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An Examination of Risk Factors for Adolescent Engagement in Directly and Indirectly Self-Injurious Behaviours

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Abstract

Research identifying similar and dissimilar risk factors for directly and indirectly self-injurious behaviours among adolescents is scarce. Due to the wide range of physical and mental health difficulties that may result from self-injurious behaviours, understanding differential risks is important to support at-risk adolescents. To address this gap in the literature, 541 clinically referred children and youth (ages 11-18 years old) were assessed using the interRAI Child and Youth Mental Health Assessment (ChYMH) and Adolescent Supplement. Logistic regression analyses revealed that older adolescents were at an increased risk for both direct and indirect self-injury. Moreover, adolescents who experienced high levels of depressive symptoms, caregiver distress, and neighbourhood violence were at an increased risk for direct self-injury (i.e., nonsuicidal self-injury, suicidal self-injury). In contrast, adolescents who experienced high levels of aggressive behaviour were at an increased risk for indirect self-injury (i.e., substance use). Implications for targeted prevention and intervention strategies are discussed.

Keywords: direct self-injury, NSSI, SSI, indirect self-injury, substance use, interRAI

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Introduction

Adolescence is among the most turbulent transitional stages in a person's life, characterized by significant physical, cognitive, emotional, and social changes (Dahl, 2004). Some adolescents are able to navigate this developmental period with little or no major problems, while others experience difficulties in controlling their emotions and behaviours (Arnett, 1999). The social environment of adolescents must provide an appropriate amount of support, including a balance of interest and supervision from responsible adults, in order to promote the development of adaptive affect regulation and self-control (Dahl, 2004). Thus, familial and community influences are highly impactful as adolescents gain autonomy from their parents and develop a sense of identity by incorporating preferred attitudes and behaviours.

Although adolescents experience noteworthy enhancement in cognitive abilities including reasoning and abstract thinking, adolescents also demonstrate heightened sensation seeking (Dahl, 2004). Consequently, adolescence represents a period of amplified risk for poor decision-making due to their proclivity to seek highly arousing experiences (Martin et al., 2002). Indeed, during emotionally demanding situations, too often otherwise capable and intelligent adolescents display a compromised capacity for making healthy decisions and planning for the future (Albert & Steinberg, 2011; Dahl, 2004). For example, engagement in risky or self-injurious behaviours including physical violence, non-suicidal and suicidal self-injury, substance use, promiscuity, participation in abusive relationships, and other anti-social behaviours increases in adolescence (Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; Gardner & Steinberg, 2005; Hamza, Willoughby, & Heffer, 2015; St. Germain & Hooley, 2012; Whitlock et al., 2013). This

propensity towards emotionally influenced decisions while disregarding potential risks among adolescents is likely due to the rapid maturity of their limbic system (involved in emotion, motivation, memory, and learning) in contrast to the readiness of their prefrontal cortex (involved with executive functioning, working memory, problem solving, planning, and reasoning; Casey, Jones, & Somerville, 2011).

Poor decision-making and engagement in risky behaviours among adolescents is both physically and psychologically hazardous due to potential risks and serious consequences such as severe bodily harm or intense emotional disturbances. Nonetheless, adolescents commonly make poor decisions, engaging in risky behaviours that are both directly and indirectly dangerous for themselves and persons around them. Particularly concerning risky behaviours commonly reported by adolescents include two practices of self-injurious behaviours: 1) direct self-injury, which includes non-suicidal self-injury (NSSI) and suicidal self-injury (SSI), and 2) indirect self-injury, such as substance use (St. Germain & Hooley, 2012; Whitlock et al., 2013). Understanding the motivations and functions associated with self-injurious behaviours among adolescents is the first step towards developing prevention and intervention strategies for reducing or eliminating these behaviours.

Self-injurious behaviours have been described as methods for coping with and regulating intense emotions (Andrews, Martin, & Hasking, 2012; Chapman, Gratz, & Brown, 2006). Correspondingly, engagement in direct or indirect self-injury may be an attempt to escape or regulate overwhelming emotions associated with intrapersonal or interpersonal conflict (Bridge, Goldstein, & Brent, 2006). For example, commonly endorsed motivations for engaging in NSSI include “affect regulation,” “self-

punishment,” and “to feel high,” (Klonsky, 2007). Similarly, motivations for substance use include “to relieve pain,” “to get high,” and “to relax and relieve tension” (McCabe, West, & Boyd, 2013). Meanwhile, adolescents engaging in SSI may be motivated by the desire to end their life in an attempt to remove negative affective states (Muehlenkamp & Gutierrez, 2004). Although emotion regulation may be relevant to both direct and indirect forms of self-injury, in a study examining adolescent inpatients in New York, NSSI was used exclusively to reduce negative emotions, while substances were used in a variety of contexts to manage both positive and negative emotions (Victor, Glenn, & Klonsky, 2012). These findings suggest that although directly and indirectly self-injurious behaviours are motivated by a desire to regulate emotions, each may function differentially among adolescents.

Many factors play a role in the initiation, maintenance, or cessation of directly and indirectly self-injurious behaviours including psychological, biological, and environmental influences (DeWit, Adlaf, Offord, & Ogborne, 2000; Nock, Teper, & Hollander, 2007). In particular, several prevalent psychological disorders tend to develop in adolescence, such as disorders related to mood, anxiety, and eating, which may be associated with engagement in self-injurious behaviours (Zahn-Waxler, Shirtcliff, & Marceau, 2008). Unfortunately, many psychological disorders have a genetic component, in which genetically predisposed individuals have an increased likelihood for developing psychological disorders. Therefore, trends in mental health concerns may be observed within families. Nonetheless, the environment plays an important role in gene expression and shaping attitudes and behaviours. This is evident, as some people who are predisposed to psychological disorders will never develop the disorder.

Given that adolescence represents a period of increased vulnerability for poor decision-making, understanding risk factors for directly and indirectly self-injurious behaviours is critical to inform targeted prevention and intervention strategies. Although several studies have found that adolescents who engage in directly self-injurious behaviours are more likely to report substance use than those who do not report any directly self-injurious behaviours (e.g., Hilt, Nock, Lloyd-Richardson, & Prinstein, 2008; Jenkins, Singer, Conner, Calhoun, & Diamond, 2014), and that directly self-injurious behaviours and substance use are motivated by similar desired outcomes (Klonsky, 2007; McCabe et al., 2013), research also suggests that directly and indirectly self-injurious behaviours serve distinctly different functions (Victor et al., 2012). In other words, it may be that various risk factors are differentially associated with directly and indirectly self-injurious behaviours. Unfortunately, there is a paucity of research that seeks to integrate findings on risk factors for directly and indirectly self-injury behaviours. The present thesis addresses this gap in the literature by examining the prevalence and associated risk factors for adolescent engagement in NSSI, SSI, and substance use.

Directly Self-Injurious Behaviours

Definition. Directly self-injurious behaviours are characterized as any deliberate and direct acts to harm one's body. In the present study, we specifically assessed non-suicidal self-injury (NSSI) and suicidal self-injury (SSI). NSSI refers to the intentional destruction of one's bodily tissue without lethal intent (e.g., cutting, burning, head banging; American Psychiatric Association, 2013). In contrast, SSI is the deliberate self-directed bodily harm with the intent to end one's life, comprising suicidal thoughts, suicide attempts, and completed suicide, through acts such as severe cutting, poisoning,

and strangulation (American Psychiatric Association, 2013). Although there are similarities between NSSI and SSI, there are also some important differences with respect to lethality, frequency, and intention. Individuals engaging in NSSI tend to use low lethality methods frequently and without suicidal intent, while SSI involves infrequent, highly lethal methods with suicidal intent (Hamza, Stewart, & Willoughby, 2012).

Past literature often used the umbrella term “deliberate self-harm (DSH)” encompassing both NSSI and SSI (e.g., Bjärehed & Lundh, 2008; Portzky & van Heeringen, 2007; Sourander et al., 2006; Stewart, Baiden, Theall-Honey, & den Dunnen, 2014). As a result, researchers have confounded NSSI and SSI, despite the finding that NSSI and SSI have vital differences, the most important of which is the actual intention of the act by the individual. Recently, however, researchers have strongly urged that NSSI and SSI be carefully distinguished (Csorba, Dinya, Plener, Nagy, & Pali, 2009; Hamza et al., 2012; Whitlock, Muehlenkamp, & Eckenrode, 2008). Moreover, the most recent edition of the Diagnostic and Statistical Manual of Mental Disorders also specifically differentiates NSSI from SSI on the basis of non-lethal intent (American Psychiatric Association, 2013). Further investigation regarding NSSI and SSI among adolescents with clearly defined terms is imperative for clinical application in identifying at-risk adolescents and the development of prevention and intervention strategies.

Although NSSI and SSI are distinct methods of direct self-injurious behaviours, they tend to co-occur (Hamza et al., 2012; Miller et al., 2013; Whitlock et al., 2013). NSSI has consistently been found to be an important risk factor for attempted suicide among adolescents, suggesting that through habituation to directly self-injurious behaviours, NSSI may reduce inhibition, increasing the likelihood for suicide attempts

(Guan, Fox, & Prinstein, 2012; Hamza et al., 2012; Klonsky, May, & Glenn, 2013; Whitlock et al., 2013). Indeed, even after controlling for demographic and psychological factors, recent research has demonstrated that suicidal ideation is the only factor more strongly related to attempted suicide than NSSI (Klonsky et al., 2013). The method of NSSI behaviour has an impact on the strength of the relationship between NSSI and SSI, such that more severe forms of NSSI are reported to have a stronger predictability for SSI (Miller et al., 2013; Orlando, Broman-Fulks, Whitlock, Curtin, & Michael, 2015).

Several theories have suggested explanations for the link between NSSI and SSI. Given that current research does not strongly support any one theory independently, Hamza and colleagues (2012) proposed an integrated model to explain the relationship between NSSI and SSI comprising the three dominant theories. The integrated model suggests that similar to Gateway Theory, there is likely a direct link between NSSI and SSI, but that this association is stronger for those experiencing acute psychological distress (Brausch & Gutierrez, 2010). Additionally, as predicted by the Third Variable Theory, shared risk factors for NSSI and SSI likely contribute to the high rates of co-occurrence (Jacobson, Muehlenkamp, Miller, & Turner, 2008; Muehlenkamp, Ertelt, Miller, & Claes, 2011). Finally, as with Joiner's Theory of Acquired Capability for Suicide, the integrated model proposes an indirect path from NSSI to SSI through acquired capability for suicide (Joiner, 2005). The association between NSSI and acquired capability for suicide is expected to be stronger for individuals engaging in more severe forms of NSSI as well as those individuals with high levels of suicidal desire (Hamza et al., 2012).

Prevalence. Research suggests that both NSSI and SSI are increasingly common behaviours exhibited among adolescents. Recently reported rates of NSSI are between 7-24% in community samples of adolescents (Barrocas, Hankin, Young, & Abela, 2012) and between 30-40% among inpatient adolescents (Jacobson et al., 2008). Further, hospitalizations for directly self-injurious behaviours increased by 110% in Canada from 2009 to 2014 (Canadian Institute for Health Information, 2014). Moreover, suicide is currently the second leading cause of death among adolescents in Canada, only after unintentional accidents (Statistics Canada, 2012). Unfortunately, estimates for directly self-injurious behaviours are likely drastically underestimated in the general population since only severe injuries require medical attention and adolescents are often reluctant to seek treatment to reduce this maladaptive coping behaviour (Bridge et al., 2006). Furthermore, present methods for recording a verdict of death by suicide among adolescents and children is unreliable. Coroners rarely report death by suicide among children younger than 12 years old and are cautious when reporting for older children (Gosney & Hawton, 2007). This underreporting of death by suicide may be in an attempt to protect families from the stigma associated with suicide or the belief that young children do not have the capacity to understand the consequences of suicide completion (Gosney & Hawton, 2007).

Past literature indicates that the most common methods of direct self-injury among adolescents include overdosing, self-poisoning, and self-cutting (Lowenstein, 2005; Miller et al., 2013). Likewise, the Canadian Institute for Health Information (2014) found that a majority of the hospitalizations for direct self-injury among adolescents involve poisoning, with prescription medication as the most common toxin, followed by

narcotics, illegal drugs, alcohol, and chemical solvents. Although inconsistencies for directly self-injurious behaviours by biological sex exist among young adult populations, clear trends are present among adolescents. Female adolescents are consistently reported to be more likely than male adolescents to engage in NSSI, however males tend to be more likely than females to die by suicide (e.g., Hamza et al., 2012; Miller et al., 2013; Sornberger, Heath, Toste, & McLouth, 2012; Värnik et al., 2009). Specifically, in Canada from 2013-2014, females comprised 80% of the adolescents who were hospitalized for directly self-injurious behaviours (Canadian Institute for Health Information, 2014). Female adolescents report higher rates of NSSI, more cutting and scratching, and more injuries to the arms and legs, while males report more burning and hitting-type behaviour (head banging and punching), with injuries to the chest, face, and genitals (Sornberger et al., 2012). Additionally, compared to males, females have a higher tendency to misuse medication or overdose without suicidal intent (Stewart, Baiden, & den Dunnen, 2013). Yet, males are more likely than females to engage in directly self-injurious behaviours while under the influence of substances, likely reducing the pain threshold and potentially leading to greater severity of the injury sustained (Madge et al., 2008; Miller et al., 2013). Similarly with respect to suicide attempts, males are more likely to use highly lethal methods including the use of firearms, while females are more likely to overdose (Värnik et al., 2009).

Further, directly self-injurious behaviours are typically established as habitual behaviours among adolescents by 12 to 13 years old; however, females have a slightly earlier age of onset than males (Hamza et al., 2012; Hilt et al., 2008; St. Germain & Hooley, 2012; Stallard, Spears, Montgomery, Phillips, & Sayal, 2013; Zanarini et al.,

2006). Although suicide is uncommon for adolescents younger than 15 years old, the prevalence of suicide among older adolescent and young adult populations increases with age (Hawton, Saunders, & O'Connor, 2012). Sex differences in directly self-injurious behaviours among adolescents may be associated with age of onset and/or reporting bias due to social desirability and stigma for both the adolescent for NSSI and the coroner for reporting death by suicide. Given the distinct differences, biological sex should be considered when clinicians are determining prevention and intervention strategies for adolescents engaging in directly self-injurious behaviours.

Indirectly Self-Injurious Behaviours

Definition. Indirectly self-injurious behaviours can be defined as behaviours that are preformed with the knowledge that bodily harm is a possibility; however, often the harm is an unintended by-product of the behaviour (e.g., cigarette smoking, alcohol use, etc.; Nock, 2010). In the present study, we exclusively examined substance use, which can be defined as low frequency or irregular use of one or more psychoactive substances without the presence of social, behavioural, or health problems (American Psychiatric Association, 2013). Substance abuse is indicative of regular or compulsive use of one or more psychoactive substances such that an individual experiences either directly or indirectly psychological, physical, or social problems (American Psychiatric Association, 2013). Health risks associated with substance abuse include nausea, vomiting, weakened immune system, cardiovascular conditions, liver damage, seizures, and widespread brain damage (Johnson, 2012; McDowell & Spitz, 2015; Pateria, de Boer, & MacQuillan, 2013; Rezkalla, Stankowski, & Kloner, 2016).

Although substance use is characterized by the absence of social, behavioural, or health problems, substance use is a precursor to substance abuse and even mild substance use can lead to severe consequences. Substances commonly used by adolescents, such as alcohol, nicotine, cannabis, and cocaine, affect the brain's reward system, increasing pleasant feelings (Dackis & O'Brien, 2001; Leshner & Koob, 1999). Substance use is associated with alterations in brain chemistry affecting a person's behaviour by increasing aggressiveness and impulsiveness, impairing judgement, and lowering inhibitions through a loss of self-control (Davis, George, & Norris, 2004; Perry & Carroll, 2008). In some cases, substance use can cause direct changes to the brain that are irreversible after substance use cessation (Dackis & O'Brien, 2001; Leshner & Koob, 1999). Ultimately, substance use can impact one's ability to make healthy decisions, which may increase the likelihood for engaging in other risky behaviours such as direct self-injury, promiscuity, driving while impaired, and miscalculating ordinary risks (Hasking, Momeni, Swannell, & Chia, 2008; Williams & Hasking, 2010).

Gateway Theory is currently the leading model to explain the manner in which individuals transition from non-users to substance users. Gateway Theory suggests that substance use progresses in a sequential manner where mild substance use precedes more severe substance use. Kandel (1975) suggested that substance use advances in a progressive manner through distinct stages from non-use, to the initiation of substance use through experimentation with licit drugs (e.g., alcohol or tobacco), followed by use of illicit drugs, beginning with cannabis (e.g., marijuana, hashish) and then other illicit drugs (e.g., hallucinogens, inhalants, stimulants, opiates). Therefore, substance use can be

described on a continuum with extreme behaviours at each pole, from non-users to illicit polysubstance users.

Consistent with Gateway Theory, alcohol and tobacco use have been identified as the initial gateway drugs leading to use of cannabis and other illicit drugs (Kandel & Kandel, 2015; Kirby & Barry, 2012). Additionally, simultaneous polysubstance use is rare for first use of alcohol, tobacco, or cannabis, while first use of illicit substances such as hallucinogens and stimulants is most often reported to be simultaneous with use of alcohol, tobacco, or cannabis (Olthuis, Darredeau, & Barrett, 2013). Further, Gateway Theory has been applied to the misuse of prescription drugs (e.g., opioid pain relievers, central nervous system depressants, stimulants) indicating that a history of substance use, specifically tobacco, cannabis, hallucinogens, or inhalants, is a significant predictor of misuse of prescription medication (Viana et al., 2012). Despite the typical sequential pattern in substance use progression, use of a particular drug does not always lead to use of drugs further in the sequence. Rather, there is a greater propensity for users of specific substances to use drugs further along in the sequence than non-users (Kirby & Barry, 2012).

Prevalence. Research has consistently demonstrated the extensive use of both licit and illicit substances among Canadian adolescents despite legal restrictions prohibiting use (e.g., Hammond, Ahmed, Yang, Burkhalter, & Leatherdale, 2011; Leatherdale & Burkhalter, 2012; Paglia-Boak, Hamilton, Adalf, & Mann, 2013). Substance use is suggested to become prevalent among adolescents as young as 11 or 12 years old beginning with use of alcohol, tobacco, and cannabis (Leatherdale & Burkhalter, 2012; Paglia-Boak et al., 2013). It is well documented that rates of substance

use increase with age from childhood to adulthood. Specifically, there is a marked increase in drug use among secondary school students, ages 13-19 years old, such that about 66% of grade 12 students report engaging in substance use (Leatherdale & Burkhalter, 2012; Paglia-Boak et al., 2013).

In Canada, alcohol, tobacco, and cannabis are the most commonly used substances among adolescents in grades 7-12, such that approximately 50% of all students drink alcohol, about 10% smoke tobacco, and roughly 25% use cannabis (Leatherdale & Burkhalter, 2012; Paglia-Boak et al., 2013). Comorbid use of both licit and illicit substances is common and it is rare for adolescents to use tobacco and illicit drugs without initially drinking alcohol (Hammond et al., 2011; Leatherdale & Burkhalter, 2012; Olthuis et al., 2013; Paglia-Boak et al., 2013). Regardless of alcohol and tobacco use, 40% of secondary school students (grades 9-12) report using illicit drugs or misusing prescription and over-the-counter medications (Paglia-Boak et al., 2013). According to the Ontario Student Drug Use and Health Survey, estimates for use of specific illicit drugs among adolescents include: 3.4% for inhalants (e.g., glue and solvents), 10% for over-the-counter cough or cold medication containing dextromethorphan, and 12% for opioid pain relievers (e.g., Percocet, Demerol, Codeine); among students in grades 9-12 prevalence rates are reported at 1.5-3.7% for hallucinogens (e.g., LSD, salvia, mushrooms, psilocybin), 1.0-2.4% for stimulants (e.g., methamphetamine and cocaine), and less than 0.5 % for opiates (e.g., heroin; Paglia-Boak et al., 2013). Overall, a significant number of Canadian adolescents report engaging in substance use, which is concerning due to the immediate and future health risks associated with substance use and abuse.

Trends in engagement in substance use appear to be distinguishable with respect to biological sex. Similar rates of alcohol and tobacco use are reported for both males and females, however males are more likely than females to report use of cannabis (Leatherdale & Burkhalter, 2012; Paglia-Boak et al., 2013). Overall, males are more likely than females to report using illicit drugs and over-the-counter cough or cold medication containing dextromethorphan, however females are more likely to misuse prescription medications (Leatherdale & Burkhalter, 2012; Paglia-Boak et al., 2013). According to Chen and Jacobson (2012) females demonstrate higher levels of substance use early in adolescence, yet males report greater use in mid-adolescence and in early adulthood. Further, adolescents who engage in substance use are likely to have similar patterns of engagement later in adulthood. Specifically, adolescents who begin drinking alcohol between 11-14 years of age are at the greatest risk compared to adolescents and young adults who begin drinking at an older age for later alcohol abuse problems (DeWit et al., 2000). However, trends indicate that for adults who do not struggle with substance abuse, substance use typically decreases in adulthood, but at a later point for males than females (Chen & Jacobson, 2012). Considerations with respect to biological sex and age should be addressed when examining adolescent substance use for determining prevention and intervention strategies to circumvent future health risks.

Risk Factors for Direct and Indirect Self-Injury

Both directly and indirectly self-injurious behaviours, which tend to have their onset in adolescence, can have serious physical and mental health consequences for adolescents. Given that adolescence is an important period of development, where developmental trajectories are set or altered in important ways (Dahl, 2004),

understanding the individual and interpersonal risk factors associated with engagement in these self-injurious behaviours is a necessity to reduce the need for modifying unfavourable trajectories later in life.

Individual factors. With dramatic change in physical, cognitive, emotional, and social aspects of their life, adolescents are prone to the onset of emotional difficulties including mood and anxiety disorders as well as behavioural difficulties such as aggressive behaviours and conduct disorder. Self-injurious behaviours, including NSSI, SSI, and substance use are consistently associated with several mental health concerns, both emotional difficulties (e.g., depressive symptoms, anxiety symptoms, and low self-esteem) and behavioural difficulties (e.g., aggressive behaviour and criminal activity; Andrews et al., 2012; Brausch & Gutierrez, 2010; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006; Tatnell, Kelada, Hasking, & Martin, 2014; Zahn-Waxler et al., 2008). Elevated rates of major depressive disorder, posttraumatic stress disorder, borderline personality disorder, conduct disorders, and substance use disorders have been found among those individuals with a history of NSSI (Nock et al., 2006). Further, poor emotion regulation, self-esteem, and self-efficacy were found to be salient to the initiation of NSSI among adolescents (Tatnell et al., 2014). Similarly, the presence of emotional difficulties (depressive and anxiety symptoms) and behavioural difficulties (aggression, antisocial personality, and substance use) are associated with SSI, such that major depressive disorder presents the greatest risk for suicidal attempts (Jenkins et al., 2014; Liu et al., 2006; Verona, Sachs-Ericsson, & Joiner, 2004). Specifically among women, comorbidity of both emotional and behavioural difficulties was the greatest predictor for suicide attempts (Verona et al., 2004).

An investigation of the longitudinal associations between childhood and adulthood mental health concerns (e.g., depressive disorders, anxiety disorders, obsessive-compulsive disorder, disruptive behaviour, and criminal activity) and adolescent substance use revealed that early emotional difficulties are not a risk for later substance use, however behavioural difficulties in childhood are associated with later substance use (Miettunen et al., 2014). Specifically, behavioural difficulties are highly associated with engagement in the use of alcohol, tobacco, and cannabis as reported in a study examining the associations of emotional and behavioural problems and the concurrent presentation with early adolescent substance use (Colder et al., 2013). Interestingly, emotional difficulties, in the absence of behavioural difficulties, revealed to be protective for adolescents with respect to engagement in using tobacco or cannabis (Colder et al., 2013). Among males, adolescent substance use predicted criminality, specifically as associated with use of cannabis (Miettunen et al., 2014). Similarly, among females, adolescent alcohol and cannabis use predicted adulthood emotional difficulties (Miettunen et al., 2014).

Indirectly self-injurious behaviours, such as substance use, more commonly occur within peer groups and function to regulate both positive and negative emotions, whereas directly self-injurious behaviours, NSSI and SSI, more commonly occur in isolation to regulate distressing negative states (Chein et al., 2011; Gardner, & Steinberg, 2005; Victor et al., 2012). Perhaps directly self-injurious behaviours are more likely than indirectly self-injurious behaviour to be associated with strong internalizing symptoms such as depressive or anxious symptoms. Given the increased likelihood for impulsive and reckless decision making when in the presence of peers (Chein et al., 2011; Gardner,

& Steinberg, 2005) and the longitudinal association between behavioural difficulties in childhood and later substance use issues (Miettunen et al., 2014), perhaps behavioural difficulties will be more strongly associated with indirectly self-injurious behaviours than directly self-injurious behaviours.

Interpersonal factors. Adolescence is a critical period of development during which family and community play a significant role in influencing the beliefs and behaviours adolescents incorporate into their self-concept. Support by caring and responsible adults is particularly important when considering engagement in self-injurious behaviours. If adolescents do not feel supported, their experience of psychological distress may increase, limiting their likelihood to pursue additional support and consequently encouraging engagement in dysfunctional coping behaviours such as direct or indirect self-injury (Wichstrom, 2009). Research indicates that secure attachment and social support are protective factors for adolescent engagement in self-injurious behaviours during this vulnerable period (Tatnell et al., 2014).

Attachment theory states that it is necessary for infants to develop a strong relationship with at least one caregiver in order to promote successful social and emotional development and specifically for learning how to regulate emotions effectively (Bowlby, 1958). In order to develop a secure attachment, caregivers must be sensitive and responsive to their infant. Parents who are experiencing distress (e.g., physical or mental health difficulties, substance dependence, financial issues, loss of a loved one, etc.) may not be as attentive and supportive to their child as necessary to form and maintain a secure attachment. A lack of secure attachment diminishes a child's opportunity to learn how to regulate emotions appropriately. Therefore, parents who are

experiencing distress may be restricted in their parenting ability, accordingly limiting their child's development (Biederman et al., 2000; Leslie & Cook, 2015).

Correspondingly, mothers who experience high levels of trauma symptoms and hold their children to high expectations and strict rules, have adolescents who endorse more depressive symptoms than adolescents whose mothers are more flexible and responsive to their child's needs (Leslie & Cook, 2015). Similarly, adolescence is a critical period for exposure to parental substance use disorders; adolescents who are exposed to substance use disorders are at an increased risk for substance use (Biederman et al., 2000). Further, early research indicated that insecure attachment is associated with poor emotion regulation outcomes including significant symptomology and engagement in risky behaviours (e.g., Bowlby, 1958; Cooper, Shaver, & Collins, 1998). These findings are consistent with current research supporting the view that individuals who endorse insecure attachment patterns in childhood and early adolescence are more likely to report engagement in NSSI (Martin et al., 2011). Similarly, among a sample of 71 substance dependant adolescents and 39 non-clinical controls, insecure attachment was predominant among the substance dependent adolescents and the severity of the substance use was positively correlated with insecure-anxious adolescents and negatively correlated with insecure-avoidant adolescents (Schindler et al., 2005). The necessity for children and adolescents to feel supported by a caring and responsible adult suggests that there is likely a link between attachment and engagement in direct and indirect self-injury.

Furthermore, the community in which an adolescent lives also plays an important role in either reducing or supporting their likelihood of engaging in self-injurious

behaviours. As adolescents become more independent from their parents, the community provides a model for socially acceptable behaviours (Reitz-Krueger, Nagel, Guarnera, & Reppucci, 2015). Underprivileged neighbourhoods with high rates of crime and violence pose a risk to the wellbeing and healthy development of children and youth even if they do not directly experience violence (Reitz-Krueger et al., 2015). Although several studies have indicated that there are no differences for engagement in directly self-injurious behaviours based on socioeconomic status (e.g., Andrews et al., 2012; Lloyd-Richardson, Perrine, Dierker, & Kelley, 2007), witnessing domestic violence is a predictor for NSSI (Cerutti, Manca, Presaghi, & Gratz, 2011; Lamers-Winkelmann, Schipper, & Oosterman, 2012). Perhaps living in an environment that is perceived to be unsafe, by way of witnessing violence no matter the type of violence, may increase the likelihood for directly self-injurious behaviours among adolescents. High rates of crime and violence in a neighbourhood are associated with problem behaviours among adolescents and teens including delinquent behaviours, substance use, and poor academic achievement (Reitz-Krueger et al., 2015). Additionally, neighbourhoods with low socioeconomic status have been found to be associated with increased peer alcohol use, which is linked to increased adolescent alcohol use (Chuang, Ennett, Bauman, & Foshee, 2005). These findings suggest that the community in which an adolescent lives can influence the risk for engaging in both directly and indirectly self-injurious behaviours, however the impact of living in a neighbourhood with pervasive violence may differ for each type of self-injurious behaviour.

Current Study

Despite increased research on direct and indirect self-injury, research on risk factors for directly and indirectly self-injurious behaviours has been largely non-overlapping (Andrews et al., 2012; Nock, 2010). As a result, it is unclear whether some risk factors may be more strongly associated with directly self-injurious behaviours, whereas other risk factors may be more strongly associated with indirectly self-injurious behaviours. Due to the wide range of physical and mental health difficulties that may result among adolescents from directly and indirectly self-injurious behaviours, it is necessary to understand the differential risks associated with each form of self-injury.

The current study focused on examining the predictive effect of several individual and interpersonal risk factors, including sex, age, depressive symptoms, aggressive behaviours, caregiver distress, and pervasive neighbourhood violence and criminal activity, on NSSI, SSI, and substance use among a convenience sample of adolescents seeking mental health care in Ontario. On the basis of previous research, it was anticipated that higher levels of individual and interpersonal risk would be associated with increased risk for both directly and indirectly self-injurious behaviours (Biederman et al., 2000; Leslie & Cook, 2015; Martin et al., 2011; Schindler et al., 2005); however, it was also anticipated that the predictive effect of each risk factor may vary depending on the type of self-injurious behaviours.

More specifically, on the basis of previous research, females were expected to be more likely than males to engage in directly self-injurious behaviours, both NSSI and SSI (Hamza et al., 2012; Miller et al., 2013; Sornberger et al., 2012); in contrast, males were expected to be more likely than females to engage in indirectly self-injurious behaviours,

such as substance use (Leatherdale & Burkhalter, 2012; Paglia-Boak et al., 2013). Moreover, we anticipated that higher levels of depressive symptoms as compared to aggressive behaviours would be more strongly associated with NSSI and SSI, given that research has consistently shown that NSSI and SI occur in the context of high levels of psychosocial distress (Armev, Crowther, & Miller, 2011; for a review see Klonsky, 2007). It was also hypothesized that higher levels of depressive symptoms would be more strongly predictive of adolescents who engaged in SSI than adolescents who engaged in NSSI (Jenkins et al., 2014; Liu et al., 2006; Nock et al., 2006; Tatnell et al., 2014; Verona et al., 2004). Conversely, it was hypothesized that higher levels of aggressive behaviours as compared to depressive symptoms would be more strongly associated with substance use, given findings that substance use is often associated with high levels of externalizing behaviours (Colder et al., 2013; Miettunen et al., 2014).

Furthermore, it was hypothesized that the presence of caregiver distress would be strongly predictive of engagement in both directly and indirectly self-injurious behaviours, given the importance for adolescents to feel supported by responsible and caring adults who can provide protection and assist in developing the capacity to regulate emotions adaptively (Biederman et al., 2000; Leslie & Cook, 2015; Martin et al., 2011; Schindler et al., 2005). Finally, it was hypothesized that having lived in neighbourhoods with pervasive violence or criminal activity would also be predictive of engagement in both directly and indirectly self-injurious behaviours (Lloyd-Richardson et al., 2007; Chuang et al., 2005). Determination of individual and interpersonal factors associated with differential risk pathways for direct and indirect self-injury is critical to support at-

risk adolescents through the development of targeted and evidence-informed prevention and intervention strategies.

Method

Participants

A convenience sample of 541 clinically referred adolescents who accessed mental health services at one of the twenty agencies in the Province of Ontario between November 2012 and August 2015 participated in this study. The interRAI Child and Youth Mental Health Assessment and interRAI Adolescent Supplement (ChYMH; Stewart et al., 2015) were administered as part of typical clinical practice upon accessing mental health services at each of the supporting agencies. Both male (57.9%) and female (42.1%) adolescents ranging in age from 11-18 years old ($M=14.61$, $SD=1.75$) were included in this study. Only English speaking adolescents who completed both the interRAI ChYMH and the interRAI Adolescent Supplement assessments were included in the current study. Youth with developmental disabilities were excluded from this study. There were no direct benefits to participants in this study and health care was not affected.

Measures

The *interRAI Child and Youth Mental Health Assessment and Adolescent Supplement* (ChYMH; Stewart et al., 2015). The interRAI ChYMH is comprised of approximately 400 clinical elements covering medical, functional, psychological, social and environmental strengths, preferences and needs of school-age children, and a variety of scales are embedded within the instrument that can be used for outcome measurement, and 29 care planning protocols identifying areas of imminent concern or risk. The

instrument is based on a semi-structured interview format that supports the collection of both quantitative and qualitative information. Clinicians completed the instrument using all available sources of information, including direct contact with the family and their child or youth, and other service providers and records (e.g., educators and health care clinicians). The interRAI Adolescent Supplement is integrated into the ChYMH and completed for all youth who are twelve years old or older. However, if younger children report engaging in mature or risky behaviours, such as substance use and sexual activity, assessors may complete this supplement to generate a more comprehensive assessment of the child.

The interRAI suite of assessments was designed to be used by researchers and clinicians to assist vulnerable populations and is currently being used internationally. Rigorous reliability and validity studies have been conducted across the family of instruments displaying strong psychometric properties for adults (Burrows, Morris, Simon, Hirdes, & Phillips, 2000; Hirdes et al., 2008; Hirdes et al., 2002; Morris, Carpenter, Berg, & Jones, 2000; Morris et al., 1997), children, and youth (Phillips et al., 2012; Stewart, Currie, Arbeau, Leschied, & Kerry, 2015; Philips & Hawes, 2015). Several items from both the interRAI ChYMH and Adolescent Supplement were included in the current study to investigate the relationship between individual as well as interpersonal factors and self-injurious behaviours among adolescents.

Demographics. Demographic information, including variables such as the child/youth's age and sex as well as proxy information related to socio-economic status (SES), was obtained from the assessment. Specifically, pervasive violence and criminal activity was utilized as a proxy for SES with the presence of such problematic

neighbourhoods as indicative of low SES (0 = *never having lived in a neighbourhood with pervasive violence or criminal activity*, 1 = *having experienced pervasive violence within the neighbourhood*).

Depressive symptoms. Depressive symptoms were measured using the *Depressive Severity Index* (DSI), which measures the frequency and severity of indicators of depression, such as tearfulness, self-deprecation, expressions of hopelessness, irritability, and withdrawal from typical activities of interest. DSI scores were determined by summing nine items, which were rated on a scale of 0-4 (from 0 = *Not present*, to 4 = *Exhibited daily in last 3 days, 3 or more episodes or continuously*). Scores on the DSI range from 0-36 where higher scores are indicative more severe depressive symptoms. The scale was found to have good reliability, $r = 0.80$.

Aggressive behaviour. Aggressive behaviour was measured using the *Aggressive Behavior Scale* (ABS), which measures the frequency and severity of aggressive behaviours, such as physical abuse, verbal abuse, and socially inappropriate or disruptive behaviour. Similar to the DSI, ABS scores were determined by summing four items, which were rated on a scale of 0-4 (from 0 = *Not present*, to 4 = *Exhibited daily in last 3 days, 3 or more episodes or continuously*). Scores on the ABS range from 0-16 where higher scores are indicative of higher levels of aggressive behaviours. The scale was found to have acceptable reliability, $r = 0.68$.

Caregiver distress. Caregiver distress was identified using the *Caregiver Wellbeing Scale* (CWB), which measures factors contributing to the caregiver's ability to care for the child or youth. Examples of the factors evaluated include an assessment of the caregiver's ability and willingness to continue caregiving activities, the caregiver's

current developmental, mental health, and substance use issues, and financial hardship (economic trade-offs). All factors were scored as 0 = *Not present* or 1 = *Present*. The CWB ranges from 0-5 where higher scores are indicative of caregiver distress. The scale was found to have acceptable reliability, $r = 0.73$. For the purpose of this study, this scale was treated dichotomously (0 = *caregiver was not experiencing distress*, >0 = *caregiver was experiencing distress*).

Directly self-injurious behaviour. Self-injury was measured based on two items from the interRAI ChYMH addressing the presence of engagement in direct self-injury as well as the intent of the directly self-injurious behaviours. The first item was used to determine whether or not the adolescent has engaged in direct self-injury of any kind over his or her lifetime. The second item was used to distinguish between NSSI and SSI through establishing the intent of the direct self-injury exhibited by the adolescent, “intent of any self-injurious attempt was to kill self.” If any direct self-injurious behaviours were suicidal in intent, a score of “2” was given to represent the occurrence of SSI. For those adolescents who have engaged in direct self-injury but never with the intent to kill, a score of “1” was assigned, signifying NSSI. Therefore, if an adolescent ever engaged in direct self-injury with the intent to kill self, the adolescent was included in the SSI group, irrespective of their history of NSSI. Finally, those who had not engaged in any directly self-injurious behaviours received a score of “0”.

Indirectly self-injurious behaviour. Indirect self-injury was assessed as related to substance use utilizing both the interRAI ChYMH and the Adolescent Supplement. Ten items were examined to identify substance-using adolescents: two items from the interRAI ChYMH address tobacco and nicotine use, while eight items on the Adolescent

Supplement address alcohol and illicit substance use as well as misuse of prescription medication. Those adolescents who reported tobacco or nicotine use, consuming alcohol to the point of intoxication, illicit drug use (e.g., cannabis, hallucinogens, inhalants, stimulants, or opiates), or intentional misuse of prescription medication were identified as substance users. Those adolescents who did not report using any of the formerly stated substances were identified as non-users.

Procedure

Data collection using the interRAI ChYMH and Adolescent Supplement instruments was approved by the University ethics board (REB #106415) and carried out by trained assessors across twenty sites in the Province of Ontario. Data collected from patients was stored on the interRAI Canada secure server (VPN protected with similar security measures as the Canadian Institute of Health Information) at a partner University. No personal identifiers were collected and stored on this server as each individual participant is assigned a randomly generated study-specific participant number. De-identified data was provided to the lead interRAI developer on a quarterly basis and stored on a password protected standalone computer (e.g., no access to internet; no usable USB ports) in the primary investigator's locked laboratory at Western University.

Data collected from October 2012 until August 2015 was examined for this study. All assessors completing assessments were required to have a diploma or degree in the mental health field, and have at least two years of clinical experience with children and youth. Additionally, all assessors have completed a two and a half day training program on the administration of the interRAI ChYMH and Adolescent Supplement. Completion

of the interRAI instruments takes approximately 60-90 minutes depending on case complexity and may be conducted in person or over the phone. As part of this process, assessors (including nurses, psychologists, psychiatrists, social workers, child and youth workers, and speech and language pathologists) conduct a semi-structured interview with the client, guardians, family members, and collateral contacts with appropriate consents (e.g., teachers, therapists) as well as use any information available with respect to medical and education records to complete the instrument. Although the agencies implementing the interRAI tools may use the assessments at intake, milestone, or outcome evaluations, only the initial assessments for those adolescents seeking mental health care at time of intake into treatment were used for this study.

Plan of Analysis

First, frequency and descriptive analyses were conducted for all variables. Second, chi square analyses and independent t-tests were conducted, as appropriate, to examine sex differences for each variable examined to predict risk for engagement in self-injurious behaviours. Next, the association between the directly self-injurious behaviours, NSSI and SSI, and predictor variables (sex, age, depressive symptoms, aggressive behaviours, caregiver distress, and lived in a neighbourhood with pervasive violence or criminal activity) was examined using a stepwise multinomial logistic regression analysis. Finally, the association between the indirectly self-injurious behaviour, substance use, and predictor variables (sex, age, depressive symptoms, aggressive behaviours, caregiver distress, and lived in a neighbourhood with pervasive violence or criminal activity) was examined using a stepwise binary logistic regression analysis. All analyses were performed using SPSS version 18.0 software (SPSS Inc.,

Chicago, IL, USA) and the assumptions for all tests were followed to control for threats to statistical conclusions.

Results

Preliminary Analyses

In the present study, 33.1% of adolescents had engaged in NSSI, 11.3% had engaged in SSI, and 18.5% of adolescents had engaged in substance use. The average score on the DSI was 12.37 ($SD= 7.49$) and the average score on the ABS was 3.45 ($SD= 3.41$). Further, 69.5% of the participants experienced caregiver distress, while 8.1% reported having lived in a neighbourhood with pervasive violence and criminal activity.

Chi-square analyses revealed that compared to males, females were more likely to engage in directly self-injurious behaviours, NSSI and SSI, $\chi^2(2) = 39.083, p < .000$. However, there were no sex differences for engagement in substance use. An independent samples t-test, examining sex differences for the DSI, was statistically significant, $t(539) = -3.13, p = .002$. Female adolescents ($M = 13.54, SD = 7.46$) reported significantly greater depressive symptoms than male adolescents ($M = 11.52, SD = 7.40$). Further, an independent samples t-test, examining sex differences for the ABS, was also statistically significant, $t(539) = 3.22, p = .001$. Male adolescents ($M = 3.85, SD = 3.39$) reported significantly greater aggressive behaviours than female adolescents ($M = 2.90, SD = 3.37$). Further, chi-square analyses revealed that there were no sex differences for adolescents whose caregivers were experiencing distress, as with adolescents who had lived in a neighbourhood with pervasive violence or criminal activity.

Primary Analyses

A multinomial logistic regression analysis was used to predict the presence/absence of directly self-injurious behaviour (no self-injury, NSSI, SSI) from sex, age, depressive symptoms, aggressive behaviours, caregiver distress, and pervasive neighbourhood violence and criminal activity. The full model provided a significantly better fit to the data than the constant-only model, indicating that the predictors, when taken together, reliably distinguish between those participants who engaged in each NSSI and SSI and those who did not engage in NSSI or SSI ($\chi^2=115.997$, $df=12$, $p<0.000$). A goodness of fit model was evidenced by non-statistically significant results on a Pearson Chi-square test, $\chi^2 (n=541) = 985.852$, $df=992$, $p = .549$. Results indicated that of the six predictors in the model, female biological sex, older age, high levels of depressive symptomology, caregiver distress, and pervasive neighbourhood violence and criminal activity significantly predicted engagement in direct self-injury, both NSSI and SSI. Notably, the presence of caregiver distress increases the likelihood for NSSI by 1.75 times and increases the likelihood for SSI by 2.5 times. Similarly, the presence of pervasive neighbourhood violence and criminal activity increases the likelihood for NSSI by 2.5 times and increases the likelihood for SSI by 3.3 times. Table 1 presents the results for the model including the regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals.

Table 1.

Regression Analysis: Directly Self-Injurious Behaviour (NSSI & SSI)

Outcome	Predictor	<i>B</i>	Wald chi- square	Odds ratio Exp(<i>B</i>)	95% confidence interval	<i>p</i> value
NSSI	Biological sex	-1.003	22.230	.367	[.242, .557]	.000
	Age	.313	24.935	1.367	[1.209, 1.546]	.000
	Depressive symptoms	.049	10.295	1.050	[1.019, 1.082]	.001
	Aggressive behaviours	.042	1.510	1.043	[.975, 1.116]	.219
	Caregiver distress	.564	5.734	1.757	[1.108, 2.787]	.017
	Neighbourhood violence	.928	6.180	2.530	[1.217, 5.258]	.013
SSI	Biological sex	-1.408	19.616	.245	[.131, .456]	.000
	Age	.399	18.490	1.491	[1.243, 1.789]	.000
	Depressive symptoms	.062	8.440	1.064	[1.020, 1.110]	.004
	Aggressive behaviours	.026	.266	1.026	[.930, 1.132]	.606
	Caregiver distress	.942	6.370	2.566	[1.234, 5.335]	.012
	Neighbourhood violence	1.195	5.892	3.302	[1.259, 8.665]	.015

A binary logistic regression analysis was used to predict the presence/absence of indirectly self-injurious behaviour (substance use) from sex, age, depressive symptoms, aggressive behaviours, caregiver distress, and pervasive neighbourhood violence and criminal activity. The full model provided a significantly better fit to the data than the constant-only model, indicating that the predictors, when taken together, reliably

distinguish between those who engage in substance use and those who do not ($\chi^2=74.206$, $df=6$, $p<0.000$). A goodness of fit model was evidenced by non-statistically significant results on the Hosmer-Lemeshow test, $\chi^2 (n=541) = 5.436$, $df=8$, $p = .710$. Results indicated that of the six predictors in the model, older age and high levels of aggressive behaviours significantly predicted engagement in substance use. Additionally, a trend effect for pervasive neighbourhood violence and criminal activity was revealed, suggesting that pervasive neighbourhood violence and criminal activity increases the likelihood for engagement in substance use by two times when compared to those adolescents who do not live in an area with pervasive neighbourhood violence and criminal activity. Table 2 presents the results for the model including the regression coefficients, Wald statistics, odds ratios, and 95% confidence intervals.

Table 2.

Regression Analysis: Indirectly Self-Injurious Behaviour (Substance Use)

Predictor	<i>B</i>	Wald chi- square	Odds ratio Exp(<i>B</i>)	95% confidence interval	<i>p</i> value
Biological sex	-.248	.988	.780	[.478, 1.273]	.320
Age	.587	55.950	1.799	[1.542, 2.098]	.000
Depressive symptoms	-.005	.097	.995	[.961, 1.029]	.755
Aggressive behaviours	.084	4.394	1.087	[1.005, 1.175]	.036
Caregiver distress	.254	.829	1.289	[.746, 2.229]	.363
Neighbourhood violence	.738	3.658	2.091	[.982, 4.453]	.056

Discussion

Adolescents have a propensity towards making impulsive, emotionally charged decisions without considering possible risks or potentially fatal consequences for themselves and people around them (Dahl, 2004). Risky behaviours that may result from poor decision-making can be directly and indirectly dangerous, leading to physical or psychological difficulties. During this period of vast development and increased independence, two practices of self-injurious behaviours that are directly harmful, non-suicidal self-injury (NSSI) and suicidal self-injury (SSI), as well as one self-injurious behaviour that is indirectly harmful, substance use, are prevalent among adolescents (St. Germain & Hooley, 2012; Whitlock et al., 2013). Although an alarming number of adolescents report engaging in directly and indirectly self-injurious behaviours (Barrocas et al., 2012; Jacobson et al., 2008; Paglia-Boak et al., 2013), research regarding the overlapping risks for engagement in each type of self-injurious behaviour is lacking. The present study addressed this gap in the literature by examining the associations between a set of individual and interpersonal risk factors and directly (i.e., NSSI, SSI) and indirectly self-injurious behaviours (i.e., substance use), respectively.

As predicted, higher levels of individual and interpersonal risk were found to be associated with increased risk for self-injurious behaviours, such that the predictive effect of each risk factor varied depending on the type of self-injury (i.e. direct or indirect). More specifically, it was found that for directly self-injurious behaviours all of the predicted risk factors (older age, female sex, higher levels of depressive symptoms, caregiver distress and neighbourhood violence) increased the likelihood for engagement in both NSSI and SSI. In contrast, only two of the predicted risk factors increased the

likelihood for engagement in indirect self-injury, substance use. In particular, older age and higher levels of aggressive behaviours were significantly associated with increased risk of substance use, whereas male sex, caregiver distress, and neighbourhood violence were not significantly associated with increased risk for substance use. There was a trend effect for neighbourhood violence, such that the presence of neighbourhood violence was associated with an increased risk for substance use, however to a lesser extent than age and high levels of aggressive behaviour. Ultimately, the results suggest that directly self-injurious behaviours, NSSI and SSI, and indirectly self-injurious behaviours, specifically substance use, may be predicted more strongly by different risk factors. Potential explanations for the presence of distinct risk factors for engagement in direct and indirect self-injury are discussed and clinical implications as well as future directions are suggested.

Consistent with research that suggests that adolescence represents a period of increased risk for engagement in risky behaviours, 44% of the adolescents in the present study engaged in direct self-injury, NSSI and SSI (Barrocas et al., 2012; Jacobson et al., 2008). In comparison, 18.5% of adolescents in the present study engaged in indirect self-injury, substance use, which is fewer than would be expected based on community findings. For example, recent studies have found that among students in grades 7-12, 50% drink alcohol, 10% smoke tobacco, and 25% use cannabis (Leatherdale & Burkhalter, 2012; Paglia-Boak et al., 2013). This difference in prevalence is likely due to the young average age of participants in the present study (fourteen years old) given that dramatic increases in substance use are reported in late secondary school, such that 66% of grade 12 students report substance use (Leatherdale & Burkhalter, 2012; Paglia-Boak

et al., 2013). For both, direct and indirect self-injury, as adolescents increased in age, there was an increased likelihood for engagement these behaviours. Future research examining differential risk factors for engagement in directly and indirectly self-injurious behaviours present for elementary students as compared to high school students would be beneficial. This would allow opportunities for the development of age-based preventative and early intervention strategies that could be incorporated into elementary level health education programs, redirecting the use of dysfunctional coping techniques prior to initiation.

On the basis of previous literature, sex was expected to be an important risk factor for adolescent engagement in direct and indirect self-injury. Consistent with previous research, it was found that females were more likely than males to engage in direct self-injury, both NSSI and SSI (Hamza et al., 2012; Miller et al., 2013; Sornberger et al., 2012). Further, elevated levels of depressive symptoms, which were more common among female adolescents as compared to males, were strongly predictive of SSI (e.g., Jenkins et al., 2014). Contrary to expectations, males were no more likely than females to engage in indirect self-injury, namely substance use. For the purposes of this study, substance use was a broad term encompassing alcohol, tobacco or nicotine, cannabis, hallucinogens, inhalants, stimulants, opiates, and misusing prescription medications. Previous research indicates that males and females use similar rates of alcohol and tobacco, however males report higher rates of cannabis and illicit drugs, while females report higher rates of prescription medication use (Leatherdale & Burkhalter, 2012; Paglia-Boak et al., 2013). Since alcohol, tobacco, and cannabis are the most commonly used substances among adolescents (Leatherdale & Burkhalter, 2012; Paglia-Boak et al.,

2013), it is likely that this trend is also true among the substance users in this study, such that only cannabis use would be expected to differ by sex. Therefore, sex might not have been predictive of substance use in this study due to the types of substances reportedly engaged in by adolescents. Although all substance use among adolescents is considered to be highly risky, certain substances (e.g., hallucinogens, opiates) may be associated with poorer physical and mental health consequences. Future research should examine risk factors for substance use based on the type of drug used.

Difficulties in controlling emotions and behaviours are experienced by some adolescents and have been associated with self-injurious behaviours (Andrews et al., 2012; Arnett, 1999; Brausch & Gutierrez, 2010; Nock et al., 2006). Previous research indicates that self-injurious behaviours are a method for coping with and regulating intense emotions (Andrews et al., 2012; Chapman et al., 2006). As predicted, high levels of depressive symptoms were predictive of engaging in both directly self-injurious behaviours, NSSI and SSI (Nock et al., 2006; Tatnell et al., 2014). Consistent with current literature, as levels of depressive symptoms increased, there was a greater risk for NSSI and SSI (Jenkins et al., 2014; Liu et al., 2006). These findings support the suggestion that adolescents may engage in NSSI and SSI to escape from psychological pain that could be associated with intrapersonal or interpersonal conflict (Bridge et al., 2006). It is also noteworthy that depressive symptoms did not predict increased risk for substance use in the context of the model, suggesting that internalizing risk factors, such as depressive symptoms, may be more strongly associated with direct (rather than indirect) forms of self-injury.

Previous research suggests that behavioural difficulties, such as aggression and delinquency, are highly associated with engagement in the use of alcohol, tobacco, and cannabis (Colder et al., 2013; Miettunen et al., 2014). Consistent with past research, it was found that higher levels of aggressive behaviours predicted engagement in indirectly self-injurious behaviour (i.e., substance use); however, the present study also found that aggressive behaviours did not predict engagement in directly self-injurious behaviours (i.e., NSSI, SI). It is possible that compared to directly self-injurious behaviours, indirectly self-injurious behaviours more commonly occur in the presence of peers, whereby there is an increased likelihood for impulsive and poor decision-making, which may be associated with an increase in aggressive behaviours (Chein et al., 2011; Gardner & Steinberg, 2005). In contrast, directly self-injurious behaviours tend to occur alone (Glenn & Klonsky, 2009), and may be more strongly associated with internalizing, rather than externalizing problem behaviours.

As suggested by Linehan (1993), familial and community influences are highly impactful during adolescence, such that living in an invalidating environment promotes poor emotion regulation. Additionally, developing and maintaining a secure attachment between caregiver and child is important because when children and youth do not feel supported within their family, they are predisposed to engage in maladaptive coping strategies to manage their emotions (Nock, 2009; Tatnell et al., 2014). Caregiver's who are experiencing distress (e.g., physical or mental health difficulties, substance use, financial trade offs, etc.) may be less likely to meet their child or youth's emotional needs (Biederman et al., 2000; Leslie & Cook, 2015), perhaps increasing the likelihood for engaging in self-injurious behaviours due to poor emotion regulation skills.

Unexpectedly, caregiver distress was not a predictive risk factor for both directly and indirectly self-injurious behaviours in the present study. Rather, caregiver distress was only predictive of direct self-injury, NSSI and SSI. NSSI has been found to be associated with poor family functioning (Wilkinson, Kelvin, Roberts, Dubicka, & Goodyear, 2011), such that adolescents who engage in NSSI report poorer relationship quality with their parents than adolescents who do not engage in NSSI (Hilt, et al., 2008). Furthermore, there is an increased likelihood for SSI among adolescents who live in conflicting family environments with high parent-child conflict and low emotional support (Frey, & Cerel, 2015; Wagner, Silverman, & Martin, 2003). Thus, the finding that caregiver distress was predictive of engagement in direct self-injury is well supported in the literature. Fortunately for adolescents, the risk of moving from NSSI to SSI is reported to decrease among those who report parents as confidants and the presence of meaning in their life, which provides a starting point for prevention and intervention with adolescents and their families (Whitlock et al., 2013).

Although it was expected that adolescent engagement in indirect self-injury would increase when caregiver distress was high, the present study revealed that caregiver distress was not predictive of substance use. There are many possible explanations for this finding. Specifically, having a parent who is a substance abuser (which may be one form of caregiver distress) has been shown to be predictive of adolescent substance use (Biederman et al., 2000). In the present study, however, caregiver distress represented several circumstances by which a caregiver may be experiencing distress including the caregiver's ability or willingness to continue caregiving activities, and the caregiver's current developmental, mental health, substance use issues, financial hardship, etc.

Therefore, it is possible that none of the adolescents in the study were living with a parent/caregiver who was struggling with substance issues, which as predicted by the literature, would have been predictive of adolescent substance use. Additionally, parents or caregivers may not have disclosed their problem, whether substance use, mental health issues, or financial troubles. Since the initial assessment was used in this study, it is possible that further information about the family dynamics might surface in later assessments when the family is engaged in the therapeutic process and has established a stronger relationship with the health care professional. Future research should examine different types of caregiver distress to determine if mental health, disability, or financial hardship are independently associated with adolescent substance use as previously found with parental substance abuse.

Living in violent and invalidating neighbourhoods poses a risk for the wellbeing of children and adolescents (Reitz-Krueger et al., 2015). Adding to previous literature, living in a neighbourhood with pervasive violence or criminal activity was predictive of directly self-injurious behaviours, NSSI and SSI, among adolescents. Living in highly violent neighbourhoods may be extremely distressing and fear provoking. In an attempt to cope with this high level of distress (e.g., living in fear, witnessing violence, poverty, etc.), engagement in direct self-injury may be an approach utilized by adolescents to deal with these negative emotions. Also, these adolescents may see a bleak future on the horizon given their current living conditions, which would then add to their negative worldview, further increasing their likelihood for engagement in direct self-injurious behaviours. Additionally, adolescents who live in an environment where violence is perpetuated may have learned that violence is a way to solve problems. Specifically, it is

possible that witnessing or experiencing other-directed violence, may lead to self-inflicted violence over time. Since, witnessing domestic violence is a predictor for NSSI (Cerutti et al., 2011; Lamers-Winkelmann et al., 2012), it is possible that living in an environment that is perceived to be unsafe, such as that of a neighbourhood with pervasive violence may increase the likelihood for direct self-injury among adolescents. Future research should investigate if the type of violence witnessed has an impact on the risk for engagement in direct self-injury behaviours.

Inconsistent with study hypotheses, having lived in a neighbourhood with pervasive violence or criminal activity was not significantly associated with indirectly self-injurious behaviour (i.e., substance use); however there was a trend effect, such that living in a neighbourhood with pervasive violence or criminal activity was associated with greater risk for substance use. This finding suggests that the predictive strength of neighbourhood violence for substance use was lower relative to age and aggressive behaviours, however was stronger than sex, depressive symptoms, and caregiver distress. This trend is consistent with research that suggests that higher rates of substance use are observed in areas of greater social disadvantage (Chuang et al., 2005; Reitz-Krueger et al., 2015). Additionally, neighbourhood violence was found to be a stronger predictor of substance use than race and population density (Mason & Mennis, 2010). Further, since adolescent physical aggression can be predicted by neighbourhood violence (Jennings, Maldonado-Molina, Reingle, & Komro, 2011) and adolescents are more prone to make impulsive decisions when in the presence of peers (Chein et al., 2011; Gardner & Steinberg, 2005), this suggests that adolescents living in neighbourhoods with pervasive violence would be more likely to engage in indirect self-injurious behaviours, such as

substance use. Additionally, the present study did not take into account when the adolescent lived in the neighbourhood with pervasive violence. As with caregiver distress, it is possible that living in a neighbourhood with pervasive violence might be more influential during specific developmental periods. Future research should assess the impact of neighbourhood violence throughout distinct periods during adolescence as associated with substance use.

Overall, the results from the present study both reinforced current literature and present new findings regarding risk factors for adolescent engagement in direct and indirect self-injury behaviours. Taken together, these findings will support the development of prevention and intervention strategies to reduce the risk for serious consequences as a result of direct and indirect self-injury. Nonetheless, eliminating exposure to all risk factors predictive of direct and indirect self-injury behaviours is not a realistic approach. Rather, familial and community support in developing adaptive coping techniques for regulating intense emotions is discussed as an effective approach for at-risk adolescents.

Clinical Implications

Adolescence is an important developmental period for altering an individual's trajectory to prevent aversive mental health outcomes in the long term. In the present thesis, several individual and interpersonal risk factors for both directly and indirectly self-injurious behaviours were explored, to elucidate differential risk-pathways to self-injury and to inform targeted-prevention and intervention strategies aimed at adolescents. Specifically, directly self-injurious behaviours are strongly associated with internalizing difficulties (e.g., depressive symptoms), while indirectly self-injurious behaviours are

associated with externalizing problems (aggressive behaviours). Thus, adolescents who present with high depressive symptoms should be considered for risk of engagement in NSSI and SSI, while adolescents who exhibit high aggressive behaviours should be considered for risk of engagement in substance use. Additionally, unlike, direct self-injury, indirect self-injury commonly occurs among adolescents while in the presence of peers (Chein et al., 2011; Gardner & Steinberg, 2005). Intervention for adolescents engaging in substance use may involve changing the adolescent's peer group that is supportive of their current substance use lifestyle. This intervention strategy might involve supporting the development of strong social skills and enhancing positive peer relationships as well as encouraging the adolescent to identify and participate in activities that are incompatible with substance use, such as athletics, clubs, or part-time employment. Nonetheless, other risk factors including sex and age as well as familial and community factors must be considered when planning prevention and intervention strategies for at-risk adolescents.

Self-injurious behaviours have been described as dysfunctional strategies commonly used by adolescents for coping with and regulating strong emotions (Andrews et al., 2012; Chapman et al., 2006). Direct self-injury behaviours, such as NSSI and SSI, are typically used to reduce intense negative emotions, while indirect self-injury behaviours such as substance use are used in a variety of contexts to regulate positive and negative emotions (Victor et al., 2012). Therefore, once identified, at-risk adolescents should be taught healthy emotion regulation strategies. Specifically, adolescents at-risk for NSSI and SSI should be taught strategies for coping with strong negative emotions and worldviews. Whereas, adolescents at-risk for substance use should be taught

techniques for reducing heightened emotions, both positive and negative, being mindful of the moment before making impulsive decisions that may include substance use.

Further, familial and community support are highly influential during adolescence (Reitz-Krueger et al., 2015). Adolescents who engage in direct or indirect self-injury who have difficulty in regulating emotions may also report interpersonal difficulties. Specifically for adolescents engaging in direct self-injury, but also for adolescents engaging in indirect self-injury, it is important to teach how to initiate and maintain healthy relationships, whether within their family system or the community.

Adolescents who present with directly self-injurious behaviours, such as NSSI and SSI, may benefit from behavioural and family based treatment approaches for reducing their life-threatening and quality of life concerns (Fleischhaker et al., 2011; Katz, Cox, Gunasekara, & Miller, 2004; Prabhu, Molinari, Bowers, & Lomax, 2010; Rathus & Miller, 2002). Specifically, dialectical behaviour therapy (DBT) has been identified as an evidenced informed approach for teaching adolescents adaptive coping techniques and problem solving skills for managing strong emotions (Andrews et al., 2012; Miller, Rathus, Linehan, Wetzler, & Leigh, 1997; Miller, Rathus, & Linehan, 2007). Family therapy is encouraged when working with adolescents using DBT because the family system is highly influential in the maintenance of adolescent distress (Miller, Glinski, Woodberry, Mitchell, & Indik, 2002). Family therapy can serve as psycho-education for family members or to resolve familial issues; a positive home environment may benefit adolescents struggling to cope with strong emotions (Linehan, 1993).

Ultimately, by enhancing an adolescent's perceived meaning in life and reinforcing how

to build and maintain healthy relationships, adolescents may be empowered to seek assistance during times of distress (Andrews et al., 2012; Whitlock, et al., 2013).

Similarly, adolescents who present with indirect self-injury behaviours, such as substance use, may benefit from behavioural and family based intervention support for reducing their substance use by introducing or improving their use of healthy coping skills for dealing with distress (Cornelius et al., 2011; Henderson, Dakof, Greenbaum, & Liddle, 2010; Ogel & Coskun, 2011). Combining two behavioural techniques, motivational enhancement therapy (MET) and cognitive behavioural therapy (CBT), has demonstrated effectiveness for substance use treatment among adolescents (Cornelius et al., 2011). Both of the aforementioned techniques require adolescents to actively participate in their treatment. MET is a brief intervention that is effective for motivating adolescents to participate in additional types of CBT for substance use treatment by reducing their uncertainty regarding engaging in treatment to reduce their current substance use (Barnett, Sussman, Smith, Rohrbach, & Spruijt-Metz, 2012; Jensen et al., 2011; Tevyaw & Monti, 2004). CBT interventions for substance use highlight the connections between thoughts, feelings, and behaviours, assisting adolescents in understanding their vulnerabilities and triggers while providing support in the development of self-control skills including emotion regulation and substance reduction (Kaminer, Burlison, & Goldberger, 2002).

Despite the findings in the present study that caregiver distress was not predictive of adolescent engagement in substance use, as with adolescents engaging in directly self-injurious behaviours, family involvement in substance use treatment is highly important because adolescents typically live with their parents and other family members. Family

therapy has the potential to be highly efficacious for adolescents engaging in substance use because family members can reinforce, outside of therapy, the strategies learned in therapy in order to regulate emotions and cope with distress. Additionally, family therapy can address underlying relational and communication difficulties that may trigger substance use. Specifically, brief strategic family therapy (BSFT) emphasizes that families should be viewed as a system such that each member impacts every other member (Szapocznik, Muir, & Schwartz, 2013). Therefore, if one person is struggling with emotional or behavioural difficulties, unhealthy familial interactions are suggested to be the root of the problem (Szapocznik, Muir, et al., 2013). By addressing the family as an interdependent system to restructure maladaptive family interactions, the family member exhibiting the emotional and behavioural difficulties should show a reduction in symptoms (Szapocznik, Muir et al., 2013). BSFT has been found to be effective in reducing problem behaviours including substance use and delinquency among children and youth by increasing engagement in treatment and improving retention as well as increasing positive outcomes for families (Szapocznik, Zarate, Duff, & Muir, 2013; Waldron & Turner, 2008).

Limitations

While there are numerous strengths in the present study such as the large sample size and the use of a multisource comprehensive assessment tool completed by trained clinicians, it is not without limitations. First, the findings may not be generalizable to a community-based sample of adolescents due to the fact that all of the adolescents assessed were accessing outpatient or inpatient mental health services. Additionally, the adolescents were not randomly selected to participate in this study, but instead were

accessed as a convenience sample since the assessment tool was completed as part of typical clinical practice at 20 mental health agencies across the Province of Ontario. Next, cross-sectional information on risk factors and engagement regarding self-injury behaviour was examined and therefore the directionality of the findings cannot be determined. Although it is assumed that the examined risk factors would be present prior to engaging in the self-injury behaviours (e.g., depressive symptoms, aggressive behaviours, caregiver distress, lived in a neighbourhood with pervasive violence or criminal activity), it is also possible that engaging in self-injurious behaviours could increase the presence of risk factors such as caregiver distress in the future. Finally, the current study did not examine the frequency or severity of the predicted self-injury behaviours. With the exception of the distinction between NSSI and SSI, the extent of the self-injury behaviours is unknown. It is possible that self-injury behaviours may be predicted by dissimilar risk factors depending on the intensity and severity of the behaviours.

Future Directions for Research

Additional future research should examine the risk factors for engaging in other indirect self-injury behaviours to determine if any other behaviours are closely related with one another as well as engagement in direct self-injury behaviours. Moreover, the mode, frequency, and intensity of the self-injurious behaviours should be considered when determining risk factors for engagement. Adolescents who engage in more frequent, high intensity behaviours are likely at an increased risk for serious physical and mental health consequences. Furthermore, a longitudinal study to evaluate if there are critical periods during which certain risk factors are more predictive of engagement in

direct or indirect self-injury is needed. Finally, it is possible that interpersonal risk factors, such as caregiver distress or environmental risks, may be more predictive of engagement in self-injurious behaviours in early adolescence as compared to late adolescence.

Conclusions

Adolescent engagement in direct and indirect self-injury can result in serious physical and mental health consequences. Thus, identifying risk factors predictive of each form of self-injury behaviour (i.e., direct or indirect) can improve the development of targeted prevention and intervention strategies for at-risk adolescents. The results from the present study suggest that older, female adolescents who experience high levels of depressive symptoms, whose caregiver is experiencing distress, and who have lived in a neighbourhood with pervasive violence or criminal activity, are more likely than their peers to engage in directly self-injurious behaviours, both NSSI and SSI. Additionally, the results suggest that older adolescents who experience high levels of aggressive behaviour are more likely than their peers to engage in indirectly self-injurious behaviours, specifically substance use. Further, a trend exists such that those adolescents who have lived in a neighbourhood with pervasive violence or criminal activity are also more likely than their peers to engage in substance use. Understanding the risk factors for engagement in directly and indirectly self-injurious behaviours is important to circumvent potential immediate and long-term consequences and to develop evidence-informed prevention and intervention strategies.

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Curriculum Vitae

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RELATED WORK EXPERIENCE

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Research Assistant (September 2014 - Present)
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Co-Facilitator (May 2015 - April 2016)
Fetal Alcohol Spectrum Disorder Support Group, Dr. Kim Harris, London Family Court Clinic, London, ON

Research Assistant (May 2015 - August 2015)
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Research Fellow (May 2013 – August 2013)
Undergraduate Summer Student Research Fellowship, Queen's University, Kingston, ON

PUBLICATIONS

Stewart, S.L., **Klassen, J.A.**, & Hamza, C.A. (accepted). Emerging mental health diagnoses and school disruption: An examination among clinically referred children and youth. Paper submitted to *Exceptionality Education International*, 31 pages.

AWARDS AND SCHOLARSHIPS

Ontario Graduate Scholarship (OGS) (2015-2016)
Western Graduate Research Scholarship (WGRS) (2014-2016)
Queen Elizabeth Aiming for the Top II Scholarship (2010-2014)
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