater (reflected by higher readiness to change scores on both the URICA and Readiness to Change Ruler) post-intervention and at follow-up compared with pre-intervention for youth and caregiver participants in both intervention groups. Greater benefits were expected for participants in the modified TAPP-C intervention, as this intervention included elements of motivational interviewing which targets treatment readiness. Specifically, it was anticipated that at post-treatment and follow-up (3 months), caregivers and youth in the modified TAPP-C intervention condition group would report, on average, higher readiness to change scores on the Readiness to Change Ruler post-intervention and at follow-up, compared with their pre-intervention reports and compared with caregivers and youth in the FSE condition group. It was also anticipated that at post-treatment and follow-up, adolescent participants in the modified TAPP-C intervention condition group would report, on average, higher Total Readiness to Change Scores on the URICA Scale post-intervention and at follow-up, compared with their pre-intervention reports and compared with adolescents in the FSE condition group (see Tables 35-36 for mean youth and caregiver Readiness to Change Ruler Scores, and Table 37 for mean youth Total Readiness to Change Scores by condition group, over time).

Table 35. *Mean Youth Readiness to Change Ruler Scores by Condition Group and Total Study Sample over Time*

Treatment Group	N	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	11	Pre-Intervention	7.77	6.27 – 9.28
		Post-Intervention	9.41	8.67 – 10.15
		Follow-up	9.36	8.57 – 10.16
Fire Safety Education Intervention	9	Pre-Intervention	8.00	6.34 – 9.66
		Post-Intervention	9.50	8.68 – 10.31
		Follow-up	9.61	8.73 – 10.49
Total Study Sample	20	Pre-Intervention	7.88	6.76 – 9.01
		Post-Intervention	9.45	8.91 – 10.00
		Follow-up	9.48	8.89 – 10.08

Table 36. *Mean Caregiver Readiness to Change Ruler Scores by Condition Group and Total Study Sample over Time*

Treatment Group	N	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	10	Pre-Intervention	8.10	6.71 – 9.49
		Post-Intervention	9.55	8.56 – 10.54
		Follow-up	9.35	8.73 – 9.97
Fire Safety Education Intervention	8	Pre-Intervention	7.81	6.26 – 9.36
		Post-Intervention	8.31	7.21 – 9.42
		Follow-up	9.56	8.87 – 10.26
Total Study Sample	18	Pre-Intervention	7.97	6.92 – 9.00
		Post-Intervention	9.00	8.19 – 9.67
		Follow-up	9.44	8.99 – 9.92

Table 37. *Mean Youth (Ages 12 to 16) Total Readiness to Change Scores (URICA) by Condition Group and Total Study Sample over Time*

Treatment Group	N	Time	Mean	95% Confidence Interval
Modified TAPP-C Intervention	6	Pre-Intervention	6.00	3.30 – 8.69
		Post-Intervention	6.81	3.93 – 9.69
		Follow-up	6.98	3.82 – 10.13
Fire Safety Education Intervention	6	Pre-Intervention	7.81	5.11 – 10.50
		Post-Intervention	7.55	4.66 – 10.43
		Follow-up	7.24	4.08 – 10.39
Total Study Sample	12	Pre-Intervention	6.90	5.00 – 8.81
		Post-Intervention	7.18	5.14 – 9.22
		Follow-up	7.11	4.88 – 9.34

The adolescent Total Readiness to Change Score variable and the youth and caregiver Readiness to Change Ruler Score variables were first tested for estimates of covariance and sphericity. For the adolescent Total Readiness to Change Score variable, Box`s M Test of Equality of Covariance Matrices and Levene`s Test of Equality of Error Variances both produced non-significant results ($p > .05$); thus, the equal variances assumption was not violated. Mauchley`s Test of Sphericity also produced a non-significant result ($p > .05$); thus, the sphericity assumption was not violated for this variable. For the youth Readiness to Change Ruler Score variable, Box`s M Test of Equality of Covariance Matrices produced a significant result (Box's $M[6,2068.11] = 37.47$, $p < .001$); however, Levene`s Test of Equality of Error Variances produced non-significant results at all three time points ($p > .05$). Mauchley`s Test of Sphericity produced a significant result for the youth Readiness to Change Ruler Score variable ($W[2] = .65$, $p < .05$), indicating that the sphericity assumption was violated for this variable and thus, the data was skewed. For the caregiver Readiness to Change Ruler Score variable, Box`s M Test of Equality of Covariance Matrices produced a non-significant result ($p > .05$). Levene`s Test of Equality of Error Variances also produced non-significant results for the caregiver Readiness to Change Ruler Score pre-intervention and follow-up data ($p > .05$); however, a significant result was produced for post-intervention data for this variable ($F[1,16] = 9.01$, $p < .01$). Mauchley`s Test of Sphericity produced a significant result for the caregiver Readiness to Change Ruler Score variable ($W[2] = .62$, $p < .05$), indicating that the sphericity assumption was also violated for this variable and thus, the data was skewed.

For the adolescent Total Readiness to Change Score variable (from the URICA), the results of a mixed 3 x 2 ANOVA were non-significant ($p > .05$). Thus, the Total Readiness to Change Scores were not significantly different between pre-intervention ($M = 6.90$), post-intervention ($M = 7.18$), and follow-up ($M = 7.11$) ($p = .888$). There also were no significant differences found in the Total Readiness to Change Scores between the two condition groups at post-intervention and follow-up ($p = .599$). Contrary to predictions, the adolescent Total Readiness to Change Score did not show statistically significant improvement (reflected by a higher score) with treatment over time, nor did it significantly differ between the two condition groups at post-intervention or follow-up.

For the youth Readiness to Change Ruler Score variable the results of a mixed 3 x 2 ANOVA revealed a significant main effect of Time, $F(1.48, 26.71) = 7.06$, $p < .01$, such that the Readiness to Change Ruler scores were significantly different pre-intervention, post-intervention, and at follow-up. Since Mauchley`s Test of Sphericity was violated, the Greenhouse-Geisser correction was used. Partial Eta² effect size ($\eta^2 = .28$) indicated that the main effect of Time was substantial. As predicted, the youth Readiness to Change Ruler scores significantly increased over time. The pairwise comparisons for the main effect of Time, corrected using a Bonferroni adjustment, indicated that the significant main effect reflected a significant difference between pre-intervention ($M = 7.88$) and post-intervention ($M = 9.45$) youth Readiness to Change Ruler scores ($p = .049$), and pre-intervention and follow-up ($M = 9.48$) youth Readiness to Change Ruler scores ($p = .015$). No significant difference was found between post-intervention and follow-up youth Readiness to Change Ruler scores ($p = 1.00$) (see Table 38 for the pairwise comparisons for youth Readiness to Change Ruler scores over time).

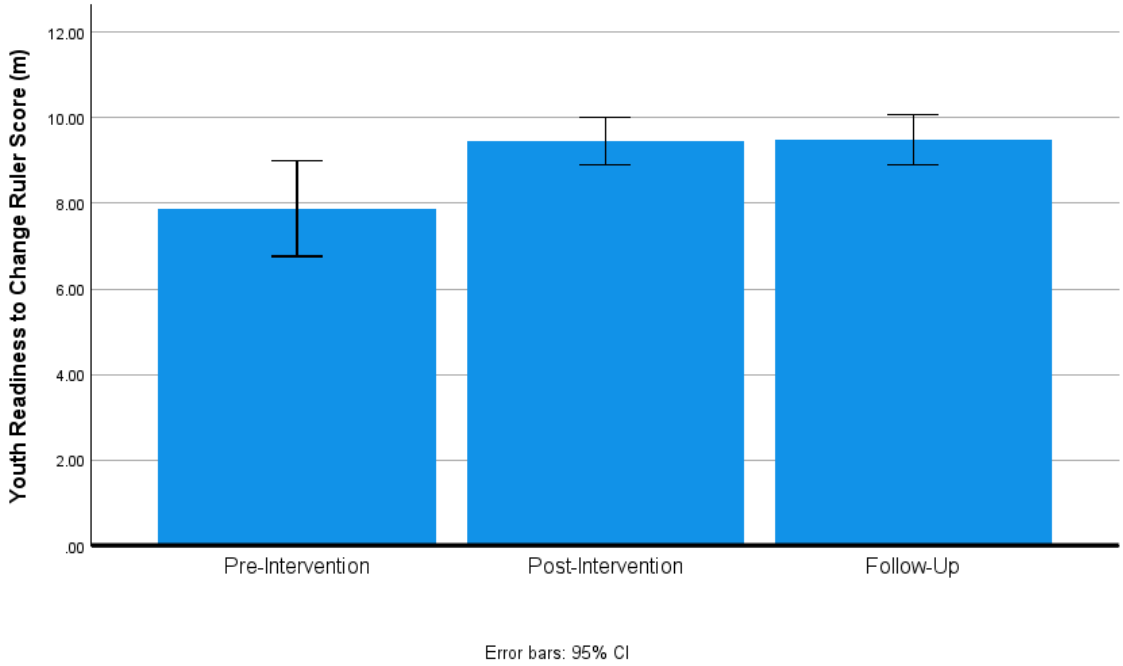
There were no significant differences found in the youth Readiness to Change Ruler scores between the two condition groups at post-intervention and follow-up (p = .717); regardless of condition group, youth Readiness to Change Ruler scores improved (reflected by an increase in scores) with treatment at post-intervention, and the improvement was maintained at follow-up (see Figure 17).

Table 38. *Pairwise Comparisons for Youth Readiness to Change Ruler Score Over Time for Entire Sample*

Time		Mean Difference	Standard Error	95% Confidence Interval
Pre-Intervention	Post-Intervention	-1.57*	0.59	-3.13 — -0.01
	Follow-Up	-1.60*	0.50	-2.92 — -0.28
Post-Intervention	Pre-Intervention	1.57*	0.59	0.01 — 3.13
	Follow-Up	-0.03	0.33	-0.91 — 0.84
Follow-Up	Pre-Intervention	1.60*	0.50	0.28 — 2.92
	Post-Intervention	0.03	0.33	-0.84 — 0.91

* denotes p < .05, for mean difference

Figure 17. *Mean Youth Readiness to Change Score Over Time for Entire Sample*



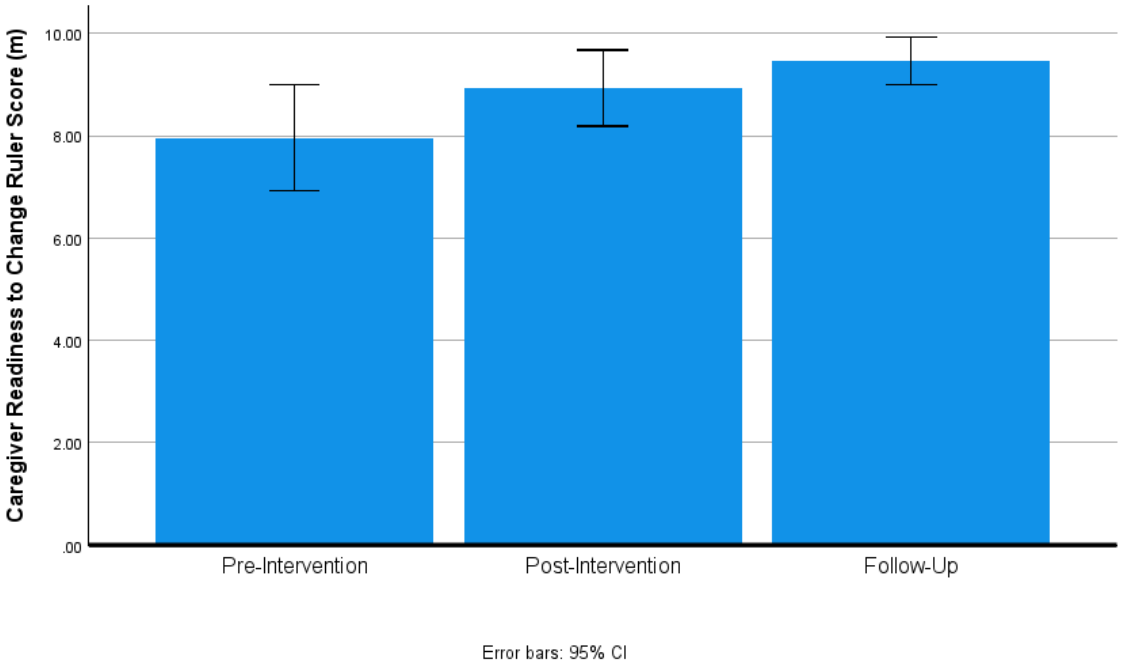
For the caregiver Readiness to Change Ruler Score variable the results of a mixed 3 x 2 ANOVA revealed a significant main effect of Time, $F(1.45, 23.20) = 5.00$, $p < .05$, such that the Readiness to Change Ruler scores were significantly different pre-intervention, post-intervention, and at follow-up. Since Mauchley`s Test of Sphericity was violated, the Greenhouse-Geisser correction was used. Partial Eta² effect size ($\eta^2 = .24$) indicated that the main effect of Time was substantial. As predicted, the caregiver Readiness to Change Ruler scores significantly increased over time. The pairwise comparisons for the main effect of Time, corrected using a Bonferroni adjustment, indicated that the significant main effect reflected a significant difference between pre-intervention ($M = 7.97$) and follow-up ($M = 9.44$) caregiver Readiness to Change Ruler scores ($p = .035$). No significant differences were found between pre-intervention and post-intervention ($M = 9.00$) caregiver Readiness to Change Ruler scores ($p = .321$), and post-intervention and follow-up caregiver Readiness to Change Ruler scores ($p = .307$) (see Table 39 for the pairwise comparisons for caregiver Readiness to Change Ruler scores over time). There were no significant differences found in the caregiver Readiness to Change Ruler scores between the two condition groups at post-intervention and follow-up ($p > .05$); regardless of condition group, caregiver Readiness to Change Ruler scores improved (reflected by an increase in scores) at post-intervention, with a significant improvement found at follow-up (see Figure 18).

Table 39. *Pairwise Comparisons for Caregiver Readiness to Change Ruler Score Over Time for Entire Sample*

Time		Mean Difference	Standard Error	95% Confidence Interval
Pre-Intervention	Post-Intervention	-0.98	0.57	-2.50 — 0.55
	Follow-Up	-1.50*	0.53	-2.91 — -0.09
Post-Intervention	Pre-Intervention	0.98	0.57	-0.55 — 2.50
	Follow-Up	-0.53	0.30	-1.34 — 0.29
Follow-Up	Pre-Intervention	1.50*	0.53	0.09 — 2.91
	Post-Intervention	0.53	0.30	-0.29 — 1.34

* denotes $p < .05$, for mean difference

Figure 18. *Mean Caregiver Readiness to Change Score Over Time for Entire Sample*



Discussion

The present study tested an enhanced model of service delivery for firesetting youth that includes a mental health component provided by mental health professionals. The study compared a modified TAPP-C protocol that included both fire service and

mental health components, to the most common treatment, which is FSE alone. The study examined the potential benefits for fire-involved youth and their caregivers of participating in a modified TAPP-C intervention, which included a fire-specific risk assessment, MI, and the skills-based CBT and PMT components of the standardized, manualized TAPP-C treatment, as well as a home safety check session with a trained fire educator. Such benefits were compared with any benefits potentially gained through participation in a standardized, manualized fire service intervention comprising of fire safety education, an intervention that mimics those typically available outside of Ontario. The study was both a replication and extension of the Kolko (2001) RCT study. It improved upon study design and methodology (i.e., matched dosage across treatment groups and included a broader age range), as well as ecological validity (i.e., the treatment protocol matched the length of interventions that are typically provided). Additionally, the present study utilized a broader scope of measures, including measures of youth emotional and behavioural functioning, in addition to fire-specific assessment measures. Measures were also included for other previously unexplored areas in this population; namely, readiness to change, executive functioning and impulsivity, as well as measures of perceived parental competence and control, and parental cognitions and perceptions of the caregiver-child relationship.

Characteristics of the Youth Firesetting Sample

The descriptive analyses indicated that the characteristics of the present study sample were consistent with what has previously been reported in the youth firesetting population, further highlighting the complex constellation of difficulties many of these youth face beyond their fire involvement. The sample included predominantly male youth

(93%), which is consistent with the male-dominated samples reported in the youth firesetting literature (e.g., Sambrooks, Olver, Page & Gannon, 2021); further research is required to examine firesetting behaviour in females to determine any potential differences across gender. A majority of the youth sample were White (44%), spoke English as their first language (89%) and were born in Canada (82%). Caregivers were predominantly female (85%), and 30% were not a youth's parent, but other relatives or legal guardians, foster parents, and child and youth workers.

Consistent with reports in the youth firesetting literature (e.g., Bell, Doley, & Dawson, 2018), academic difficulties were reported for a majority of the youth, with 78% having academic accommodations in place, 48% attending specialized classrooms, and over half (56%) diagnosed with a learning disability. Also consistent with what has been previously highlighted in the literature (e.g., Barreto & Parker, 2022), significant co-occurring mental health difficulties were reported in the study sample, with three-quarters of the youth previously receiving mental health services, and 44% receiving concurrent mental health services at the time of the study. Eighty-nine percent of the youth were reported to have a mental health diagnosis, the majority (52%) being an ADHD diagnosis, which is consistent with other reports of ADHD prevalence in firesetting youth in the literature (e.g., Sasaki et al., 2023). Over a third of the youth were currently taking medication for a mental health purpose.

In terms of family characteristics, the study results also highlight the complexities and difficulties fire-involved youth face in their home environments. Forty-one percent of the youth sample did not live with their parent(s); rather, they mainly resided with other family members or guardians, or in foster or group homes. Forty-one percent of youth

also resided in a single-parent household. Thirty percent of the youth's families were reported to be currently involved with a child welfare agency, and a majority (82%) were reported to have "ever" had such involvement. These results are also consistent with reports in the youth firesetting literature, where links have been noted between youth firesetting and single-parent households (e.g., Root et al, 2008), child welfare involvement (e.g., Chen et al., 2011), and more frequent disruptions in their caregivers (e.g., Strachan, 1981). Nineteen percent of the youth were reported to have a parent currently receiving mental health services, which is also consistent with reports of serious parental psychopathology in caregivers of children involved with fire in the firesetting literature (e.g., McCarty & McMahon, 2005), and additionally speaks to the complexity of the difficulties these youth might present with upon entering a firesetting intervention program.

This study provides further evidence of the complex and diverse needs and challenges inherent in the youth firesetting population. It is imperative that professionals working with this population be aware of the potential for factors that could impact the ability of individuals and families to access, successfully engage with, and complete an intervention program. Comprehensive assessment that considers the context of other individual- and family-level factors, beyond a youth's fire involvement, which could pose challenges or create barriers to treatment is especially important to be able to provide informed care and intervention that is specific to and best serves an individual's unique needs. As was found in the present study in particular, academic and learning challenges, co-occurring mental health factors, and complex, adverse family dynamics can all create barriers to treatment for fire-involved youth. In the present study, participant attrition

occurred primarily due to a host of adverse family-level factors, including low caregiver motivation, disagreement between custodial parents, youth-caregiver conflict, poor caregiver health, child welfare involvement, and other barriers that occurred due to the transient, unstable living situations and caregiving environments of some youth. These factors not only emphasize the vulnerability of these youth, but how important it is to consider the broader context of the children and families referred for services, to reveal the specific treatment barriers that may be targeted to improve treatment engagement and outcome. Importantly, factors at the family-level, such as poor caregiver mental health or single-parent homes, can also impact on the level of child supervision and monitoring that can be provided in the home, as well as access to fire-starting materials, and are thus important to assess as possible treatment goals for fire-involvement as well as risk-factors for recidivism. The recently adopted holistic approach taken by the Ahikura Whānau-Centred Fire Education Programme in New Zealand is one example of a culturally-informed intervention that considers broader factors such as a participant's age, background, past behaviour and learning abilities to better serve the needs of their community and address declining referrals to their program. The complexity of the youth firesetting population also speaks to the relevance of interventions that are both multimodal and collaborative across the many disciplines involved in their care and well-being. Participant attrition in the present study additionally suggests that many of the most complex and vulnerable fire-involved youth are not being adequately represented in youth firesetting research, including the present study.

Fire-Specific Factors

Results for the fire specific variables revealed that youth were referred from a variety of sources (i.e., mental health agencies, child welfare agencies, family physicians, schools, probation services, and hospitals), with the majority being referred for either match/lighter play (19%) or for burning small objects (67%). A minority were referred for burning large objects (11%), or for burning themselves or someone else (4%), all of whom were adolescents aged 13 and above. These results are consistent with prior research (Pooley & Ferguson, 2017), and lend further support for a developmental progression from fire play and more minor fire experimentation in younger youth, to more serious and risky fire experimentation in adolescents, which is a developmental period when unsanctioned burning is also more likely to occur outside the home and in community settings, as well as more likely to be influenced by social media (Thomas, MacKay, & Salsbury, 2012) and "copycat" behaviour (Lambie, Randell, & McDowell, 2014). With ever younger children acquiring unsupervised access to social media, future research will be important to examine the impacts of social media on firesetting behaviour not only on adolescents, but across age groups. Further research is required to examine age differences between child and adolescent firesetting, to better inform assessment and treatment for these age groups.

The age of onset for fire involvement results revealed that for the majority of the sample, roughly half of these youth began their fire involvement, including match/lighter play, and/or unsanctioned burning, between the ages of 6 and 9 (with 44-46% engaging in match/lighter play, and 39-44% engaging in unsanctioned burning, depending on informant), and the other half at age 10 and above (with 39-48% engaging in

match/lighter play, and 39-48% engaging in unsanctioned burning, depending on informant). Only a minority of youth engaged in match/lighter play (7-15% depending on informant) or unsanctioned burning (4-8% depending on informant) at a very young age (i.e., at or below the age of 5), with a higher percentage (roughly double) of match/lighter play reported than unsanctioned burning at this age. Although reports slightly varied between caregivers and youth, with a greater percentage (roughly double) of youth reporting engaging in each of these behaviours at or below the age of 5, this is most likely explained by caregivers being unaware of covert fireplay, which is common (Del Bove, Caprara, Pastorelli, & Paciello, 2008). Additionally, given that under-reporting their own fire involvement is also common in youth not wanting to get into any further "trouble" (especially if they were not caught until they were older), and the fact that they may simply not be able to recall behaviours occurring when they were younger, it is important to consider that the youth-reported percentages, although higher than caregiver-reported percentages may still be an underestimate.

Effect of Treatment on Youth Fire Involvement and Fire Interest

The present study confirmed expectations of both lower levels of fire involvement, as well as lower levels of fire interest, post-intervention and at follow-up in all participants (i.e., hypothesis 1). Caregivers and youth in both condition groups reported a lower frequency of fire involvement post-intervention and at follow-up compared with their pre-intervention scores. In fact, there was no recidivism reported in either condition group; all caregiver and youth participants reported no unsanctioned youth firesetting post-intervention and at follow-up. These results represent a substantial reduction in youth firesetting after intervention. As anticipated, reduced frequency of

youth carrying matches and lighters also was also found post-intervention and at follow-up as reported by both caregivers (reducing from 69.2% to 4.5% at post-intervention, and ultimately to no reports of this behaviour at follow-up) and youth (reducing from 40.7% to 18.2% at post-intervention, and 14.3% at follow-up). Additionally, as expected, improvements were found in youth level of fire interest in both condition groups; that is, caregivers and youth both reported significantly reduced levels of youth fire interest after intervention. Interestingly, caregiver reports of youth fire interest showed significantly further improvement at follow-up compared to post-intervention, suggesting that the benefits of treatment weren't only maintained over time (as was found with the youth reports of fire interest), but enhanced with time. Contrary to expectations, no differences were found between the condition groups in fire involvement or fire interest at post-intervention or follow-up. With no recidivism found in either condition group, the expectation of lower frequency of fire-involvement in the modified TAPP-C intervention group compared to the FSE intervention group at post-intervention and follow-up was not supported. The expectation of lower levels of fire interest in the modified TAPP-C intervention group compared to the FSE intervention group was also not supported; regardless of condition group, caregiver and youth reports of youth fire interest improved (reflected by a decrease in scores) over time.

The results of this study showed substantially greater treatment efficacy at post-intervention in terms of recidivism compared to the Kolko (2001) RCT, with no unsanctioned youth firesetting reported post-intervention by youth or caregivers in the present study. Unlike the Kolko (2001) RCT, the present study did not include 1-year follow-up data; thus, longer-term comparisons cannot be made with regards to

recidivism. Regardless, the present study's result of no firesetting recidivism reported by youth or caregivers post-intervention and at 3-month follow-up is a significant contribution to the literature. Consistent with the Kolko (2001) RCT, results of the present study showed favourable results for all participants; regardless of condition group, significant reductions in fire involvement and fire interest were found after intervention. As only the second RCT of a firesetting intervention to be conducted (to our knowledge), these results represent a significant addition to the research literature, and provide further evidence that more intensive, structured, and manualized interventions might be more effective than brief, single-session interventions (typically conducted by fire services and comprising of a home safety visit) in reducing fire involvement behaviour. Although the FSE intervention in the present study was designed to mimic "service as usual," it is important to highlight that the FSE intervention was more intensive, structured, and manualized than standard FSE interventions used outside of Ontario.

The results of the present study showed that both interventions were effective in reducing youth firesetting and fire interest in the study sample. It is important to note that the sample size was ultimately smaller than was anticipated for the present study, which is a study limitation, but also not uncommon in clinical research. A replication of this study utilizing a larger sample size, as well as additional and longer follow-up periods (e.g., 1- and 2-years post-intervention), would be important to further investigate fire-specific treatment outcomes between interventions consisting of different components (i.e., FSE and MH components). It is possible that a larger sample would reveal group differences across the intervention condition groups. Additionally, it should be noted that

the finding of no recidivism in either of the intervention conditions differs from the 25% recidivism rate reported in the preliminary TAPP-C evaluation study (i.e., MacKay et al., 2004), a finding that may not be replicable with a similar large sample size (i.e., 200 fire-involved youth) and comparable, longer follow-up periods (i.e., 1 and 2 years).

Nonetheless, this finding has important implications given the current context of mental health service accessibility in Ontario, where levels of need are often much higher than the number of resources available to meet such needs, with long waitlists, high costs, and reductions in funding for mental health services. Given the often complex and diverse needs of the youth firesetting population, in particular the high prevalence of co-occurring mental health factors at both the individual- and family-level, further research could determine if individuals might be better served by a more tailored approach to intervention, whereby youth could be matched with treatment components that best serve their needs. Specifically, an approach where youth could be matched to either a stand-alone FSE intervention, or a combined intervention that includes both FSE and mental health components, subsequent to assessment of their particular risk factors and needs. Such an approach could improve accessibility to interventions.

Effect of Treatment on Youth Behavioural and Emotional Constructs

The present study was the first RCT to examine the benefits of intervention for broader behavioural and emotional constructs in the youth firesetting population. Contrary to expectations (i.e., hypothesis 2), the present study found significant improvements in reported behavioural and emotional difficulties in all youth post-intervention and at follow-up, compared with pre-intervention reports; additional benefits were not found for these constructs in the modified TAPP-C intervention condition

group. Surprisingly, no significant differences were found between the condition groups; youth in both intervention conditions were reported (by both caregivers and youth) to have significantly fewer behavioural and emotional problems (reflected by a decrease in scores on the Behavioural Symptoms Index [BSI], Externalizing Problems Composite [EPC], and Emotional Symptoms Index [ESI]) after completing their intervention. Significantly fewer behavioural and emotional problems were also found at 3-month follow-up for youth in both intervention conditions, suggesting that these improvements were maintained at follow-up, with the exception of the youth-reported ESI, where significant improvements were not maintained. A near-significant trend was found for the youth-reported Inattention-Hyperactivity Composite (IHC) scores over time, with scores decreasing over time (reflecting an improvement) as expected. It should be noted that the sample size was smaller for the IHC variable compared with the other generalized behavioural variables; as the SRP-Interview does not yield an IHC score, the youngest youth (ages 6 to 7) were not included in this variable. Thus, a more-limited sample size could explain why significant differences were not found over time for the IHC variable.

Although the finding of no additional benefits for the behavioural and emotional constructs in the modified TAPP-C intervention condition group was unexpected, it can possibly be explained by the smaller than expected sample size not having enough power to detect group differences. Again, a replication of this study utilizing a larger sample, with an expanded follow-up period, would be important to further investigate the effectiveness of these interventions in reducing behavioural and emotional difficulties in fire-involved youth, and any further benefits that might be provided by the addition of a mental health component. As was highlighted above, the youth firesetting population

presents with complex and diverse needs and challenges at both the individual- and family-level. It is therefore additionally plausible that for fire-involved youth and their caregivers, participating in any form of intensive, structured intervention involving multiple contacts with caring service providers, regardless of intervention content, could have a positive impact on a youth's generalized behavioural and emotional functioning, beyond their fire involvement. This could possibly explain the similar, favourable results of the two intervention conditions. Additionally, to equate dosage across the intervention conditions, modifications had to be made to the structure of the sessions, whereby the FSE intervention content was divided in a way to create an additional session, and the modified TAPP-C intervention content was combined in a way to reduce the number of sessions. Although the content of the sessions was not altered in any way, these structural changes to the number of contacts with service providers in the interventions could have impacted on treatment outcome. It is possible that the potential additional benefits of a mental health component in reducing generalized behavioural and emotional difficulties may have been lost when delivered in this more condensed format (i.e., fewer sessions delivered over a shorter period of time), and conversely, that the benefits of the FSE component may have been bolstered by being delivered in a more intensive manner with additional contacts than is typical in the TAPP-C program. The FSE intervention condition group also took, on average, twice as long as the modified TAPP-C intervention condition group to complete their intervention. It is possible that receiving their intervention over a longer period of time positively impacted treatment outcomes. Nonetheless, being the only RCT thus far to examine behavioural and emotional constructs (in addition to firesetting) in the youth firesetting population, the findings of

reduced behavioural and emotional problems subsequent to intervention represent a significant contribution to the research literature. Further research is needed to further investigate the efficacy of FSE and MH intervention components in reducing co-occurring emotional and behavioural problems inherent in the youth firesetting population. Future research should also investigate if widely-available brief, single-session interventions (such as those consisting solely of a home safety check by fire service professionals) pose similar benefits for behavioural and emotional constructs in this population.

Parental Relationship Perceptions and Youth Fire Involvement

The present study included measures of perceived parental competence and control, and parental cognitions and perceptions of the caregiver-child relationship, which are all previously unexplored areas in this population. The study confirmed negative caregiver perceptions of the child/adolescent-caregiver relationship, at pre-intervention (i.e., hypothesis 3a). Descriptive statistics (mean T-Scores) revealed that caregivers reported problematic perceptions of the child/adolescent-caregiver relationship at pre-intervention in three main areas: relational frustration, communication, and parenting confidence. As expected, the caregivers of fire-involved youth in the study reported high levels of stress/distress in relating to and controlling their youth's behaviour, a tendency to be overreactive and frustrated in common parenting situations, difficulties regarding the quality of information exchanged with their youth as well as their listening skills, and difficulties regarding their comfort, control and confidence in their parental role and in making parenting decisions. When examining the frequency distribution of caregiver scores falling within the normal, problematic, and significantly problematic ranges at pre-

intervention, it was found that almost half of the caregivers reported that attachment, as well as parenting confidence, was either problematic or significantly problematic in their relationship with their youth, and slightly more than half reported that implementing discipline practices with their youth was either problematic or significantly problematic. A majority of caregivers additionally reported that communication was either problematic or significantly problematic with their youth. Approximately a third of caregivers reported problems or significant problems with their level of involvement with their youth and with relational frustration, as well as with their level of satisfaction that their youth's school is meeting the youth's needs. Taken together, these results show that, as expected, caregivers of fire-involved youth perceive many aspects of their relationship with their youth to be problematic. This finding is consistent with previous findings of adverse effects on families of children with externalizing behaviours in general (Donenberg & Baker, 1993), as well as on families of children with firesetting behaviour, whereby firesetting behaviour has been linked to dysfunctional and maladaptive parenting practices (Bailey et al., 2001; Becker et al., 2004; Bradford & Dimock, 1986; Dadds & Fraser, 2006; McCarty & McMahon, 2005; Ritvo, Shanok, & Lewis, 1983), disruption in family relationships and parenting practices (Kolko & Kazdin, 1990), and higher levels of negative family interactions (Lambie et al., 2013; Vreeland & Waller, 1980). This study was the first, to our knowledge, to specifically examine caregiver perceptions and cognitions of the caregiver-child relationship in the youth firesetting population; these findings confirm that the caregiver-child relationship is an important area of inquiry in this population, and thus, represent a significant addition to the youth firesetting literature. Further research, with a larger sample, would be important to both

replicate and expand upon these findings. The reciprocal relationship between caregiver cognitions/parenting practices and child behaviour is important to understand for both assessment and intervention; a potential area for future research would be to examine youth cognitions and perceptions of the caregiver-child relationship in the youth firesetting population.

Parental Locus of Control and Youth Fire Involvement

Although normative data is not available to permit statistical comparisons utilizing the parental locus of control pre-intervention data, the descriptive results suggest that the caregivers of fire-involved youth might have a more external locus of control when compared with two experimental parent groups: a group of parents who reported no difficulties on many dimensions related to the concept of parental locus of control, and a group of parents reporting parenting difficulties (experimental means for these parent groups are from Campis, Lyman, & Prentice-Dunn [1986]). Specifically, they were more external in terms of how effective they feel in their parenting role, as well as in their belief that parenting and child behaviour is influenced by external factors such as fate or chance. To our knowledge, the present study was the first to examine PLOC in the context of youth fire involvement. These preliminary findings suggest that fire-involvement may be associated with a more externalized PLOC orientation, which is consistent with previous links found between an externalized PLOC orientation and externalizing behaviour problems in children (Mouton & Tuma, 1988; Roberts et al., 1992). Additionally, these findings suggest that caregivers of fire-involved youth may be even more externalized in their PLOC orientation compared to caregivers reporting parenting problems in general. It is possible that the heightened seriousness of firesetting

behaviours, as well as the complex needs and challenges of the youth and families in this population, could be contributing to a more externalized PLOC orientation in these caregivers. Additional research is necessary to investigate PLOC orientation in caregivers of fire-involved youth, and how their orientation might compare with caregivers of youth displaying other forms of externalizing behavioural difficulties. As has been posited in the literature on child externalizing behaviours in general (i.e., McCabe et al., 2008; Morton, 1997; Roberts et al., 1992), future research should also investigate whether PLOC operates in a bi-directional manner in the youth firesetting population, whereby it may contribute to the development of fire-involved behaviours, as well as be impacted by these behaviours.

Relationships Among Parenting Constructs: Parental Self-Efficacy, Locus of Control, and Relationship Perceptions

The study expectations of relationships among the parenting variables at pre-intervention (i.e., hypothesis 3b) were partially supported. As expected, a significant negative relationship was found between parental locus of control and parental self-efficacy, such that caregivers with a more external locus of control had poorer parental self-efficacy, and caregivers with a more internal locus of control had better parental self-efficacy. Additionally, as expected, significant relationships were found between parental locus of control and 4 areas pertaining to caregiver perceptions of the child/adolescent-caregiver relationship: attachment, communication, parenting confidence, and relational frustration. Specifically, caregivers with a more external locus of control perceived more problems in their attachment, communication and parenting confidence, as well as more relational frustration, in their relationship with their youth, and caregivers with a more

internal locus of control perceived fewer of these problems and less relational frustration in their relationship with their youth. Contrary to expectations, significant relationships were not found between parental locus of control and caregiver perceptions of their ability to implement discipline practices, their level of involvement with their youth, or their satisfaction that their youth's school is meeting their needs; however, the direction of these relationships were negative, as expected. This may suggest that caregiver perceptions in these areas are not related to, nor impacted by, their locus of control orientation. Finally, as expected, a significant positive relationship was confirmed between parental self-efficacy and caregiver perceptions of their parenting confidence, such that caregivers with better parental self-efficacy also perceived themselves to have greater confidence in their parenting abilities, and caregivers with poorer parental self-efficacy also perceived themselves to have less confidence in their parenting abilities. This is the first study, to our knowledge, to examine relationships among these parenting constructs in the context of youth firesetting. The study findings confirmed significant relationships between these constructs; thus, parental locus of control, parental self-efficacy, and caregiver perceptions of the child/adolescent-caregiver relationship are relevant areas of study in youth firesetting research and warrant further investigation.

Relationships Between Parental Constructs and Youth Fire-Specific and Behavioural Constructs

Positive and negative relationships were expected between the parenting variables (including parental locus of control, parental self-efficacy and caregiver perceptions of the child/adolescent-caregiver relationship), and the youth- and caregiver-reported fire-specific and generalized behavioural variables at pre-intervention (i.e., hypothesis 3c);

the study results confirmed several significant relationships among these variables. Extreme heterogeneity in our sample precluded some of the planned correlation analyses for these variables, which is a study limitation. Given that the assumptions for Pearson's r correlations were not met for both the caregiver-reported and youth-reported frequency of unsanctioned firesetting variables, the caregiver report of youth fire interest variable, and the youth-reported emotional symptoms variable, with extreme non-normality found for these variables, relationships between these variables and the parenting variables could not be examined. It is possible that a larger, more normalized study sample would enable further study of the relationships between these variables, which is an area for future research.

Several significant relationships were confirmed between caregiver perceptions of attachment, parenting confidence, and relational frustration, and caregiver-reported youth behavioural symptoms, at pre-intervention. As expected, caregivers that reported poorer attachment and parenting confidence, as well as increased relational frustration within the context of the caregiver-youth relationship, also reported greater youth behavioural symptoms, and caregivers that reported greater attachment and parenting confidence, as well as decreased relational frustration within the context of the caregiver-youth relationship, also reported fewer youth behavioural symptoms. A significant positive relationship was also confirmed between caregiver perceptions of relational frustration and caregiver-reported youth externalizing problems in particular, whereby caregivers that reported increased relational frustration within the context of the caregiver-youth relationship also reported greater youth externalizing problems, and caregivers that reported decreased relational frustration within the context of the caregiver-youth

relationship also reported fewer youth externalizing problems. This is the first study, to our knowledge, to examine relationships between parenting constructs (including parental locus of control, parental self-efficacy and caregiver perceptions of the child/adolescent-caregiver relationship), and fire-specific and generalized behavioural variables, in the youth firesetting population. Further research is still required to replicate these findings. It is important to emphasize that these findings are correlational in nature, and therefore do not confirm causal relationships between these constructs; however, the findings are still an important initial investigation of these constructs in the youth firesetting population and provide further evidence that the parent-child relationship is a highly relevant area of inquiry in this population. Parental cognitions, in general, have been shown to play an important role in parent-child relationships (Bugental & Johnston, 2000), whereby they can operate in a reciprocal way, by not only contributing to parenting behaviour and thus, a child's behaviour, but they can also be affected by the behaviour of the child being parented (Ohan, Leung, & Johnston, 2000). The finding of significant relationships between parental cognitions and youth behaviour in the youth firesetting population is consistent with these previous findings. Further research, in particular an investigation of whether causal relationships exist between these constructs, could reveal if these parental factors specifically influence and contribute to youth firesetting behaviours, factors that could then be assessed and more-specifically targeted for change in firesetting interventions. In particular, interventions which already include parenting strategies and skills as a treatment component (i.e., the caregiver PMT component of TAPP-C), would directly benefit from such research, as it would further validate this treatment component.

Contrary to expectations, no significant relationships were found between any of the parenting variables and youth-reported fire interest at pre-intervention; thus, parental locus of control, parental self-efficacy, and parental perceptions of the child/adolescent-caregiver relationship were not significantly related to youth-reported fire interest at pre-intervention. This suggests that these parenting constructs are not directly related to youth fire interest, per say. Additionally, no significant relationships were found between parental locus of control and parental self-efficacy, and any of the caregiver- and youth-reported generalized behavioural variables; thus, contrary to expectations, parental locus of control and parental self-efficacy were not significantly related to generalized behavioural difficulties in the youth at pre-intervention. However, as discussed above, PLOC and parental self-efficacy were both found to be significantly related to many areas pertaining to caregiver perceptions of the child/adolescent-caregiver relationship, including attachment, communication, parenting confidence, and relational frustration. Interestingly, caregiver perceptions in the areas of attachment, parenting confidence, and relational frustration were found to be significantly related to youth behavioural symptoms, which is perhaps suggestive that an indirect relationship might exist among these constructs, whereby PLOC and parental self-efficacy may impact upon parental cognitions, which may then impact upon youth behaviour. Additionally, the small sample size of the study limits statistical power; thus, it is also possible that significant relationships among these constructs were missed. Further research, with a larger sample size, is required to replicate the significant relationships found in the present study, as well as to further investigate the relationships among these constructs.

Effect of Treatment on Parental Self-Efficacy and Locus of Control

The present study was the first to examine the impacts of intervention on parental self-efficacy and PLOC in the youth firesetting population. Greater benefits were expected for caregivers in the modified TAPP-C intervention condition group, given that these participants received PMT as part of the mental health component. Caregivers who received the modified TAPP-C intervention were expected to show higher parenting self-efficacy and a more internalized parental locus of control post-intervention and at follow-up, compared with their pre-intervention reports and compared with caregivers in the FSE condition group. Contrary to expectations (i.e., hypothesis 3d), no significant differences were found between the intervention condition groups on the PLOC or parental self-efficacy variables. Caregiver PLOC Score did not show statistically significant improvement from pre-intervention to a more internalized parental locus of control (reflected by a decrease in scores) at post-intervention or follow-up, nor did it significantly differ between the two condition groups at post-intervention or follow-up. However, results trended in the expected direction, with mean PLOC scores showing a decrease (indicating a more internalized parental locus of control) at post-intervention compared with pre-intervention. This decrease was not maintained at follow-up, whereby mean scores increased. Parental self-efficacy also did not show statistically significant improvement (reflected by an increase in scores) at post-intervention or follow-up compared with pre-intervention, nor did it significantly differ between the two condition groups at post-intervention or follow-up. Similar to the PLOC results, the parental self-efficacy results trended in the expected direction over time, with mean scores showing increases (indicating greater parenting self-efficacy) at post-intervention and follow-up,

compared with pre-intervention. The small sample size of the study likely limited statistical power and could possibly explain the lack of significant results. The fact that trends were noted in expected directions for both the parental self-efficacy and PLOC variables over time is promising that differences might be revealed with a larger sample size, and suggests a direction for future research. Due to the smaller than expected sample size for the study, the number of planned analyses had to be reduced; thus, analyses to examine the impact of intervention on parental cognitions were not conducted. Future research, with a larger sample size, should examine the impact of firesetting intervention on parental cognitions. It thus remains unknown whether firesetting interventions positively impact parental self-efficacy, PLOC, or caregiver perceptions of the child/adolescent-caregiver relationship; however, given that parental interventions for externalizing behavioural problems in other populations (i.e., ADHD and Asperger disorder) have been shown to benefit these parental constructs, further research is important.

Executive Functioning and Impulsivity in Fire-Involved Youth

The present study included executive function (EF), impulsivity, and readiness to change as exploratory areas of inquiry. Results confirmed that caregivers reported deficits in EF for their youth, and that youth demonstrated impaired performance on an impulsivity task, at pre-intervention (i.e., hypothesis 4a). Consistent with expectations, caregiver-reported scores placed youth within the clinically elevated range for all of the EF variables at pre-intervention. Youths were reported to exhibit executive dysfunction consistently across the clinical subscales, as was indicated by a clinically elevated EF summary score (i.e., GEC). Specifically, youths exhibited dysfunction in their ability to

cognitively manage attention and problem solving in a variety of contexts, and to use planning and organization skills while sustaining task completion in working memory (indicated by clinically elevated scores on the Metacognition subscale). They also exhibited dysfunction in their ability to maintain appropriate regulatory control of their behaviour and emotional responses (indicated by clinically elevated scores on the Behavioural Regulation subscale), abilities that are considered to be a precursor to appropriate metacognitive problem solving. Notably, more than half (56%) of the youth received scores in the clinical range on the BRI, and a majority (72%) of the youth received scores in the clinical range on the MI. Sixty-four percent of youth received scores in the clinical range on the GEC. This is the first study, to our knowledge, to examine EF in the youth firesetting population; the finding of a significant EF deficit in fire-involved youth, thus, represents an important contribution to the literature. This finding is consistent with previous research findings of EF deficits in other populations of children with behavioural problems, such as ADHD (e.g., Schmitt et al., 2012) and alcohol-exposed children (Brown et al., 2022; Kodituwakku et al., 2001). This finding has important implications for firesetting interventions, as EF can be targeted in treatment through teaching skills to decrease impulsivity and improve problem-solving (which are both constructs related to EF). TAPP-C already includes teaching these skills as part of the child CBT component of the intervention; the study finding of a significant EF deficit in fire-setting youth further validates the use of this treatment component. Although this study measured EF using one of the most commonly used measures of EF (i.e., the BRIEF) (Toplak, West & Stanovich, 2013), future research (using larger sample sizes)

should also include additional measures of EF, including individual performance-based tests, to further understand, replicate and validate this finding.

Consistent with expectations, results additionally confirmed that youth performance on an impulsivity task was very poor (i.e., falling within the 3.3 to 6.7 percentile range), reflecting significant difficulties with sustained attention and impulse control. Of note, all youth performed at or below the 57th percentile, with a majority (76%) performing at or below the 20th percentile. Almost half of the youths performed only at or below the 1st percentile. Impulsivity has previously been identified as a risk factor for firesetting behaviour (Geller, 1992; McCarty & McMahon, 2005; Sakheim & Osborn, 1986); these findings are consistent with this research and suggest that fire-involved youth are greatly impaired in terms of their ability to demonstrate impulse control. This finding is not surprising given the high rate of co-occurrence of ADHD found in the study sample, a disorder that presents with symptoms of impulsivity. This finding also has important implications for firesetting interventions, as it further validates the use of CBT components that specifically teach skills to decrease impulsivity. The findings of both an EF deficit and significant impairment on an impulsivity task in fire-involved youth represent a significant contribution to the literature. These results are considered preliminary, particularly given the small sample size, but are suggestive of important areas to investigate in future research with the youth firesetting population.

Relationships Among Cognitive, Fire-Specific and Behavioural Constructs

Surprisingly, no significant relationships were found between the EF and impulsivity variables at pre-intervention (i.e., hypothesis 4b), despite findings of both a significant EF deficit and significantly impaired performance on the impulsivity task in

the youth at pre-intervention. One possible explanation for this finding is that limited statistical power, due to the small sample size of the study, caused significant relationships between these constructs to be missed. The data for these constructs was also collected via different informants and sources (i.e., caregiver report via questionnaire for the EF data, and youth task performance for the impulsivity data), which may have impacted the findings. Further research, with a larger sample size and additional measures, is required to further investigate the relationship between EF and impulsivity in the youth firesetting population, particularly given the extent of the deficit and impairment this study found in these constructs.

Significant positive relationships were confirmed between EF and youth-reported fire interest, as well as between EF and generalized behavioural difficulties as reported by caregivers (i.e., hypothesis 4b). As expected, a greater overall EF deficit was significantly associated with more behavioural problems in the youth (as per caregiver reports), as well as greater youth-reported fire interest, and vice versa. This was also the case for the subscale measures of EF; specifically, greater deficit in the aspects of EF related to behavioural regulation was significantly associated with more youth behaviour problems (as per caregiver reports) and greater youth-reported fire interest (and vice versa), and greater deficit in metacognitive EF abilities was significantly associated with more youth behaviour problems as reported by caregivers (and vice versa). Although these preliminary findings are correlational in nature and therefore do not confirm a causal relationship between EF and youth fire interest and behavioural problems, they do suggest that EF is linked to fire interest and behavioral problems in fire-involved youth. The next step for research would be to replicate these findings with a larger sample.

Furthermore, establishing if a causal relationship exists between EF and youth fire interest and behavioural problems is a future area of study, and could have important implications for what could be relevant to specifically target in firesetting intervention. Surprisingly, performance on the impulsivity task was not significantly related to youth-reported fire interest or the generalized behaviour variables at pre-intervention. Although the present study did find significant impairment in performance on the impulsivity task in the youth at pre-intervention, results did not establish links between performance on this task and youth fire interest and behaviour problems. It is possible that, due to the study's small sample size, relationships between these variables were missed. Future research should further investigate links between impulsivity, fire interest and behavioural problems in fire-involved youth using larger sample sizes, as well as additional measures of impulsivity, including other performance-based tests. Extreme heterogeneity in our sample also precluded some of the planned correlation analyses pertaining to the EF and impulsivity variables, which is a study limitation. As extreme non-normality was found for both the caregiver-reported and youth-reported frequency of unsanctioned firesetting variables, the caregiver report of youth fire interest variable, and the youth-reported emotional symptoms variable, relationships between these variables and the EF and impulsivity variables could not be examined. Again, it is possible that a larger, more normalized study sample would enable further study of relationships between these variables, which is an area for future research. This is the first study, to our knowledge, to explore relationships between EF and impulsivity, and fire interest and behavioural problems in fire-involved youth; the findings of many significant

relationships among these constructs are therefore an important contribution to the research literature.

Effect of Treatment on Youth Impulsivity

Consistent with expectations (i.e., hypothesis 4c), findings confirmed that youth performance on an impulsivity task (i.e., the Walk, Don't Walk subtest of the TEA-Ch) significantly improved after intervention for youth in the modified TAPP-C intervention group; youth in the FSE intervention group did not show a significant improvement in performance after intervention. These results are not surprising, given that the modified TAPP-C intervention taught skills to decrease impulsivity and improve problem solving as part of the youth CBT component, a component not included in the FSE intervention. The present study was the first to examine the impacts of intervention on impulsivity in the youth firesetting population. This is the first study to show that a firesetting intervention that includes a mental health component can have a positive impact on impulse control ability in a sample of fire-involved youth, a benefit not found for youth that did not receive a mental health component as part of their firesetting intervention. This finding is particularly important considering the present study's finding of significant impairment in impulse control ability in the youth sample prior to beginning their interventions. Impulsivity has been previously identified as a risk factor for firesetting behaviour (Geller, 1992; McCarty & McMahon, 2005; Sakheim & Osborn, 1986), and these findings thus have important implications for youth firesetting intervention, as they further validate the use of CBT components that specifically teach skills to decrease impulsivity. Next steps for research include replicating these findings with a larger sample size and using additional measures for impulsivity, as well as

including follow-up data to examine if this treatment benefit is maintained over time. A smaller sample size and lack of follow-up impulsivity data are limitations in the present study. Future research should also examine how improved impulsive control in fire-involved youth after intervention impacts on firesetting recidivism, and well as other generalized behavioural problems. Although no recidivism was found in the present study for youth in either of the intervention condition groups, further research, using a larger sample size, is still necessary before drawing conclusions regarding the specific benefits, or lack thereof, of firesetting intervention treatment components. More research is required to further investigate the relationship between impulsivity and firesetting behaviour in fire-involved youth, as well as how the presence of ADHD, which is a highly prevalent co-occurring disorder related to impulse control in this population, might impact upon this relationship.

Effect of Treatment on Youth and Caregiver Readiness to Change

The present study confirmed improvements in readiness to change after intervention for youth and caregivers in both intervention conditions (i.e., hypothesis 4d); however, contrary to expectations, no additional benefits were found for youth and caregivers in the modified TAPP-C intervention, as no significant differences were found between the intervention condition groups on any of the readiness to change measures after intervention. Regardless of condition group, youth readiness to change, as measured by the Readiness to Change Ruler, significantly improved after treatment, an improvement which was maintained at follow-up. Caregiver readiness to change, as measured by the Readiness to Change Ruler, also improved (reflected by an increase in scores) after treatment, regardless of condition group; however, significant improvement

was only found at follow-up, suggesting that the full impact of this treatment benefit is delayed for caregivers. One possible explanation for this delay could be that caregiver readiness to change was further positively impacted by other positive changes after intervention, particularly the finding of no recidivism at follow-up. Contrary to predictions, on the URICA measure of readiness to change, adolescent participants did not show statistically significant improvement with treatment over time, or between the two condition groups at post-intervention or follow-up. However, it is possible that the study's small sample size, which was even smaller for this measure (i.e., only adolescent participants completed the URICA), limited statistical power and could possibly explain the lack of significant results for this variable, as well as the lack of significant results between the condition groups on all readiness to change measures.

Readiness to change has not been previously explored in the youth firesetting population, and the present study was the first RCT to examine the impacts of intervention on readiness to change in fire-involved youth as well as their caregivers. Although the modified TAPP-C intervention was not found to provide additional benefit for youth and caregiver readiness to change, the present study's findings of improvements in readiness to change for youth and caregivers after receiving either intervention are an important additional to the research literature. These findings help to validate that firesetting interventions, with or without the addition of a mental health component, can significantly improve motivation to address and change fire-related behaviours not only in fire-involved youth, but also in their caregivers. A replication of this study utilizing a larger sample, would be important to further explore the effectiveness of these interventions for improving readiness to change in fire-involved

youth and their caregivers, and any further benefits that might be provided by the addition of a mental health component that targets such motivation via motivational interviewing (MI). Future research should also investigate if brief, single-session interventions show similar benefits for readiness to change in this population.

Limitations

It is important to note some limitations to the present study. The study sample was limited to the referral base for the TAPP-C program, and as fewer than typical referrals were received over the course of the study than was expected based on referral history within the program, it resulted in a smaller than expected sample size. Additionally, as is not uncommon in clinical research with complex populations, many of the referred youth failed to meet the study's inclusion/exclusionary criteria, and there was also some participant attrition after enrolment; both of these factors contributed to further reducing the study sample size. The small sample size limits the validity and generalizability of the study findings, and the findings should thus be considered preliminary. Replication of the study findings with larger samples, as well as additional, longer follow-up periods, is required before drawing firm conclusions. Small sample sizes are not uncommon in clinical research, so it is important to highlight that this limitation is not unique to the present study.

The smaller than expected sample size also likely limited statistical power, which may have impacted the findings. Limited statistical power could explain the lack of significant findings, in particular, the lack of significant differences found between the intervention condition groups for most of the constructs investigated, as well as the lack of significant relationships among some of the study constructs. Additionally, the number

of planned analyses for the present study had to be reduced due to the smaller than expected sample size, narrowing the study's scope of findings. Extreme heterogeneity in our sample precluded some of the planned correlation analyses, which is another study limitation. It is possible that a larger, more normalized study sample would enable further study of the relationships between the study variables, which is an area for future research.

A further limitation of the present study was adherence to research protocol. Despite the research protocols in place, some deviations from this protocol did occur (as was described in the "procedure" section above), which is to be expected when working in a clinical setting, compared with the high level of control that can be achieved when conducting research in laboratories. The study involved working with complex clients who had diverse needs (e.g., residential care, child welfare involvement, transient living arrangements and/or inconsistency in caregivers, caregiver mental health needs, single-parent households, financial difficulties), as well as collaboration and coordination across multiple service providers including researchers, clinicians, fire educators, and in many cases, child welfare workers, foster parents, and residential care staff. Clinical research occurs in the "real world." It is a balancing act, a constant give and take process to manage and satisfy both the clinical needs of the research participants, and the need for empirical research to be conducted in a controlled, systematic, and rigorous manner. Although we implemented structured research protocols, we also desired the interventions used in the study to mimic, as much as possible, "service as usual" to ensure ecological validity; that is, we aimed to have the methods, materials and settings of the study approximate the real-world implementation of these interventions. Thus, while we

always strove to uphold the demands of our rigorous research protocol, at times this had to be balanced with the complex clinical needs of the participants and the, sometimes, competing goals of the service providers involved. For example, rightly so, the first priority of fire educators and clinicians is to serve their clients to the best of their ability, which at times can compete with the goals of researchers for rigorous study when it is in the best interest of the client to deviate from research protocol.

Finally, the study sample included predominantly male youth, which is another study limitation. Although this is consistent with the male-dominated samples reported in the youth firesetting literature (e.g., Sambrooks, Olver, Page & Gannon, 2021), future research should attempt to include more females to not only improve generalizability of findings, but also to explore potential differences across gender in firesetting behaviours. Caregivers in the study sample were also predominantly female; future research should also explore the perspective of male caregivers of fire-involved youth, as well as the relative benefits of firesetting interventions for male caregivers.

Conclusion

Fire involvement by children is a dangerous behaviour associated with significant costs to society, including property damage, injuries, and fatalities. While interventions are necessary to address this dangerous and costly behaviour, data on the efficacy of existing interventions for firesetting children and youth is limited, and the literature thus far has only included a single RCT (i.e., Kolko, 2001). The present study tested the TAPP-C protocol, an enhanced model of service delivery for firesetting youth that includes a mental health component provided by mental health professionals. At the current time, the TAPP-C protocol is the intervention for juvenile firesetters used in most

jurisdictions in Ontario; beyond Ontario, FSE is the standard intervention. The present study was a RCT that examined the relative benefits of a multimodal, collaborative firesetting intervention by comparing a modified TAPP-C protocol, which included both fire service and mental health components, to the most common treatment, which is FSE alone. The study was designed to examine change across domains that tap fire-specific safety knowledge, attitudes, and behaviors, and was the first to additionally examine change across broader indices of behavioural and emotional well-being.

Contrary to expectations, the results of the present study showed that both interventions were effective in reducing youth firesetting and fire interest (consistent with results of the Kolko [2001] RCT), as well as youth behavioural and emotional difficulties; greater benefits were not seen for participants who received the modified TAPP-C intervention. Remarkedly, no unsanctioned youth firesetting was reported post-treatment or at 3-month follow-up for either intervention condition group, reflecting substantially greater reduction in this behaviour compared with results from the Kolko (2001) RCT, and further validating the efficacy of both combined interventions (that include FSE and mental health components) and stand-alone FSE interventions in reducing fire involvement. It is possible that limitations, including a smaller than anticipated sample size (not uncommon in clinical research) and subsequent limited statistical power, could possibly explain the lack of significant differences found between the two interventions. It is also important to highlight that although the FSE intervention was designed to mimic “service as usual,” it was still more intensive and structured than standard FSE interventions used outside of Ontario, which could possibly explain the similar, favourable results of the two intervention conditions. Additionally, the smaller

than anticipated sample size and lack of longer-term follow-up periods in the present study limits the validity and generalizability of the results. In particular, the favourable recidivism results may not be replicable with a larger sample size and at longer follow-up periods.

The present study was the first to examine parental cognitions and perceptions of the caregiver-child relationship, as well as perceived parental competence and control, in a sample of fire-involved youth. Results confirmed, as expected, negative caregiver perceptions of the caregiver-child relationship, specifically in the areas of relational frustration, communication and parenting confidence, which is consistent with previous findings of adverse effects on families of children with externalizing behaviours in general (Donenberg & Baker, 1993), and children with firesetting behaviour (Bailey et al., 2001; Becker et al., 2004; Bradford & Dimock, 1986; Dadds & Fraser, 2006; Kolko & Kazdin, 1990; Lambie et al., 2013; McCarty & McMahon, 2005; Ritvo, Shanok, & Lewis, 1983; Vreeland & Waller, 1980). The preliminary findings on parental locus of control (PLOC) also suggest that fire-involvement may be associated with a more externalized PLOC orientation, which is consistent with previous findings of links between an externalized PLOC orientation and externalizing behaviour problems in children (Mouton & Tuma, 1988; Roberts et al., 1992). Significant relationships were also confirmed among the parenting constructs. In particular, caregivers with a more external PLOC had poorer parental self-efficacy and also had more negative perceptions of the caregiver-child relationship (and vice versa). Significant relationships were additionally confirmed between caregiver perceptions of the caregiver-child relationship and caregiver-reported youth behavioural symptoms, with more negative perceptions

being associated with more behavioural problems, and vice vera. Promising trends were noted in expected directions when the impact of intervention on parental self-efficacy and PLOC was examined, with PLOC becoming more internalized and parental self-efficacy increasing in all caregivers post-intervention. These novel, preliminary findings suggest that further research is warranted on these previously unexplored parenting constructs within the youth firesetting population. In particular, if causal or reciprocal relationships are found between these parental constructs and youth generalized and fire-specific behavioural problems, it could identify new areas to target in firesetting interventions. Additionally, further research examining the impact of firesetting interventions on parental constructs would help to further validate interventions that include a PMT component, such as TAPP-C.

The present study investigated several exploratory areas of inquiry, and had several important, novel findings in the areas of executive function (EF), impulsivity and readiness to change. This is the first study, to our knowledge, to examine EF in the youth firesetting population, and the results confirmed expectations of a youth deficit in EF. Greater EF deficit was also found to be significantly related to greater youth-reported fire-interest, as well as more generalized behavioural difficulties. These findings represent an important new contribution to the research literature and are consistent with previous findings of EF deficits in other populations of children with behavioural problems (e.g., ADHD). Consistent with expectations, results additionally confirmed that youth performance on an impulsivity task was very poor, suggesting that fire-involved youth are greatly impaired in terms of their abilities to both sustain attention and demonstrate impulse control. This finding is consistent with previous research identifying

impulsivity as a risk factor for firesetting behaviour (Geller, 1992; McCarty & McMahon, 2005; Sakheim & Osborn, 1986). Significant relationships were confirmed between EF and both fire-interest and generalized behavioural difficulties, with greater EF deficit being associated with greater youth-reported fire interest, as well as more behavioural problems, and vice versa. This was also the first study to examine the effect of firesetting intervention on impulsivity. Consistent with expectations, only youth that received the modified TAPP-C intervention group showed significant improvement in performance on an impulsivity task after intervention, which shows that firesetting interventions that include a mental health component can have additional benefits not found in stand-alone FSE interventions. These findings all have important implications for firesetting interventions, as EF skills and impulsivity can be targeted in treatment. They also further validate the use of CBT components (such as the TAPP-C child CBT component) that specifically teach skills to decrease impulsivity and improve problem solving, which are both related to EF. Treatment was also found to benefit readiness to change. The study confirmed, as expected, that readiness to change improved for both caregivers and youth after intervention; however, no additional benefits were found for those who received the modified TAPP-C intervention. Motivation to address and change behaviour is an important factor for success in any form of intervention; the finding that both interventions positively impacted readiness to change in youth and caregivers lends further support to the efficacy of these interventions. Taken together, these exploratory findings suggest exciting new areas to investigate in the youth firesetting population.

The study findings should be considered preliminary, and replication with larger samples as well as additional, longer follow-up periods, is required before drawing

conclusions regarding the relative efficacy of FSE and combined, collaborative intervention approaches that additionally include a mental health component. Nonetheless, as only the second RCT of a firesetting intervention to be conducted (to our knowledge), the results represent a significant addition to the research literature, and provide further evidence that more intensive, structured, and manualized interventions might be more effective than brief, single-session interventions in reducing fire involvement behaviour. The novel findings of reduced behavioural and emotional problems in fire-involved youth subsequent to firesetting intervention are also a significant contribution that warrants further examination. Future research should investigate if widely-available (beyond Ontario) brief, single-session interventions (such as those consisting solely of a home safety check by fire service professionals) pose similar benefits for fire-specific, behavioural and emotional constructs in this population. Consistent with previous findings for the youth firesetting population, many youth in the study sample presented with complex needs and challenges at both the individual- and family-level, including a high prevalence of co-occurring mental health factors, academic and learning challenges, and adverse family dynamics. The complexity of the youth firesetting population speaks to the relevance of interventions that are both multimodal and collaborative across the many disciplines involved in their care and well-being. Future research should explore whether fire-involved youth could be better served by a tailored approach to intervention that matches youth with an intervention that delivers the component(s) that best serve their assessed needs, which could additionally improve treatment accessibility. The present study strengthens the existing literature and contributes to the establishment of best practice intervention by providing additional

preliminary data on the relative efficacy of FSE and combined, collaborative approaches that include a mental health component.

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