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Posttraumatic Substance Use Disorders (PTSUD): Perceived Causal Relations between Trauma-Related Symptoms and Substance Use Disorders

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Graduate Program in Psychology
A thesis submitted in partial fulfillment of the requirements for the degree in Master of Science
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Abstract

Substance use disorders (SUD) and posttraumatic stress disorder (PTSD) are frequently comorbid in those who have experienced psychological trauma, although little research has investigated the cause and effect relationships between the two. This thesis examined the co-occurrence of trauma-related symptoms, PTSD, and SUD using *Perceived Causal Relations* scaling in an online community sample ($n = 513$) and in persons who were or had recently attended treatment for SUDs ($n = 12$). In both samples, participants perceived trauma-related reexperiencing and avoidance as significant causes of substance use partly dependent on the gender of the respondent, and men reported that dissociative experiences were more of an effect than a cause of their substance use. Study results are considered in respect to the self-medication, high-risk and susceptibility hypotheses associating PTSD-SUD comorbidity.

Keywords: Posttraumatic stress, trauma, substance use, comorbidity, perceived causal relations

Acknowledgments

First, I would like to thank Dr. Paul Frewen and the Frewen lab for their support and help over the past two years. Specifically, I would like to thank Heather Hargraves for volunteering her time and aiding with interviewing participants for the clinical sample portion of this thesis. Similarly, many thanks to the staff and clients at Westover Treatment Centre and Quintin Warner House for being open to and participating in this research.

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1.0 Introduction

Persons who abuse alcohol and psychoactive drugs frequently experience posttraumatic stress, depression, anxiety, and dissociative experiences, such that these persons may be diagnosed with a comorbid, or co-occurring, disorder. Research is needed to clarify the etiology of comorbid substance use disorders (SUDs). It may be that in comorbid SUDs, substance use and psychological conditions including posttraumatic stress disorder (PTSD), depression, anxiety and dissociative disorders are inter-causal. For example, the most widely accepted explanation is that many persons abuse substances in order to cope with intrusive symptoms of PTSD, depression, anxiety, and dissociative disorders (i.e., the *self-medication hypothesis*; Brady, Back, & Coffey, 2004; Khantzian, 1985). However, substance use can also produce secondary symptoms that mimic PTSD, depression, anxiety, and dissociative experiences in and of itself (i.e., as in a diagnosis of a substance-induced disorder). Furthermore, long-term substance use and addiction can produce a sense of helplessness and hopelessness in the user, in turn the primary cause of a secondary affective disorder (i.e., the *susceptibility hypothesis*; Chilcoat & Breslau, 1998a, 1998b). Moreover, states of intoxication and/or withdrawal may increase the risk of psychological trauma exposure and hence posttraumatic stress (i.e., the *high-risk hypothesis*; Brady et al., 2004; Chilcoat & Breslau, 1998a, 1998b). Clearly the etiology linking SUD with PTSD, depression, anxiety and dissociative disorders is manifold and complex.

In this thesis I will investigate associations between substance use and posttraumatic stress symptomatology, specifically, the reexperiencing of traumatic memories, experiential and behavioural avoidance, and the dissociative experiences of depersonalization and derealization. In order to do so, I will apply an introspective psychometric framework titled *Perceived Causal*

Relations (PCR) scaling which assesses participants' own attributions concerning the casual associations potentially connecting their different psychological problems (Frewen, Allen, Lanius, & Neufeld, 2012; Frewen, Schmittmann, Bringmann, & Borsboom, 2013; Tzannidakis & Frewen, 2015). I will examine the co-occurrence of SUDs with posttraumatic stress, depression, anxiety, and dissociative disorders and the theories concerning comorbidity of SUDs with posttraumatic stress, depression, anxiety, and dissociative experiences. I will then explain the PCR methodology and its prior applications as a means of understanding the cause-and-effect associations that may be present between comorbid psychological disorders based on the lived experience of persons experiencing these conditions. Finally, I will describe the methods and results of an online community sample of convenience ($n = 513$) as well as a clinical sample of individuals who are currently attending or have attended treatment for SUDs ($n = 12$), in which both used the PCR methodology to examine the cause and effect relationships between trauma symptomatology and substance use. A general conclusion of data collected is to support theories that regard psychological trauma exposure and experiences of posttraumatic stress as causal risk factors for SUDs, as well as to support the use of PCR as a psychological assessment methodology for investigating the etiological significance of experiences of posttraumatic stress for SUDs in clinical practice.

It is important to point out that, within the substance use literature, varying terms are used to refer to different substances and SUDs. For example, the American Psychiatric Association (APA)'s previous Diagnostic and Statistical Manual of Mental Disorders (4th ed., text rev.; *DSM-IV-TR*; APA, 2000) and current manual (5th ed.; *DSM-5*; APA, 2013) have different terms for substance use and disorders. For the purposes of this thesis, unless otherwise stated, a SUD refers to substance use, abuse, or dependence that leads to a clinically significant biopsychosocial

disorder. The American Psychiatric Association (APA, 2013) currently officially recognizes ten substance classes in the DSM-5: alcohol; caffeine; cannabis; hallucinogens, phencyclidine, and other; inhalants; opioids; sedatives, hypnotics, and anxiolytics; stimulants such as amphetamine, cocaine, and other; tobacco; and other/unknown. However, research referring to the inclusion of all substance use classes is relatively rare in the SUDs literature. Therefore, when referring to prevalence of substance use and SUDs, I distinguish between use and SUDs whenever possible. However, when prior research statistics fail to discriminate between alcohol and other drugs of abuse, reference to substance use, abuse, dependence, and disorders can be taken to reflect the use of alcohol, drugs, or both. Where possible, I consider research regarding specific substance classes.

1.1 Substance Use Disorders (SUDs)

Substance use and abuse is a rather common occurrence in Canada, the United States, and other countries across age, educational status, marital status, and sex. The lifetime prevalence of being diagnosed with a substance use disorder in Canada is a striking 21.6% (Pearson, Janz, & Ali, 2013). Alcohol is the most commonly used substance across age categories in both Canadian adults and youth, as well as globally, partly due to its legal availability in comparison to other drugs. The Canadian Addiction Survey (CAS) suggested that of the almost 80% of Canadian adults who consume alcohol, 44% reported drinking on a weekly basis, and 10% more than four times a week (Adlaf, Begin, & Sawka, 2005). The more recent Canadian Alcohol and Drug Use Monitoring Survey (CADUMS) provided comparable estimates for young adults (Health Canada, 2012). In addition, 16% of adults indicated binge-drinking, defined as drinking five or more drinks in one sitting, with just under 25% of drinking adults exceeding the low-risk guidelines of no more than two drinks in one sitting suggested for alcohol consumption (Adlaf et

al., 2005). The CADUMS, which also defined binge-drinking as consuming more than a recommended maximum of five alcoholic beverages in one sitting, gave a 19-29% population prevalence for youth binge-drinking in the year prior to the survey (Health Canada, 2012). Other studies have also reported high prevalence of binge-drinking, with approximately two youth in five (37%) endorsing binge-drinking (Leatherdale, Hammond, & Ahmed, 2008). Between 44% to 62% of Canadian youth from grades seven to nine have reported drinking alcohol in various surveys, and by grade 12, lifetime use of alcohol among Canadian youth is as high as 77-91%, with up to 80% indicating past year alcohol use (Health Canada, 2012).

Comparable numbers have been found in other countries that have systematically assessed rates of alcohol consumption. For example, the Substance Abuse and Mental Health Services Administration (SAMHSA; 2013) reported that 71% of American adults had used alcohol within the past year, with almost 88% of Americans having a lifetime use of alcohol. In fact, 56% had used alcohol and 24% had binge-drunk at least once in the month prior to the survey (SAMHSA, 2012). Overall, 14.6 % of Americans will be diagnosed with a substance use disorder, with the majority of people having an alcohol use disorder (Kessler et al., 2005). American youth also show high levels of underage drinking, with 26% of students in grade six having reported trying alcohol at least once in one survey (Cleveland, Feinberg, Bontempo, & Greenberg, 2008). By grade 12, the number of American youth who had tried alcohol increased to 83%, with nearly a third reporting binge drinking five or more drinks in a single sitting at least once (Cleveland et al., 2008).

Although alcohol is generally the most abused substance within Canada and globally, other drugs are also found to be in high use. Lifetime cannabis use among Canadians is also startlingly high, approximately 41% to 44.5% in national surveys (Adlaf et al., 2005; Health

Canada, 2012). Fourteen percent reported using cannabis in the month prior to the CAS survey (Adlaf et al., 2005). Besides cannabis, use of other illicit drugs is reported with surprisingly high prevalence. For example, use of hallucinogens has a lifetime prevalence of 11.4%, and about 10% of the Canadian population has tried cocaine at least once (Adlaf et al., 2005). In fact, approximately one out of every six Canadians has tried hallucinogens, cocaine, speed, ecstasy, or heroin at some point in their lives (Adlaf et al., 2005).

Substance use among Canadians is generally high relative to international estimates, but somewhat lower than that observed among our neighbours to the south. Specifically, substance use rates among Americans may be even higher than those for Canadians, with over 40% having used any illicit drug sometime in their lives, 44% over the age of 12 having tried cannabis at least once in their lives, and 13% having used cannabis at least once in the previous year (SAMHSA, 2014). Reported illicit drug use rates for North America, however, are somewhat higher than those for many other countries that have been reliably surveyed. According to the United Nations Office on Drugs and Crime (UNODC), the global use of illicit drugs such as cannabis, cocaine, and opiates is anywhere from 3.4% to 6.6% of adults aged 15-64 (UNODC, 2012). Cannabis is the most globally used drug with 2.6-5% of adults using, and this number has remained relatively stable for several years (UNODC, 2012). As this number has remained stable, the percentage of Canadian and American adults who have reported using cannabis is disproportionately higher than global norms.

Although substance use is very prevalent in North America and worldwide, not all persons who abuse substances experience clinically significant adverse social, occupational, or health outcomes. As a reiteration, the lifetime prevalence of a SUD in Canada is 21.6% (Pearson et al., 2013), and the corresponding rate is 14.6% in the United States (Kessler et al., 2005),

clearly far below the prevalence of substance use. Moreover, the majority of diagnosed SUDs are alcohol-related.

The diagnostic criteria for a SUD include presenting with a variety of behavioural, cognitive, and physiological symptoms secondary to substance use such as varying severity of lack of control, social isolation, failure to perform obligations, risky and hazardous uses of substances, craving, tolerance, and withdrawal (APA, 2013). The defining feature of the diagnosis of a SUD is that the individual persists in using the substance regardless of significant biopsychosocial consequences. Moreover, all of the substances recognized by the APA can be present in a SUD with the exception of caffeine. The DSM-5 also contains a category of substance-related disorders labeled substance-induced disorders (APA, 2013). SUDs often involve polysubstance use, but the unique adverse outcomes of use of each substance should be diagnosed independently (APA, 2013). For example, a patient presenting with severe alcohol, cannabis, and amphetamine addiction will be diagnosed with three different substance-induced disorders.

A variety of risk factors for SUDs have been identified, including being male (Adlaf et al., 2005; King & Chassin, 2007; Young et al., 2002), age (rates highest among youth and young adults as compared with older age; Adlaf et al., 2005; Fergusson, Boden, & Horwood, 2008; Kilpatrick et al., 2000), ethnicity (rates found to be higher among Native Americans, Caucasians, and Hispanics than for Asians or those of African descent; McCabe et al., 2007; Merline, Jager, & Schulenberg, 2008), family history of SUDs (Kilpatrick et al., 2000; Von Sydow, Lieb, Pfister, Höfler, & Wittchen, 2002), and low social support (i.e., relative absence of family and other close relationships; Beyers, Toumbourou, Catalano, Arthur, & Hawkins, 2004; Fergusson et al., 2008). Unfortunately, Cleveland and colleagues (2008) found that typically risk factors for

SUDs are better predictors of future substance use more so than protective factors are of predicting non-use. Of particular interest to the present thesis is the relative risk for SUDs associated with having experienced one or more traumatic life events.

1.2 Posttraumatic Stress Disorder (PTSD)

About 76% of Canadians will experience a traumatic life event sometime in their lives (Van Ameringen, Mancini, Patterson, & Boyle, 2008). This may include being involved in a serious accident, war, sexual assault, molestation, assault with a weapon, rape, or witnessing death. Although many Canadians are resilient, approximately 7% of will develop lifetime PTSD, and 12-month prevalence is estimated at 2.4% (Van Ameringen et al., 2008). On a global level, trauma exposure prevalence rates are generally lower than North American rates (e.g. Canada, 76%; Van Ameringen et al., 2008; United States, 90%; Kilpatrick, Resnick, Milanak, Miller, Keyes, & Friedman, 2013), and are at approximately 67% (Karam et al., 2013; Norris & Sloan, 2014; Stein et al., 2014).

Diagnosis of PTSD globally is anywhere from 1.1% to 5.6%, if PTSD is broadly defined, and consistent with estimates observed for the United States (Karam et al., 2013; Stein et al., 2014). PTSD is a psychological disorder defined by the repetitive intrusive reexperiencing of one or more traumatic events, whether through distressing memories, nightmares, flashbacks, or psychological and physiological reactivity to reminders of the event. In addition to reexperiencing the event in one or more of these forms, PTSD is also associated with various concurrent affective and behavioural symptoms including avoidance behaviour, cognitive and emotional sequelae (e.g., cognitive impairment, emotional numbing), and hyperarousal (Friedman, 2013). Several factors tend to influence the likelihood that a traumatic event will

result in PTSD. For example, events that involve serious threats (Ozer, Best, Lipsey, & Weiss, 2003), injuries (Acierno, Kilpatrick & Resnick, 1999), violence and cruelty (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), betrayal by a person or place representative of safety (Brewin, Andrews, & Valentine, 2000; Freyd, 1998), and repetitive trauma (Brewin et al., 2000) tend to be particularly likely to lead to PTSD. Additionally, women are statistically more likely to have experienced some sort of sexually-related trauma and meet the diagnostic criteria for PTSD (Olf, Langeland, Draijer, & Gersons, 2007; Tolin & Foa, 2006). Moreover, meta-analyses gathered on PTSD risk factors show that the degree of exposure is reliably predictive of the development of PTSD (Brewin et al., 2000; Ozer et al., 2003; Vogt, King, & King, 2007).

PTSD is often diagnosed in the presence of comorbid psychological disorders, with anywhere from 17-50% of women and 15-60% of men with PTSD meeting the criteria for at least one other psychiatric condition, depending on the specific comorbid diagnosis (Creamer, Burgess, & MacFarlane, 2001; Kessler et al., 1995). PTSD is especially frequently comorbid with affective disorders such as major depressive disorder (MDD), thought to be a result of trauma exposure being a shared vulnerability and risk factor for both disorders (O'Donnell, Creamer, & Pattinson 2004; Spinhoven, Penninx, van Hemert, de Rooij, & Elzinga, 2014). In general, 50% to 60% of patients with PTSD also have comorbid depression (Creamer et al., 2001; O'Donnell et al., 2004; Kessler et al., 1995). Those who have comorbid PTSD and MDD may have a more complex patient profile, as patients who have both disorders endorse more severe PTSD symptoms and have a more global level of impairment (Momartin, Silove, Manicavasagar, & Steel, 2004; Spinhoven et al., 2014). In addition, anxiety disorders and PTSD are also frequently comorbid, which may be due in part to overlapping diagnostic features including increased startle response, hypervigilance, and irritability. The estimates for a five-year

diagnosis of any anxiety disorder with comorbid PTSD range from 27-59% (Spinhoven et al., 2014), while more conservative values for lifetime prevalence range from 7-31% depending on the specific anxiety disorder diagnosed (Kessler et al., 1995).

1.3 Common Features between SUD and PTSD

Dass-Brailford & Myrick (2010) reviewed commonalities in patients diagnosed with PTSD and SUD, as well as intervention programs designed to treat both disorders. High trauma exposure rates such as those involving childhood maltreatment and abuse are commonly reported in people with both PTSD and SUDs, and people who come to be treated for SUDs often meet criteria for PTSD (Dass-Brailford & Myrick, 2010). Persons with comorbid disorders often have poorer health and psychological functioning than persons with either disorder alone, and their PTSD symptoms including hyperarousal and intrusive reexperiencing can prompt drug and alcohol abuse as a form of coping (“self-medication”), unfortunately often leading to further health problems and dependence.

1.3.1 Trauma History

Traumatic experiences, as well as PTSD, are risk factors for SUDs. Those who abuse alcohol or drugs are approximately 1.5 to 1.7 times as likely as non-substance users to experience at least one traumatic event (Breslau, Davis, Andreski, & Peterson, 1991; Kessler et al., 1995). Experiencing physical or sexual assault and witnessing violence increases the risk of diagnosis of alcohol, cannabis, and hard drug abuse and dependence, and the number of traumatic events significantly predicts substance use behaviours (Dansky, Saladin, Brady, Kilpatrick, & Resnick, 1995; Del Gaizo, Elhai, & Weaver, 2011; Kilpatrick, Acierno, Resnick, Saunders, & Best, 1997; Kilpatrick et al., 2000), with experiences of sexual assault associated

with an especially high risk for substance abuse in women (Breslau, Davis, & Schultz, 2003; Danielson et al., 2009; Olf et al., 2007). Women who met criteria for both PTSD and SUD reported higher rates of victimization, such as physical assault and sexual molestation, than those who are diagnosed with PTSD and no SUD, adding to the evidence that past trauma history may be a risk factor for future SUDs as well as PTSD (Saladin, Brady, Dansky, & Kilpatrick, 1995). Similarly, women who meet the diagnostic criteria for both PTSD and SUD are more likely to have been a victim of childhood abuse and traumatization (Brown & Wolfe, 1994; Polusny & Follete, 1995).

Many studies have shown that the psychological traumas of childhood are also often associated with adult substance use. For example, individuals who experienced childhood traumas, such as abuse, are more likely to abuse illegal or illicit substances (Simpson & Miller, 2002) as well as tobacco (Rodgers et al., 2004). In a treatment-seeking sample, childhood traumas, and more specifically physical abuse, were associated with a younger age of onset for alcohol use, suggesting that there may be differences in adult versus childhood traumas for substance use outcomes (Schäfer et al., 2007). Interestingly, there may be a gender difference between the type of trauma experienced and the substances used; childhood sexual trauma in women has been linked with cocaine and marijuana use, and physical abuse in men was associated with cocaine and heroin use (Khoury, Tang, Bradley, Cubells, & Ressler, 2010). Similarly, childhood neglect and other psychological traumas can be linked to lifetime opioid dependence (Boscarino et al., 2010).

1.3.2 Reexperiencing

Literature on reexperiencing as a common feature between PTSD and SUD seems to be somewhat small and inconclusive. For example, individuals meeting diagnostic criteria for PTSD or for both PTSD and SUD reported no significant differences in levels of reexperiencing symptoms (Saladin et al., 1995), but most studies seem to focus on rates of revictimization based on PTSD symptoms such as reexperiencing, along with substance use (e.g. Messman-Moore, Ward, & Brown, 2009; Ullman, Najdowski, & Fillipas, 2009).

However, in some populations, reexperiencing may be related to future substance use in conjunction with other predictors. In veterans, scores on alcohol and drug screening questionnaires positively correlated with reexperiencing symptoms reported five years prior; however, in follow-up hierarchical regressions, reexperiencing scores were not predictive of future alcohol or drug use (Shipherd, Stafford, & Tanner, 2005). The opposite was found in a sample of women in residential treatment for substance use disorders. In this sample, any baseline reexperiencing symptom at intake was predictive of future relapse for both alcohol and other drug disorders, and for each additional reported reexperiencing symptom, the likelihood of relapse increased by a factor of 2.0 (Brown, 2000). Additionally, it has been shown that individuals exhibiting high levels of trauma-related symptoms, such as reexperiencing and avoidance, display increases in problem alcohol use post-trauma (Nickerson et al., 2014).

1.3.3 Avoidance

Individuals that display comorbid PTSD and SUD had a higher mean number of reported avoidance symptoms, as well as arousal symptoms (Saladin et al., 1995), and in a veteran population, avoidance was significantly correlated with future alcohol and drug use (Shipherd et

al., 2005). Experiential avoidance, the desire and behavioural effort to avoid unwanted internal experiences, thoughts, and emotions, can also be linked to substance abuse (Gratz, Bornovalova, Delany-Brumsey, Nick, & Lejuez, 2007; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). It has been suggested that experiential avoidance, which seems to heavily overlap with the PTSD diagnostic criteria of C1 (“Avoidance of or efforts to avoid distressing memories, thoughts, or feelings about or closely associated with the traumatic event(s)”; APA, 2013) can be both a mental experience and a physical action, such that the desire to avoid internal experiences is completed through the physical act of substance use (Chapman, Gratz, & Brown, 2006). Experiential avoidance has been shown to directly predict the tendency to participate in problem behaviours such as alcohol and other drug use (Kingston, Clarke, & Remington, 2010).

In a clinical sample attending a residential treatment centre for substance abuse, individuals who were moderately to severely abused as children displayed significantly high levels of experiential avoidance (Gratz et al., 2007). Similarly, in a veteran population, those who abused substances and were experiencing heightened arousal also displayed higher levels of experiential avoidance (Forsyth, Parker, & Finlay, 2003). This study, coupled with the findings from Gratz et al. (2007) suggests that there may be a relationship between trauma, substance use, and experiential avoidance. In fact, Kingston and colleagues (2010) found that experiential avoidance mediated the relationship between childhood trauma and problem behaviours such as substance use, in that childhood traumas predict problem behaviours due to the traumas increasing levels of experiential avoidance.

1.3.4 Dissociation

Finally, trauma-related dissociative symptoms have also been strongly associated with particularly hazardous substance consumption (Najavits & Walsh, 2012; Seedat, Stein, & Forde, 2003). In general, high endorsement of trauma-related dissociative experiences tends to co-occur with more severe PTSD symptomatology, and as such, a person may attempt to use substances to manage their PTSD symptoms (Carlson, Dalenberg, & McDade-Montez, 2012; Najavits & Walsh, 2012). Additionally, it seems as though this can be examined with specific substances; for example, dissociative symptoms in an alcohol dependent population were found to effect the age of onset for the alcohol dependent diagnosis such that there was an earlier onset of dependency (Schäfer et al., 2007). However, the dissociative symptoms were also associated with emotional abuse in childhood independent of the alcohol dependence, so there may not be a clear causal pathway between dissociation, PTSD, and substance use, at least in a treatment-seeking population. Although the threefold co-occurrence of dissociation, PTSD, and SUDs is not an overly common presentation, this presents as frequent enough that clinicians have been advised to assess for dissociation in individuals presenting with a SUD (Seedat et al., 2003).

1.4 Comorbidity between SUD and PTSD

Substance abuse has also been associated with various trauma-related disorders including PTSD, whether as an outcome, comorbid disorder, or a risk factor (Breslau et al, 2003; Cacciola, Koppenhaver, Alterman, & McKay, 2009; Danielson et al., 2009; Del Gaizo et al., 2011; Swendsen et al., 2010). Individuals presenting with both PTSD and SUD tend to have a more severe clinical profile than those with a SUD in the absence of PTSD (Mills, Lynskey, Teesson, Ross, & Darke, 2005). Anywhere from 12-34% of people with an SUD are expected also to meet

criteria for PTSD (Center for Substance Abuse Treatment, 2005). Women are two to three times more likely to be diagnosed with PTSD when already diagnosed with and receiving treatment for an SUD (Center for Substance Abuse Treatment, 2005). A large epidemiological study investigating the relationships of PTSD with other disorders in Canadian adults found that 44.7% of men with PTSD and 21.3% of women have comorbid alcohol abuse/dependence (Van Ameringen et al., 2008). In contrast, comparable rates for comorbid PTSD and substance abuse and dependence were 41.8% of men and 19.3% of women (Van Ameringen et al., 2008). In this study, PTSD typically resulted from experiencing a sexual assault or molestation, a loved one unexpectedly dying, or witnessing the serious injury or death of another person (Van Ameringen et al., 2008).

In addition to PTSD, SUDs are frequently associated with other trauma-related disorders including affective disorders and anxiety disorders. Referring first to affective disorders, approximately 20% of people with an SUD will meet criteria for a mood disorder, and 20% of those with a mood disorder meet criteria for an SUD (Grant et al., 2004). The diagnosis of depression does not necessarily increase use of alcohol or cannabis when compared to individuals without depression, but individuals with depression are more likely to report hard drug use over those without depression (Chakroun, Johnson, & Swendsen, 2010). In fact, researchers identified a relationship between positive mood and subsequent alcohol and cannabis use such that on a daily basis, positive moods were associated with increased alcohol and cannabis use (Chakroun et al., 2010). However, illicit drug use was associated with depressed mood (Chakroun et al., 2010). This seems to be generally at odds with depression being a risk factor for an alcohol or cannabis SUD, but suggests that depression may be a risk factor for illicit drug use such as cocaine or ecstasy.

Largely similar comorbidity rates have been found between SUDs and anxiety disorders. Overall, 17% of people with an SUD meet criteria for an anxiety disorder, and 15% of those already diagnosed with an anxiety disorder meet criteria for an SUD (Grant et al., 2004). Generalized anxiety is particularly associated with substance use (Grant et al., 2004). The substance of choice in those with comorbid generalized anxiety and a SUD is most frequently alcohol (93%) over drugs (47%; Alegría et al., 2010).

1.4.1 Theories of Comorbidity between SUDs and Trauma

While it is clear that substance use, PTSD, and related disorders are often linked, it is not necessarily clear why or how. The high rates of comorbidity between the trauma-related disorders and SUDs evidences that they are related, but the pathways between the two are not clear. Depression and anxiety disorders are also highly comorbid, and heavily overlap with PTSD and SUD comorbidity as well, further complicating the investigation of the pathways between the disorders. However, a review of the literature between PTSD and SUD concludes two main pathways (Jacobsen, Southwick, & Kosten, 2001). In the first, trauma exposure and likely PTSD precede SUD, whereas in the second pathway, SUD precedes trauma exposure and PTSD. These two pathways are detailed in the next three sections.

1.4.2 The Self-Medication Hypothesis

One of the dominant theories explaining the high rates of co-occurrence between these disorders is the *self-medicating hypothesis*. This theory posits that a person who is using substances is doing so to decrease experiences related to other comorbid disorders often linked to trauma exposure, such as to decrease trauma-related emotions such as fear or shame, and to suppress memory of the traumatic events (Brady, et al., 2004; Chilcoat & Breslau, 1998a;

Khantzian, 1985; Souza & Spates, 2008). In essence, the individual is attempting to decrease, avoid, or escape internal and external reminders of a traumatic event through substance use. As such, this theory posits that trauma-related symptoms are the primary cause of comorbid SUD and further suggests that because SUD-related withdrawal symptoms can also mimic PTSD symptoms of hyperarousal, sleep disturbance, irritability, and concentration problems, a person will continue using substances (Jacobsen et al., 2001). Withdrawal symptoms support continued drug use, creating a reinforcing self-medication cycle that can lead to dependence on the substance.

The majority of the research investigating PTSD and SUD comorbidity has tended to, at least indirectly, support the self-medication hypothesis. Referring to order of disorder onset, PTSD more often precedes the development of SUD, suggesting that trauma exposure and PTSD are frequently etiologically significant for SUD (Back, Brady, Sonne, & Verduin, 2006; Chilcoat & Breslau, 1998a, 1998b; Compton, Cottler, Phelps, Abdallah, & Sptiznagel, 2000; Stewart & Conrod, 2003). Further, Del Gaizo and colleagues (2011) found that a diagnosis of PTSD partially mediates the relationship between traumatic exposure and substance abuse, as well as the relationship between traumatic exposure and poor health outcomes. Chilcoat and Breslau (1998a) also found that the risk of substance use increases when the person already has PTSD, and that without PTSD the causal link between exposure to trauma and subsequent substance abuse is not present, likely due to an individual's resiliency following a traumatic event decreasing the likelihood of their developing PTSD. As well, women who have been physically or sexually assaulted are 2.77 times more likely to abuse alcohol and 1.92 times more likely to start or increase drug use compared to women who have not been assaulted (Kilpatrick et al., 1997) and this increased use is particularly pronounced within the two years following the

traumatic assault. Increases in substance craving are also associated with PTSD symptom severity (Saladin, Drobles, Coffey, Dansjy, Brady, & Kilpatrick, 2003), which would be consistent with both PTSD symptoms motivating substance use and a withdrawal mediated effect, both as described for the self-medicating theory.

Interestingly, Khantzian (1985, 1997) suggested that the substance of choice used by a person may be partially influenced by what kinds of psychological symptoms they are attempting to self-medicate. For example, an individual use sedating drugs such as alcohol to quell hyperarousal, opiates to pacify emotional pain such as trauma-related shame and guilt, or stimulants to combat anhedonia, lethargy, fatigue, and other depressive features. Saladin et al. (1995) further investigated this, suggesting that those who have alcohol dependence and PTSD may display more arousal symptoms, due to the chemical nature of alcohol, than individuals with PTSD and a different drug of dependence.

1.4.3 The High-risk and Susceptibility Hypotheses

Notwithstanding the general support for the self-medication theory, two alternative hypotheses have been proposed that tend to support substance use as a causal risk factor for PTSD, as opposed to the reverse. First, the *high-risk hypothesis* posits that substance use can precede trauma exposure, and that a person using substances is more likely to be engaged in a generally more high risk lifestyle, thereby being at an increased risk for exposure to traumatic events leading to PTSD (Brady et al., 2004; Chilcoat & Breslau, 1998a, 1998b; Souza & Spates, 2008). While Chilcoat and Breslau (1998a, 1998b) failed to find evidence to support the high-risk hypothesis, they mention that they cannot rule it out. However, Kilpatrick et al. (1997) partially did find evidence to support the high-risk hypothesis. Results from Kilpatrick and

colleagues' study suggest that using drugs and alcohol – but not alcohol exclusively – can increase risk of future assault within a span of two years by 1.68 to 1.84 in women. This means that women who were using drugs and alcohol at the beginning of the survey were almost twice as likely to have been physically or sexually assaulted at some point within the next two years than those who were not using. However, they also found that assault could lead to substance abuse, which provides evidence for the self-medication hypothesis.

A second alternate hypothesis to the self-medication theory is the *susceptibility hypothesis*, which, like the high-risk hypothesis, posits substance use as a causal factor for PTSD rather than the reverse. The susceptibility hypothesis suggests that a person who uses substances is biologically at an increased risk of developing PTSD after trauma exposure, due to factors such as increased anxiety and arousal or neurochemical changes in the brain due to chronic substance use, along with ineffective coping skills (Brady et al., 2004; Chilcoat & Breslau, 1998a, 1998b). Kilpatrick et al (1997) suggest that this increased vulnerability may be most apparent in those who have a past history of trauma and substance use, as those who had a past history of both were most likely to continue to use in the future. However, this position confounds the differences between the high-risk and susceptibility hypotheses, as well as the self-medication hypothesis. As both prior trauma (susceptibility and potentially self-medication) and substance use (high-risk) increase future drug use, it remains unclear as to which factor is truly the causal factor.

As such, none of these theories is likely able to universally account for the comorbidity between SUD and trauma-related disorders such as PTSD. Rather, an integrative model seems more likely based on the principles of equifinality, that is, that different cases of comorbid SUD and PTSD may have different causes. For example, PTSD may increase risk for SUD via

processes described by self-medication theory in some cases, whilst SUD may increase risk for PTSD via processes discussed by the high-risk and susceptibility hypotheses. Together, these theories may be more complementary than antagonistic, and together may be more capable of capturing the causal comorbidity between PTSD and SUDs in different individuals.

1.5 Investigating Causality

One source of information about the co-occurrence of SUD, trauma exposure, and trauma-related symptoms including PTSD is the lived experience and introspections provided by persons with such comorbidities. For example, simply asking persons suffering from both SUDs and PTSD whether and how their problems with SUDs and PTSD interrelate can help inform case conceptualization at the idiographic level such as whether a particular case better matches the self-medication theory, better represents an instance of the high-risk hypothesis and/or the susceptibility hypothesis, or fits some other form of hypothesized association or independence between SUD and PTSD.

Indeed it would seem rather common and even natural for clinicians to hypothesize the psychological problems that their patients are experiencing as primary versus secondary, that is, as the primary cause or the secondary outcome of other psychological problems with which they are facing. For example, a psychologist may hypothesize any individual's trauma exposure and associated PTSD as the primary cause or secondary effect of their SUD. Consistent with this, Palm, Strong, and MacPherson (2009), examining PTSD symptoms, suggested "there is a potential for a causal relationship among particular symptoms such that the development or exacerbation of one symptom may potentiate or inhibit others during the acute course of symptom development". Moreover, the network approach to understanding psychopathology

developed by Borsboom and colleagues similarly regards comorbidity between disorders to be the cause of causal associations that emerge at the level of symptoms, especially symptoms that diagnostically overlap between the two comorbid disorders, which they refer to as “bridging symptoms” (Borsboom, 2008; Borsboom & Cramer, 2013; Borsboom, Cramer, Schmittmann, Epskamp, & Waldorp, 2011; Boschloo et al., 2015; Cramer, Waldrop, van der Maas, & Borsboom, 2010; Fried et al., 2015; Fried, Epskamp, Nesse, Tuerlinkx, & Borsboom, 2016; Kossakowski et al., 2015; Schmittmann et al., 2011). Importantly, such pathways are frequently considered bidirectional rather than only unidirectional, although each of the directional pathways can vary in strength and dominance (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001), and the network approach generally does not examine this bidirectionality. As a result, one individual’s trauma exposure and PTSD may be a strong cause of their SUD, as per the self-medication theory, whilst their substance use may be only moderately or weakly a causal factor for their experience of PTSD symptomatology, as per the high-risk or susceptibility hypotheses; the opposite may be true for another individual.

1.6 Perceived Causal Relations (PCR) Scaling

It has been posited that an idiographic or subjectively individualized approach to assessing comorbid psychological disorders and the causal relatedness between presenting problems can be useful in helping determine case conceptualization and clinical treatment regimens (Frewen et al., 2012; Haynes, Mumma, & Pinson, 2009). Following an individualized, idiographic approach to theory development, both face and content validity can be increased, and when results are found to replicate across persons they can begin to be applied to theory at the nomothetic or generalized application level (Haynes & Lench, 2003; Haynes et al., 2009; Strauss & Smith, 2009).

While a clinician's role is frequently to link such hypothesized causal chains between their patients' various comorbid presenting problems in the service of developing a case conceptualization and treatment plan, the patient him or herself may also hold his or her own hypotheses about the cause and effect relationships that their different psychological problems exhibit with one another. For example, Kelly's (1963) personal construct theory conceptualizes individuals as scientists-researchers who interpret and apply meaning to events occurring in their lives, and attribution theory considers an individual as perceiving causal relationships between a variety of concepts and the consequences of such inferences (e.g. Kelley & Michela, 1980).

As a more recent instantiation of such approaches, *Perceived Causal Relations (PCR) Scaling* is a systematic, introspective methodology developed to assess the directional pathways people perceive to causally link their own different psychological problems (Frewen et al., 2012; Frewen, Schmittmann, Bringmann, & Borsboom, 2013; Tzannidakis & Frewen, 2015). Within the PCR methodology, an individual reports the frequency with which they are experiencing a variety of symptoms or problems associated with different psychological disorders, and then rates the degree to which they attribute each of the endorsed symptoms/problems as the cause of all other endorsed symptoms/problems, creating a matrix of perceived causal relationships associating the symptoms/problems with one another. The PCR cause and effect outcomes vary on which presenting symptoms are endorsed, and a clinician can utilize these outcomes to aid in a case conceptualization regarding which psychological symptoms and problems are those perceived by the patient to be most causally associated with one another and with functional impairment.

Relationships between symptoms of PTSD, anxiety, major depressive disorder, and trauma-altered states of consciousness (TRASC) have been examined using the PCR

methodology in three prior studies (Frewen et al., 2012; Frewen et al., 2013; Tzannidakis & Frewen, 2015). Both studies revealed bidirectionality, but differential dominance, in the PCR linking PTSD and anxiety with depression. In these studies, individuals attributed their intrusive reexperiencing of traumatic memories and their anxiety to be more causal of their experience of depressive symptoms than they attributed their symptoms of depression to be causal of their posttraumatic reexperiencing and anxiety (Frewen et al., 2012; Frewen et al., 2013; Tzannidakis & Frewen, 2015). Frewen et al. (2013) further extended PCR scaling to the investigation of moderation and mediation. For example, they found that the frequency with which a person reported posttraumatic reexperiencing significantly mediated the relationship between increased feelings of shame and depression, whilst this mediation pathway was moderated to the extent that participants perceived that such pathways were strong (i.e., via PCR; Frewen et al., 2013). A significant limitation of these prior studies, however, is that they have only been conducted in undergraduate samples, such that the generalizability of findings to community and clinical samples is unknown.

1.6.1 Application of PCR to SUD and PTSD Comorbidity

The PCR methodology has not previously been used to examine the co-occurrence of trauma-related symptoms with SUD in any detail. In prior studies, a single question on the PCR inquired about SUDs and found no difference between the overall cause versus effect associations SUDs exhibited with other psychological problems. However, the PCR between SUDs and PTSD-related symptoms specifically has never been directly examined. Furthermore, as Khantzian (1985) has suggested that different substances might be used by an individual depending on which psychosocial problems they are suffering from, it is possible that an investigation using multiple items reflecting the current DSM-5 substance use categories would

yield a pattern of results that a single, general question about substance use would not be sensitive to. In other words, it is possible that trauma-related symptoms including reexperiencing and avoidance of traumatic memories, and dissociative experiences, relate differentially with the use of different substance classes, such as alcohol, tobacco, cannabis, stimulants, hallucinogens, and opiates.

1.7 Hypotheses

The overarching goal of this study is to extend results from prior studies conducted with the PCR methodology, with the results expected to reflect similar values and comorbidity found within the prior research literature. The PCR methodology will be evaluating the co-occurrences of SUDs and trauma-related symptoms including the reexperiencing of traumatic memories, avoidance of internal and external reminders of traumatic events, dissociation (specifically, depersonalization and derealization), anxiety and depression.

Perceived causal relationships examined in the current study can be found in Figure 1. To accomplish this, items represent the symptoms for each psychological construct and/or psychiatric disorder as found in the DSM-5. Additional measures for verification of trauma exposure, PTSD, and SUD will be administered upon completion of the PCR. Adverse childhood experiences and traumatic events occurring over the lifetime will also be measured in addition to PTSD, as there is the potential to score high on the Posttraumatic Checklist (PCL-5; Weathers et al., 2013) without having PTSD. For example, the negative cognitive alterations portion of the PCL-5 heavily overlaps with the cognitive and affective symptoms of depression (APA, 2013).

Figure 1: Cause and Effect Associations Examined

<i>Causal and Effect Associations</i>						
	<i>Substance Abuse</i>	<i>PTSD Reexperiencing</i>	<i>PTSD Avoidance</i>	<i>Dissociation</i>	<i>Anxiety</i>	<i>Depression</i>
<i>Substance Abuse</i>	---	Y	Y	Y	Y	Y
<i>PTSD Reexperiencing</i>	Y	---	Y	Y	Y	Y
<i>PTSD Avoidance</i>	Y	Y	---	Y	Y	Y
<i>Dissociation</i>	Y	Y	Y	---	N	N
<i>Anxiety</i>	Y	Y	Y	N	---	N
<i>Depression</i>	Y	Y	Y	N	N	---

Based on the literature, I predicted that persons with high lifetime and childhood trauma exposure would endorse more frequent substance use, and that trauma-related symptoms, specifically reexperiencing, avoidance, and dissociation, would partially mediate the association between high trauma exposure and high substance use. These hypotheses will be examined separately in men and women, as the literature predicts sex differences in trauma exposure, PTSD, and substance use, with men typically at a higher risk for substance use and most non-sexual trauma exposures, and women typically at a higher risk for sexual traumas and PTSD.

Within the PCR, the self-medication, high-risk and susceptibility hypotheses will be evaluated. The self-medication hypothesis predicts that participants will report that their trauma-related symptoms are a greater cause of their substance use than is their substance use a cause of their trauma symptoms, whereas the reverse is predicted by the high-risk and susceptibility hypotheses. These hypotheses will be evaluated separately for trauma-related reexperiencing,

avoidance, and dissociative symptoms, and separately in men and women, and confirmed by the PCR results indicating to which direction the mean cause and effect associations are significantly stronger. Lastly, Khantzian's position that specific substances are chosen for their specific interaction with current psychological and physical symptoms will be examined, especially with regard to the clinical participants in Study 2.

2.0 Study 1 Methods

2.1 Participants

Participants were recruited through Amazon's MTurk webservice to complete an online survey. The online MTurk portal allows for a large and diverse workforce. Many psychology researchers have begun to turn to online methods of recruitment, such as MTurk, due to its associated low recruitment costs and relative ease of access to participant populations of low prevalence, including persons with psychological disorders (reviewed by Paolacci and Chandler, 2014; Shapiro et al., 2013). The purpose of MTurk is to allow for access to a wide variety of participants through an online labour market. Within this market, participants are able to complete computer tasks like psychological self-report surveys and online interventions in return for a small payment. As was the case in the present study, the ability of participants to complete studies on an external website through the MTurk portal allows for confidential and anonymous data collection. The demographical information collected on MTurk participants seems to indicate that these online participants are not significantly different from the general populations they are drawn from, with certain exceptions, such as the fact that online participants tend to be younger, more educated, and less likely to be employed (Goodman, Cryder, and Cheema, 2013; Paolacci & Chandler, 2014; Paolacci, Chandler, & Ipeirotis, 2010). Rates for trauma exposure, depression, and anxiety disorders have been tested in a prior MTurk study, and found to be largely comparable to general population endorsement rates (Shapiro et al., 2013). Interestingly, participants in this study reported that they felt more comfortable in disclosing such clinical and personal information through an online medium than they would be in person.

In the present study, there were no restrictions or exceptions placed on the ability of a person to participate, provided that the participant will have had access to the external research website as posted within MTurk, and was at least 18 years of age (an MTurk requirement).

2.2 Materials

2.2.1 Life Events Checklist (LEC-5)

The LEC-5 is a 17-item measure of exposure to 16 discrete traumatic events during a person's lifetime, with one additional item used to query whether "other" kinds of traumatic events may have occurred that are not represented by the 16 items given (Appendix 1; Weathers, Blake, et al., 2013). A sample item asks about experiencing "sexual assault (rape, attempted rape, made to perform any type of sexual act through force or threat or harm)" (Weathers, Blake, et al., 2013). Although there are no published psychometric studies of the LEC-5, changes between the LEC for the DSM-IV and the current DSM-5 version (LEC-5) are minimal and no differences between the two surveys are expected (Weathers, Blake, et al., 2013). The LEC for DSM-IV had a good retest reliability of .82 at one week, and the kappa statistics for all items but one were significantly above .50. The LEC significantly correlated with other trauma measures, such as the PTSD Checklist, in both a nonclinical population ($r = -.48$) and a combat veteran population ($r = .43$; Gray, Litz, Hsu, & Lombardo, 2004). For the present study, participants simply indicated which if any of the events described by the LEC-5 occurred anytime during their lifetime, with their "yes" or "no" answers scored 1 and 0, respectively. The sum of the total number of experienced traumatic events for each participant was calculated, and had an associated $\alpha = .729$.

2.2.2 Adverse Childhood Experiences (ACE)

The ACE measures whether stressful and traumatic events occurred during the first 18 years of life such as “did a parent or other adult in the household often or very often push, grab, slap, or throw something at you or ever hit you so hard that you had marks or were injured?” whereby the participants must answer yes or no based on childhood occurrence (Appendix 2; Felitti et al., 1998). A higher ACE score is indicative of more or greater exposure to adverse and/or stressful experiences, which increases the risk of negative outcomes such as alcoholism (Dube et al., 2006), obesity (Williamson, Thompson, Anda, Dietz, & Felitti, 2002), depression (Chapman et al., 2004), and intimate partner violence (Whitfield, Anda, Dube, & Felitti, 2003). Participants indicated which of the events described by the ACE occurred during their childhood, with their “yes” and “no” answers tallied as scored 1 vs. 0, respectively. Test-retest reliability as tested by kappa coefficients were considered good for emotional (.66), physical (.55), and sexual (.69) abuse on the ACE in a prior study (Dube, Williamson, Thompson, Felitti, & Anda, 2004). The internal reliability in this sample for adverse childhood experiences was $\alpha = .786$.

2.2.3 Posttraumatic Checklist (PCL-5)

The PCL-5 is comprised of 20 items that measure the criteria for a diagnosis of PTSD in the DSM-5 (Appendix 3; Weathers, Litz, et al., 2013). For example, an item may ask if an individual has “repeated, disturbing dreams of the stressful experience?” (Weathers, Litz et al., 2013). Possible scores range from 0 to 80, with a score of 38 or above indicating higher symptom severity and a probably PTSD diagnosis (Weathers, Litz, et al., 2013). No psychometrics from the developers have yet been made available for the PCL-5, but a preliminary study shows differences within the DSM-IV-TR and DSM-5 diagnostic criteria that

manifests within the PCL measures based on DSM-IV-TR and DSM-5 (Hoge, Riviere, Wilk, Herrell, & Weathers, 2014). The DSM-IV-TR PCL-S and the current PCL-5 have similar rates of screening for PTSD in soldiers; however, 30% of soldiers that meet the DSM-IV-TR PTSD diagnosis with the PCL-S do not meet the DSM-5 PTSD diagnosis with the PCL-5. A similar number of soldiers with DSM-5 PTSD as measured by the PCL-5 did not meet DSM-IV-TR diagnostic criteria as measured by the PCL-S (Hoge et al., 2014). Previous versions of the PCL have exhibited internal consistency reliabilities between .75 and .80, with inter-item reliabilities all over .40 (Wilkins, Lang, & Norman, 2011). Convergent validities of two of the prior versions of the PCL were between .63 and .90 with measures such as the Clinician Administered PTSD Scale (Wilkins et al., 2011). The total sum of the number of stressful experiences was calculated, and an associated $\alpha = .964$ was found.

Dissociation & TRASC Items. Ten dissociative items were appended to the PCL-5 based on prior studies conducted by Frewen and colleagues (Appendix 3; Frewen, Brown, & Lanius, 2016; Frewen, P. A., Brown, M. F. D., Steuwe, C., & Lanius, 2015). Two of these items are intended as measures of the dissociative subtype of PTSD, that is, depersonalization (“Out of body experience: Feeling detached or separated from your body, for example, feeling like you are looking down on yourself from above, or like you are an outside observer of your own body”) and derealization (“Feeling like what you are experiencing is not real: A change in the way you perceive or experience the world or other people, so that things seem dreamlike, strange, or unreal”; Frewen et al., 2015). The other eight items relate to the concept of TRASC (e.g. Frewen & Lanius, 2015; Frewen et al., 2016). Only the two depersonalization and derealization items, however, were examined in regards to this sample, and the internal reliability for the two dissociative items was $\alpha = .841$.

2.2.4 Simple Screening Instrument for Substance Abuse (SSI-SA)

The SSI-SA was developed by gathering 16 existing items from established measures of substance abuse and combining the items into one comprehensive questionnaire to measure alcohol and drug abuse (Appendix 4; Center for Substance Abuse Treatment [CSAT], 2005). For example, the item “has drinking or other drug use caused problems between you and your family or friends?” comes from the Michigan Alcohol Screening Test and the Drug Abuse Screening Test (CSAT, 1994; MAST, Selzer, 1971; DAST, Skinner, 1982). Four or more endorsed SSI-SA items indicate a moderate to high risk of substance use problems (CSAT, 1994).

The SSI-SA has 81.9% overall accuracy in identifying the presence of drug or substance dependence (Peters, Greenbaum, Steinberg, Carter, Ortiz, Fry, & Valle, 2000). The measure has a low rate of false positives, and has the highest sensitivity in identifying alcohol or substance dependence out of all multipurpose measures (Peters, et al., 2000; Boothroyd, Peters, Armstrong, Rynearson-Moody, & Caudy, 2013). The SSI-SA also exhibits high internal consistency and validity between different ethnic categories and sex and a high convergent validity with other measures and with reporting presence of substance abuse (Boothroyd et al., 2013). In this sample, the internal reliability of the substance use items were calculated at $\alpha = .897$.

2.2.5 Perceived Causal Relations (PCR) Scaling

In the context of PCR scaling, participants were first asked how often PCL-5 items 1 and 4 (both measuring reexperiencing), 6 and 7 (both measuring avoidance), and the depersonalization and derealization items developed by Frewen et al. (2015) occurred in the past month on a scale ranging from not at all (scored 0) to daily or almost daily for most of the day (scored 7; Appendix 5). On the same scale and timeline, participants were also asked about the

how frequently they experienced TRASC, the two symptoms of depression (“feeling down, depressed, or hopeless”; and “little interest or pleasure in doing things”) and anxiety (“feeling nervous, anxious or on edge”; and “not being able to stop or control worrying”) extracted from the Patient Health Questionnaire 4-item version (PHQ-4; Kroenke, Spitzer, Williams, & Löwe, 2009), and nine classes of substance use as assessed in the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST; World Health Organization [WHO] ASSIST Working Group, 2002). The SUDs items were derived from item two of the ASSIST, which was one of the most consistently reliable items across all drug classes at 0.76 in prior research. Following completion of the frequency ratings, participants were administered PCR causal association questions in the form of “How much do you think your problems with [some ‘Symptom X’] cause your problems with [some ‘Symptom Y’]?”. Only the symptoms endorsed as experienced by the participant within the past month were inserted into the causal association questions. It is important to note that participants were presented with the causal association question of “How much do you think your problems with [some ‘Symptom X’] as a cause of problems with [some ‘Symptom Y’]” as well as “How much do you think your problems with [some ‘Symptom Y’] as a cause of problems with [some ‘Symptom X’]”. However, only certain symptoms were analysed in the causal association questions, specifically those of PTSD-related reexperiencing and avoidance, and those referring to SUD (Please see Figure 1 for further explanation).

2.3 Procedure

An institutional ethics committee approved all of the procedures and analyses for the study. In order to participate, individuals followed an online link via Amazon’s MTurk that advertised the study "a computerized survey method for assessing psychological symptoms associated with depression and posttraumatic stress disorder". The link was to a website not

associated with MTurk. All data collection was anonymous, confidential, and collected on a secure, encrypted server. Participants gave their informed consent through button press prior to completing the online self-report questionnaires. Participants first gave their demographic information including age, sex, current employment or lack thereof, education level, ethnicity, current suffering, and whether they had ever been diagnosed with a mental health problem by a physician or psychologist (lifetime mental health, present or absent). Participants were then asked to complete the self-report questionnaires. Estimated time to complete the entire battery was between 20 minutes and one hour. Participants received a small financial compensation.

2.4 Statistical Analyses

Frequencies and mean scores were calculated for the LEC-5 (lifetime traumatic events), ACE (childhood traumatic experiences), PCL-5 (PTSD checklist) and SSI-SA (SUD screen), with symptom severity scores and cut-off scores calculated for the PCL-5, ACE, and SSI-SA. Sex differences in the SSI-SA measure and the WHO ASSIST item for frequency and number of substances used were analysed, and correlated with the number of traumatic experiences an individual endorsed on the LEC-5 and the ACE. The prevalence of the dissociative subtype of PTSD was also reported.

A number of multiple mediation models of the relationships between trauma exposure and substance use were conducted using Model 4 of the SPSS 20 “Process” macro (Hayes, 2013), with ratings obtained from males versus females analysed separately. Associations between childhood traumatic experiences (ACE) and lifetime trauma exposure (LEC-5), on the one hand, and substance use (SSI-SA), on the other, were analysed with PTSD reexperiencing

(PCL-5 items), PTSD avoidance (PCL-5 items), and dissociation (depersonalization and derealization items), analysed as independent and parallel mediators.

Mean causal association scores (the average rating of how much one symptom/problem causes all other symptoms/problems endorsed) and mean effect association scores (the average rating of how much one symptom/problem is caused by all other symptoms/problems endorsed) were evaluated following methods introduced by Frewen et al. (2012). However, only certain items were examined for PCR, to decrease the potentially overly large data matrix. Specifically, if a person endorsed all symptoms presented in the PCR, there would be 23 symptom frequencies and 506 (23x22) different causal association scores assessed. In other words, in the question “How much do you think your problems with [some ‘Symptom X’] cause your problems with [some ‘Symptom Y’]?”, the mean causal association score for each particular “Symptom X” would be the average of the causal association scores it obtained across up to 22 other “Symptom Y’s”. To reduce this very high number of questions, only certain PCR items were followed up. Specifically, the six TRASC items, two mood items, and two anxiety items were only followed up as a cause or effect of reexperiencing, avoidance, and substance use categories, but not as a cause or effect of each other. In contrast, the two reexperiencing items, two avoidance items, and nine substance use categories were always assessed in all possible PCR follow up questions if endorsed. By way of example, if a participant endorsed alcohol use, anxiety, dissociation, and depression items, the participant will be asked about anxiety causing alcohol use, but not anxiety causing dissociation or depression. The total number of items (23) subtract the number of items not followed up on (10) creates a matrix of only 416 potential associations, thereby lessening the amount of follow-up questions a participant would be asked about if they endorsed all items. The formula for determining this value was $n(n-1)-k(k-1)$, in which “n” is the total number of items

(23), and “k” is the number of items not followed up (10): $23(22)-10(9) = 416$. In all cases, the perceived mean cause and effect associations were tested to ensure that the scores were significantly different from zero, suggesting that there are actual perceptions of cause and effect relationships being reported.

As well, tests of means for the PCR between symptom groups for men, women, and all participants (without division by sex) were calculated for specific substance categories. Whenever possible, effect sizes of were calculated with G*Power (Faul, Erdfelder, Lang, & Buchner, 2007).

3.0 Study 1 Results

3.1 Characteristics of Sample

Participants were fairly evenly split between sexes, with 54% female ($N = 277$) and 46% male ($N = 234$), with a total of 513 participants. Age ranged between 18 and 75 years, with women being on average 35.53 years ($SD = 11.604$) and men being on average approximately two years younger, at 33.18 years ($SD = 10.537$), $t(505) = 2.373$, $p = .018$, $d_z = .150$. Twenty-six percent of women and 17% of men reported current suffering due to a mental illness, with 26% of women and 18% of men having reported suffering in the past. In addition, about 73% of participants identified as Caucasian, 10% as Mixed Race, 6% as Other Race, and the rest of the 11% reported one of the other demographic choices. 76% of the participants were employed, and about 70% reported having a least some postsecondary schooling. Table 1 shows these statistics.

Table 1: Descriptive Statistics for Study 1

Sex	<i>n</i>	%	Education	<i>n</i>	%
Male	234	45.8	Completed High school	45	8.8
Female	277	54.2	Some College or University Courses	156	30.4
			College Diploma	99	19.3
Age (years)			Undergraduate University Degree	133	25.9
18 – 40	378	74.3	Graduate or Professional University Degree	74	14.4
41 – 60	118	23.1			
> 60	13	2.6	Employed		
			No, not currently	55	10.7
Ethnicity			No, currently not able	12	2.3
Caucasian	375	73.0	Yes, as a student	46	9.0
Native American	8	1.6	Yes, self-employed	61	11.9
North East Asian	4	0.7	Yes, part-time or full-time	327	63.7
South East Asian	20	3.9	Other	6	1.2
Pacific (Polynesian)	1	0.2			
West African, Bushmen	9	1.8	Marital Status		
Mixed Race	49	9.6	Single	236	46.0
Other Race	47	9.2	Common-Law	25	4.9
			Married	185	36.1
Psychiatric Diagnosis			Separated	5	1.0
No	273	53.2	Widowed	6	1.2
Yes, in the past	107	20.9	Divorced	44	8.6
Yes, currently	107	20.9	Other	10	1.9

Most of the participants reported experiencing at least one stressful or traumatic event, with 469 (91.8%) participants endorsing at least one lifetime experience on the LEC-5 and 199 (70.1%) participants endorsing at least one adverse childhood experience on the ACE. The endorsement of various events can be seen in Table 2.

Table 2: Frequencies of Lifetime and Childhood Traumatic Experiences in Study 1

	<u>Total</u>	<u>Female</u>	<u>Male</u>	$\chi^2(1)$	<i>p</i>
<u>LEC-5</u>					
Natural disaster	239 (47.0%)	128 (46.4%)	111 (47.6%)	.081	.776
Fire or explosion	94 (18.4%)	49 (17.7%)	45 (19.2%)	.201	.654
Transportation accident	329 (64.4%)	179 (64.6%)	150 (64.1%)	.015	.903
Serious accident	111 (21.8%)	47 (17.0%)	64 (27.6%)	8.349	.004
Exposure to toxin	62 (12.2%)	23 (8.3%)	39 (16.7%)	8.431	.004
Physical Assault	243 (47.6%)	127 (45.8%)	116 (49.6%)	.705	.401
Assault with weapon	64 (12.5%)	28 (10.1%)	36 (15.5%)	3.291	.07
Sexual Assault	91 (17.9%)	73 (26.5%)	18 (7.7%)	30.382	.000
Other unwanted sexual experiences	157 (30.7%)	114 (41.3%)	43 (18.5%)	30.604	.000
Combat or war	18 (3.5%)	4 (1.4%)	14 (6.0%)	7.744	.005
Captivity	20 (3.9%)	8 (2.9%)	12 (5.1%)	1.693	.193
Life-threatening illness	85 (16.6%)	46 (16.6%)	39 (16.7%)	.000	.985
Severe human suffering	81 (16.9%)	38 (13.9%)	43 (18.5%)	1.973	.160
Witness sudden violent death	53 (10.4%)	16 (5.8%)	37 (15.9%)	13.873	.000
Witness sudden accidental death	80 (15.7%)	29 (10.5%)	51 (21.8%)	12.322	.000
Serious injury or harm	38 (7.4%)	13 (4.7%)	25 (10.7%)	6.613	.010
Other experiences	299 (58.5%)	159 (57.6%)	140 (60.1%)	.320	.572
Any traumatic event on LEC-5	469 (91.8%)	253 (91.3%)	216 (92.3%)	.159	.690
<u>ACE</u>					
Psychological abuse	184 (36.1%)	106 (38.3%)	78 (33.5%)	1.259	.262
Physical abuse	130 (25.5%)	75 (27.1%)	55 (23.6%)	.803	.370
Sexual abuse	80 (15.7%)	58 (21.0%)	22 (9.5%)	12.633	.000
Emotional neglect	168 (32.9%)	105 (37.9%)	63 (27.0%)	6.766	.009
Physical neglect	61 (12.0%)	33 (12.0%)	28 (12.0%)	.000	.995
Parental divorce/separation	175 (34.3%)	90 (32.5%)	85 (36.5%)	.894	.344

Mother figure physically abused	56 (11.0%)	37 (13.4%)	19 (8.2%)	3.505	.061
Live with a problem alcohol or drug user	139 (27.3%)	80 (28.9%)	59 (25.3%)	.808	.369
Household mental health issues	158 (31.0%)	97 (35.0%)	61 (26.3%)	4.490	.034
Household member in prison	43 (8.4%)	21 (7.6%)	22 (9.4%)	.568	.451
Any traumatic event on ACE	360 (70.6%)	199 (71.8%)	161 (69.1%)	.458	.498

Overall, 91.3% of women and 92.3% of men reported experiencing at least one traumatic life event on the LEC-5, which is not a significant sex difference, $\chi^2(1) = .159, p = .690$. There were no significant differences in the number of events experienced on the LEC-5; women experienced an average of 3.903 ($SD = 2.673$) traumatic events and men experienced an average 4.201 ($SD = 2.929$) traumatic events, $t(509) = 1.203, p = .230$. However, more women reported experiencing sexual assault ($p < .001$) and other unwanted sexual experiences ($p < .001$) on the LEC-5, whereas more men reported witnessing a violent ($p < .001$) or accidental death ($p < .001$), exposure to toxins ($p = .004$), experiencing a serious injury or harm ($p = .010$), and combat-related traumas ($p = .005$).

Overall, 71.8% of women and 69.1% of men reported experiencing at least one traumatic life event on the ACE, which is not a significant sex difference, $\chi^2(1) = .458, p = .498$. However, women reported experiencing more different kinds of ACE ($M = 2.534, SD = 2.544$) than men ($M = 2.112, SD = 2.218$), $t(508) = -2.004, p = .046, d_z = .125$. Referring to responses to the ACE, women more often reported being the victim of childhood sexual assault ($p < .001$), feeling unloved or unwanted during their childhood ($p = .009$), and having a family member with mental illness during their childhood ($p = .034$).

Within the sample overall, 107 persons (20.9%) scored above the recommended PCL-5 cut-off score of 38 for a probable PTSD diagnosis (Weathers, Litz, et al., 2013). There was no

significant sex difference in the number of participants scoring above the recommended cut-off score for a likely diagnosis of PTSD on the PCL-5; 54 (19.5%) women and 52 (22.3%) men scored above the cut-off, $\chi^2(1) = .613, p = .435$. Similarly, there was no sex difference in symptom severity on the PCL-5, $t(508) = 0.137, p = .891$. A total of 32.7% (29.6% of women and 34.6% of men) endorsed the depersonalization and/or derealization items at a score of 3 (referring to “Quite a bit”), as has been previously recommended to be suggestive of the presence of the dissociative subtype of PTSD (Frewen, Brown, Steuwe, & Lanius, 2015). There was no sex difference for D-PTSD, $t(508) = 1.358, p = .175$. The mean frequency symptom scores for the PCL-5 and D-PTSD can be seen in Table 3.

Table 3: Mean Frequency Symptom Scores on the PCL-5 for PTSD and D-PTSD in Study 1

	<u>Total</u>	<u>Female (M, SD)</u>	<u>Male (M, SD)</u>	<u>t(508)</u>	<u>p</u>
PTSD Symptoms (PCL-5)	20.71 (18.95)	20.83 (18.82)	20.60 (19.07)	0.137	.891
Dissociative Subtype (PCL-5)	.90 (1.65)	.80 (1.58)	1.00 (1.72)	1.358	.175

Note: The standard deviations are noted in the parentheses, and the t-tests analysed sex differences.

Almost 25% of the participants met the screening criteria for the SSI-SA, suggesting that they require further assessment for likelihood of SUD. More men ($n = 66, 28.2%$) than women ($n = 56, 20.2%$) met the criteria for further assessment, with $\chi^2(1) = 4.454, p = .035$. Significant gender differences were also observed for the number of substance-related problems endorsed on the SSI-SA, with men endorsing on average 2.480 ($SD = 3.491$) substance-related problems, and women endorsing on average 1.801 ($SD = 2.943$) substance-related problems, $t(509) = 2.379, p = .018, d_z = .149$.

Lastly, men ($n = 164, 70.1%$) were more likely than women ($n = 165, 59.6%$) to report the use of any substance in general, $\chi^2(1) = 6.210, p = .013$, with men using on average 1.667 ($SD = 1.972$) different substances, and women using on average 1.184 ($SD = 1.510$) substances,

$t(509) = 3.133, p = .002, d_z = .194$. The distribution of substance use in the participants, total and by sex, shows that significantly more men than women used tobacco, $\chi^2(1) = 4.721, p = .030$; alcohol, $\chi^2(1) = 9.239, p = .002$; cannabis, $\chi^2(1) = 6.875, p = .009$; inhalants, $\chi^2(1) = 7.722, p = .030$; and any substance in general, $\chi^2(1) = 6.120, p = .013$. The substance use distributions can be seen below in Table 4.

Table 4: Substance Use Frequencies in Study 1

	<u>Total (n, %)</u>	<u>Female (n, %)</u>	<u>Male (n, %)</u>	<u>$\chi^2(1)$</u>	<u><i>p</i></u>
Tobacco	165 (32.3%)	78 (28.2%)	87 (37.2%)	4.721	.030
Alcohol	264 (51.7%)	126 (45.5%)	138 (59.0%)	9.239	.002
Cannabis	97 (19.0%)	41 (14.8%)	56 (23.9%)	6.875	.009
Cocaine	27 (5.3%)	10 (3.6%)	17 (7.3%)	3.386	.066
Amphetamine Stimulants	32 (6.3%)	14 (5.1%)	18 (7.7%)	1.504	.220
Inhalants	15 (2.9%)	4 (1.4%)	11 (4.7%)	4.722	.030
Sedatives	68 (13.3%)	36 (13.0%)	32 (13.7%)	0.051	.822
Hallucinogens	25 (4.9%)	9 (3.2%)	16 (6.8%)	3.510	.061
Opioids	25 (4.9%)	10 (3.6%)	15 (6.4%)	2.137	.144
Any Substance	329 (64.4%)	165 (59.6%)	164 (70.1%)	6.120	.013
SUD Screen	122 (23.9%)	56 (20.2%)	66 (28.2%)	4.454	.035

Note: The χ^2 test is the comparison between females and males and the *p*-values are two-tailed. In the total column, the *n* and percentages represent the number in the full sample, whereas for females and males the *n* and percentages represent the numbers for each sex in the sample endorsing the item. Any substance is the sum of all of the substances as determined by the WHO ASSIST, whereas the SUD screen was determined by the SSI-SA cut-off score of 4.

3.2 Correlations between Trauma History, PTSD, Dissociation, and SUD

Correlations for measures of total number of trauma experiences, PTSD, reexperiencing, avoidance, dissociative, and substance use symptoms for men and women can be found in Table 5. Significant correlations were found between all of the measures. Further correlations showing the sex differences between number of different trauma experiences (LEC-5 and ACE), trauma-related symptomatology (reexperiencing, avoidance, and dissociation), and substance use can be

found in Table 6. For both men and women, substance-related activity and use scores are significantly positively related to childhood and lifetime trauma exposure and trauma-related symptomatology.

Table 5: Correlations between TE, SUD, PTSD, and Dissociation in Study 1

	1.	2.	3.	4.	5.	6.	7.
1. LEC-5	1.000						
2. ACE	.471*	1.000					
3. PCL-5 PTSD	.339*	.313*	1.000				
4. PCL-5 Reexperiencing	.297*	.259*	.862*	1.000			
5. PCL-5 Avoidance	.312*	.249*	.837*	.848*	1.000		
6. PCL-5 Dissociation	.291*	.190	.663*	.520*	.522*	1.000	
7. SSI-SA	.279*	.263*	.295*	.234*	.238*	.303*	1.000

Note: The correlations include both sexes together. The following tables provide information on correlations between trauma-related symptoms and substance use in both genders.

* $p < .01$.

Table 6: Correlations between Trauma Experiences and Substance Use by Sex in Study 1

	SSI- SA	WHO ASSIST	Tobacco	Alcohol	Cannabis	Cocaine	Stimulants	Inhalants	Sedatives	Halluc.	Opioids
<u>WOMEN</u>											
LEC-5	.269*	.384*	.335*	.232*	.237*	.071	.057	.056	.177*	.114	.204*
ACE	.238*	.253*	.121	.066	.136	.170*	.109	.069	.122	.116	.128
Reexp.	.189*	.202*	.130	.167*	.280*	.078	.025	.079	.127	.149	.110
Avoid.	.214*	.213*	.160*	.204*	.249*	.131	.051	.062	.112	.088	.12
Dissoc.	.178*	.276*	.147	.178*	.179*	.241*	.110	.143	.078	.192*	.227*
<u>MEN</u>											
LEC-5	.282*	.191*	.160	.047	.105	.174*	.153	.154	.113	.168	.169*
ACE	.325*	.240*	.115	.139	.183*	.206*	.170*	.227*	.173*	.181*	.218*
Reexp.	.206*	.220*	.076	.121	.173*	.280*	.235*	.230*	.276*	.233*	.219*
Avoid.	.215*	.260*	.156	.094	.206*	.263*	.217*	.243*	.283*	.248*	.233*
Dissoc.	.271*	.498*	.199*	.268*	.352*	.497*	.445*	.450*	.365*	.490*	.481*

Note: The SSI-SA screened for need for further assessment of a substance use disorder. WHO ASSIST reported both use of certain substances and total number of substances used.

* $p < .01$

When comparing the strengths of the correlations between men and women, significant sex differences were also found for the correlations between the LEC-5 and WHO ASSIST, $z = 2.119$, $p = 0.032$; LEC-5 and tobacco $z = 2.090$, $p = 0.035$; and LEC-5 and alcohol, $z = 2.115$, $p = 0.033$, such that women exhibited higher positive correlations than men in all three instances. However, men demonstrated higher positive correlations between dissociation and WHO ASSIST, $Z = -2.927$, $p = .004$, cannabis, $Z = -2.182$, $p = .027$, cocaine, $Z = -3.323$, $p < .001$, stimulants, $Z = -4.084$, $p < .001$, inhalants, $Z = -3.781$, $p < .001$, sedatives, $Z = -3.382$, $p < .001$, hallucinogens, $Z = -3.791$, $p < .001$, and opioids, $Z = -3.257$, $p < .001$. Men also demonstrated higher positive correlations with reexperiencing and cocaine use, $Z = -2.340$, $p = .018$, reexperiencing and stimulant use, $Z = -2.395$, $p = .016$, and avoidance and inhalant use, $Z = -2.069$, $p = .036$. The significance of these associations give reason to examine multiple mediation models as a means of understanding the link between trauma exposure and SUD by way of trauma-related reexperiencing, avoidance, and dissociation separately in women and men.

3.3 Simultaneous Multiple Mediation Analyses

The simultaneous multiple mediations using regression to predict SSI-SA scores from trauma exposures by way of trauma-related symptoms (ratings of reexperiencing, avoidance, and dissociation from the PCR) can be seen in for women in Figure 2 (LEC-5 trauma exposure) and Figure 3 (ACE trauma exposure) and men in Figure 4 (LEC-5 trauma exposure) and Figure 5 (ACE trauma exposure). Also included are statistics such as confidence intervals (95%) and beta weights. For all instances, the total models were significant, as were tests of direct and indirect effects, indicating partial mediation in all models. However, only specific mediators were found

to be significant; in all models, reexperiencing and avoidance were not significant partial mediators, but dissociative experiences were.

Figure 2: Simultaneous Multiple Mediation Model of Lifetime Trauma Exposure (LEC-5) on SSI-SA Scores by PTSD Symptoms in Women from Study 1

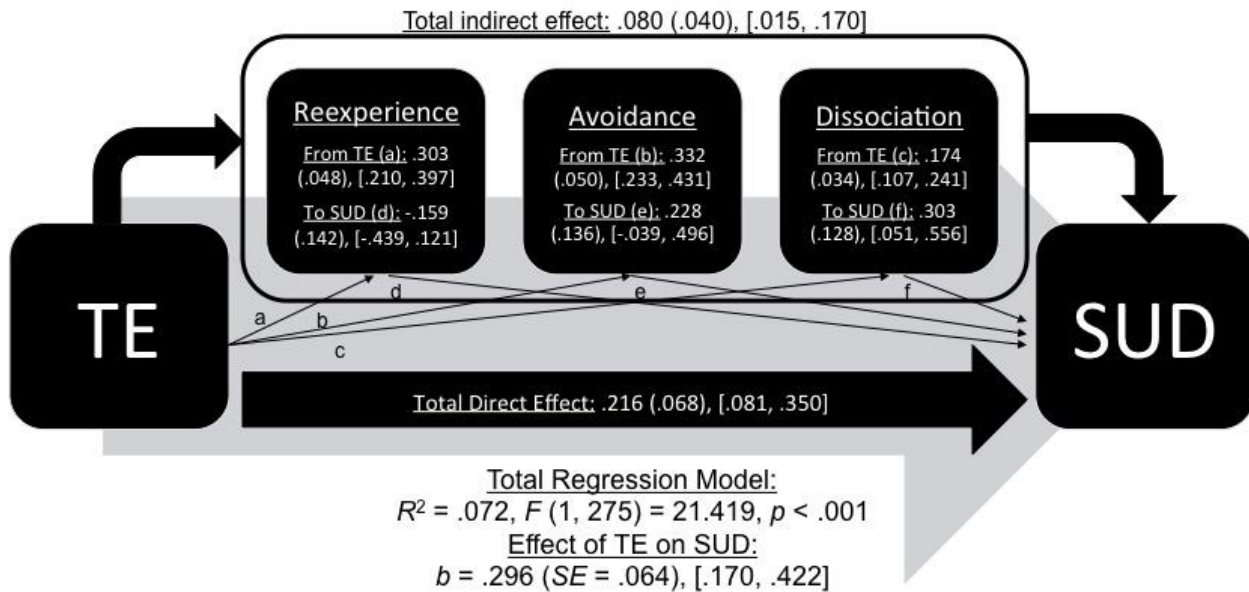


Figure 3: Simultaneous Multiple Mediation Model of Childhood Trauma Exposure (ACE) on SSI-SA Scores by PTSD Symptoms in Women from Study 1

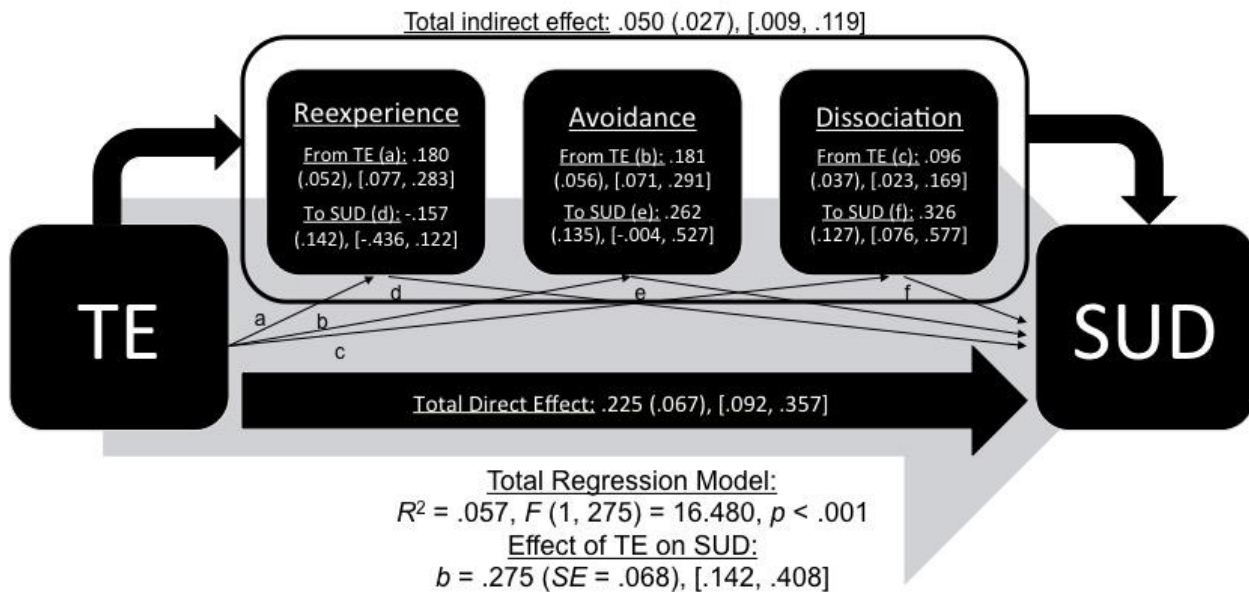


Figure 4: Simultaneous Multiple Mediation Model of Lifetime Trauma Exposure (LEC-5) on SSI-SA Scores by PTSD Symptoms in Men from Study 1

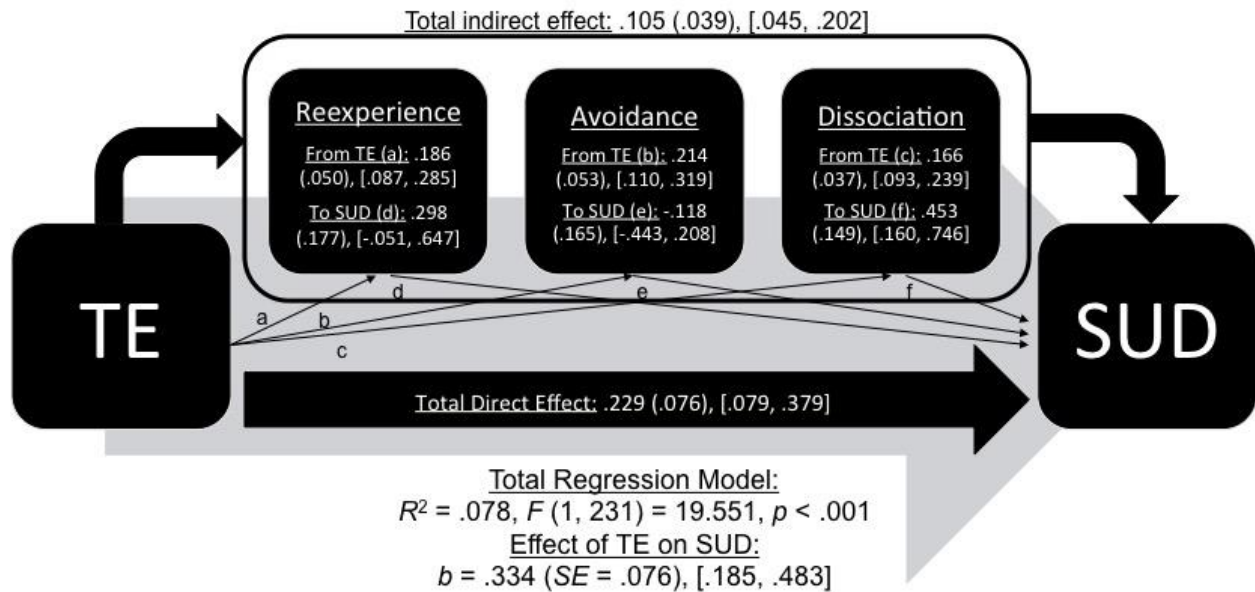
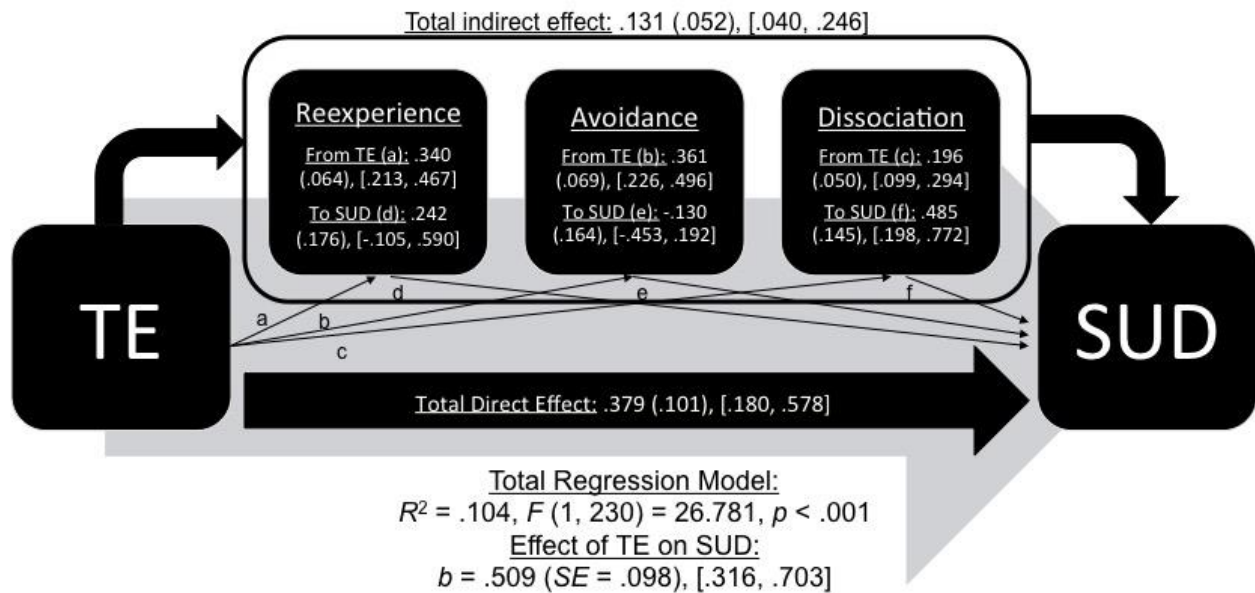


Figure 5: Simultaneous Multiple Mediation Model of Childhood Trauma Exposure (ACE) on SSI-SA Scores by PTSD Symptoms in Men from Study 1



3.4 Perceived Causal Relations

All mean cause and effect associations were significantly different from zero at $p < .001$, suggesting that the individuals perceived relationships between the cause and effect ratings of each symptom or substance class. Across substance class, within women, reexperiencing trauma was perceived to be more of a cause ($M = 3.082$, $SD = 2.920$) than effect ($M = 2.257$, $SD = 2.729$) of substance use, $t(114) = 3.581$, $p = .001$, $d_z = .206$. The same was found in reference to avoidance symptoms; women perceived their avoidance symptoms to be a stronger cause ($M = 2.737$, $SD = 2.917$) than effect ($M = 2.156$, $SD = 2.672$) of their substance use, $t(120) = 2.737$, $p = .007$, $d_z = .147$. However, in reference to dissociative symptoms, no significant difference in women's ratings referring to dissociative experiences as perceived to be a cause ($M = 2.007$, $SD = 2.842$) versus effect ($M = 1.914$, $SD = 2.632$) of substance use was observed, $t(69) = .326$, $p = .745$.

Within men, reexperiencing trauma was also perceived to be a greater cause ($M = 2.916$, $SD = 2.663$) than effect ($M = 2.510$, $SD = 2.465$) of substance use, $t(107) = 2.106$, $p = .038$, $d_z = .112$. However, no significant difference was observed between men's PCR ratings referring to avoidance symptoms as a cause ($M = 3.020$, $SD = 2.908$) versus effect ($M = 2.732$, $SD = 2.599$) of substance use, $t(110) = 1.384$, $p = .169$. Finally, men perceived their substance use to be a greater cause ($M = 2.469$, $SD = 2.510$) than effect ($M = 2.142$, $SD = 2.642$) of their dissociative symptoms $t(80) = -2.004$, $p = .048$, $d_z = .096$.

A test of the causal ratings of each substance category within the PCR by sex revealed significant differences, and overall men and women differed in their cause and effect associations. Tobacco ($p < .001$), alcohol ($p = .002$), cannabis ($p < .001$), and sedatives ($p = .002$)

were perceived to be less a cause than an effect of other endorsed psychological symptoms in women (Table 7). Specifically, women rated reexperiencing as a significant cause of tobacco use, $t(56) = 2.870$, $p = .006$, $d_z = .175$, cannabis use, $t(33) = 2.664$, $p = .012$, $d_z = .388$, and sedative use, $t(29) = 2.717$, $p = .011$, $d_z = .448$, and avoidance as a significant cause of tobacco use, $t(58) = 2.006$, $p = .043$, $d_z = .140$.

Men also perceived tobacco ($p = .001$) and alcohol ($p = .040$) more so as effects than causes of other endorsed psychological symptoms (Table 8). However, men perceived that their use of amphetamine-type stimulants were more of a cause than an effect of other psychological problems they faced, $p = .014$. Specifically, men reported that reexperiencing caused their alcohol use, $t(89) = 2.020$, $p = .046$, $d_z = .213$, cannabis use, $t(41) = 2.062$, $p = .046$, $d_z = .318$, and sedative use, $t(29) = 2.134$, $p = .041$, $d_z = .385$, whereas their amphetamine-type stimulant use was reported as a cause of their reexperiencing, $t(13) = 2.167$, $p = .046$, $d_z = .579$. Similarly, hallucinogen use was perceived to be a cause of avoidance, $t(13) = 2.256$, $p = .042$, $d_z = .603$.

Table 7: PCR Descriptives and Mean Cause and Effect Associations in Women in Study 1

<u>Symptom</u>	Cause		Effect		Frequency		r_{FC}	r_{FE}	r_{CE}	t_{CE}	df_{CE}	p_{CE}	d_{zCE}
	(M)	(SD)	(M)	(SD)	(M)	(SD)							
Tobacco	1.474	2.224	2.974	2.520	1.54	2.689	.035	.128	.646 [#]	6.539	76	.000	.745
Alcohol	1.989	2.197	2.494	2.405	1.29	1.767	.338 [#]	.388 [#]	.698 [#]	3.117	122	.002	.281
Cannabis	1.790	2.487	3.391	3.315	.54	1.599	3.17	.383 [*]	.686 [#]	4.078	37	.000	.661
Cocaine	3.089	2.933	2.818	3.046	.06	.396	.728 [*]	.757 [*]	.984 [#]	1.418	7	.199	.496
Amphetamine	3.620	3.157	3.705	3.268	.17	.929	.165	.017	.944 [#]	.272	11	.791	.079
stimulants													
Inhalants	7.202	2.022	6.956	2.444	.02	.269	.165	.017	.944 [#]	.824	1	.561	.288
Sedatives	2.395	3.151	3.568	2.853	.41	1.291	.254	.213	.758 [#]	3.292	34	.002	.557
Hallucinogens	4.007	3.717	3.620	3.607	.05	.364	.589	.649	.993 [#]	2.369	6	.056	.866
Opioids	3.479	3.245	4.443	2.785	.13	.800	-.078	-.139	.841 [#]	1.654	8	.137	.549

Note: r_{FC} is the correlation between the frequency of the symptom and it's respective mean causal association rating and r_{FE} is correlation between the frequency of the symptom and it's respective mean effect association rating. r_{CE} is the correlation between the symptom mean causal rating and the symptom mean effect rating. All p -values apply to two-tailed tests.

* $p < .05$, # $p < .01$.

Table 8: PCR Descriptives and Mean Cause and Effect Associations in Men in Study 1

<u>Symptom</u>	Cause		Effect		Frequency		r_{FC}	r_{FE}	r_{CE}	t_{CE}	df_{CE}	p_{CE}	d_{zCE}
	(M)	(SD)	(M)	(SD)	(M)	(SD)							
Tobacco	2.301	2.425	3.166	2.666	1.72	2.627	.002	.136	.654 [#]	3.555	83	.001	.408
Alcohol	2.200	2.362	2.513	2.496	1.79	1.895	.345 [#]	.437 [#]	.819 [#]	2.071	129	.040	.213
Cannabis	2.572	2.430	2.620	2.298	.86	1.902	-.006	.141	.798 [#]	.473	53	.638	.033
Cocaine	3.376	2.768	3.058	3.000	.20	.838	.366	-.013	.906 [#]	.398	15	.696	.250
Amphetamine stimulants	3.327	2.727	2.657	2.812	.27	1.109	.367	.218	.963 [#]	2.773	16	.014	.884
Inhalants	3.921	3.096	3.634	3.150	.16	.802	.299	.102	.979 [#]	.373	9	.718	.362
Sedatives	3.567	2.707	3.763	2.731	.37	1.094	.078	.208	.710 [#]	.860	30	.397	.095
Hallucinogens	3.638	3.046	2.939	2.934	.21	.908	.526	.397	.871 [#]	1.203	13	.250	.459
Opioids	3.556	3.083	3.398	3.103	.21	.922	.600 [*]	.371	.801 [#]	.162	13	.874	.081

Note: r_{FC} is the correlation between the frequency of the symptom and it's respective mean causal association rating and r_{FE} is correlation between the frequency of the symptom and it's respective mean effect association rating. r_{CE} is the correlation between the symptom mean causal rating and the symptom mean effect rating. All p -values apply to two-tailed tests.

* $p < .05$, # $p < .01$.

4.0 Study 1 Discussion

Previous studies have shown that there are strong links between substance use, posttraumatic stress, and psychological trauma experiences, but to our knowledge, none of these studies have established these links while incorporating the trauma type (i.e. trauma occurring in childhood or over the lifespan), the substance classes used, the gender of the user, and the comorbidity hypotheses between PTSD and SUD. In particular, to our knowledge, these associations have not been examined in reference to the *self-medication*, *high-risk*, and *susceptibility hypotheses*. In the current sample, these associations were analysed using PCR scaling and simultaneous multiple mediation models in an online convenience sample. As expected, consistent with PTSD literature, childhood traumatic experiences were endorsed more frequently by women, and lifetime traumatic experiences were endorsed by a large proportion of both men and women. Contrary to the literature, there were no sex differences identified in PTSD symptomatology in the present sample. However, as expected, substance use in general, substance use-related problems, and the potential for an SUD were reported significantly more frequently by men than women, especially in reference to particular substances such as tobacco, alcohol, cannabis, and inhalant use.

The results from the multiple mediation models mostly supported the *self-medication hypothesis* of comorbid PTSD and SUD, or when substance use is a function or a coping mechanism for suppressing trauma-related symptoms (Brady et al., 2004; Chilcoat & Breslau, 1998a). In particular, the multiple mediation models were supportive particularly with regards to dissociative experiences as mediators between trauma exposure and substance use whereas reexperiencing and avoidance symptoms did not significantly mediate associations between

trauma exposure and substance use. Moreover, this was found in both women and men. These results were unexpected, as a diagnosis of PTSD was previously found to partially mediate the association between trauma exposure and substance use (Del Gaizo et al., 2011), but dissociative experiences were not specifically shown to play a role in mediating these associations.

Also unexpected were the differences observed between PCR ratings compared to the multiple mediation analyses. Consistent with the self-medication hypothesis, PCR scaling showed that trauma-related reexperiencing was perceived to be a greater cause than effect of overall substance use in both women and men. Similarly, trauma-related avoidance was perceived to be more so a cause of substance use than an effect in women. However, overall substance use in men was endorsed as being a greater cause of trauma-related dissociative symptoms than vice versa, which is a partial support of the high risk and susceptibility hypotheses.

While there were overall trends in PCR ratings for both men and women, it is important to note that the effect sizes significantly varied by substance class used. For example, dissociative symptoms were not perceived to be significantly more so a cause than an effect of any one substance class. These relationships were only significant when the frequency of substance use was averaged across substance class. Additionally, there was evidence for Khantzian's (1985, 1997) assertion that the chemical properties of the substances and the person's inner psychophysiological state may affect the specific drug sought after. Specifically, tobacco, cannabis, and sedatives in women, and alcohol, cannabis, and sedatives in men, were perceived as more of an effect than a cause of trauma-related reexperiencing and avoidance. In other words, use of these specific substances was perceived to be caused by the trauma-related symptoms of reexperiencing and avoidance. This may be due to the fact that these substances

tend to act as depressants or relaxants on relevant body systems, such as the central nervous system and the cardiovascular system. In contrast, men rated trauma-related reexperiencing and avoidance as higher effects than causes of hallucinogens and amphetamine-type stimulants. In this, Khantzian's (1985, 1997) hypothesis holds consistent, as psychedelics can cause hallucinations and other alterations in consciousness akin to traumatic flashback and stimulants may be used to increase energy in lethargic individuals. However, once more, usage varied significantly with different substances used more often, and this should influence interpretation.

Further, it should be noted that overall, there were few differences observed between trauma-related symptoms and substance use in reference to cause versus effect associations. Notwithstanding the trends that were identified, general conclusions from the present study can be drawn such that, especially in the case of avoidance and dissociative experiences, participants generally tended to perceive their trauma-related symptoms and substance use to be intercausal and bidirectional. Therefore, substance use was perceived to be causal of trauma-related symptoms, and trauma-related symptoms were perceived to beget substance use. These findings are consistent with *both* the self-medication hypothesis and the high-risk and susceptibility hypotheses. The subject of a future study should then be examining in which specific circumstances is a person more likely to perceive their trauma-related symptoms as a cause versus effect of their substance use.

The present study did present with a number of limitations. First, an online convenience sample was used for the participants, and as a result, we do not have a comprehensive psychodiagnostic history or characteristics beyond the basic demographical information collected with which to describe participants. Second, this study did not collect causal associations between trauma-related symptoms and substance use behaviours. Rather, causal

associations were examined between trauma-related symptoms and frequency of use of specific substances. As such, the study cannot provide information detailing how certain substance-taking behaviours, such as risk-taking, may causally relate to trauma symptoms. Furthermore, an inventory for personality traits was not administered in this study, to abide by Khantzian's (1985, 1997) proposition that personality traits may impact substance of choice. As well, all assessments required participants to examine causal relations between trauma-related symptoms and specific substance use retrospectively. Given that participants would have been using substances in the past in order to make these causal connections, time and additional impairment in judgments due to substance intake may increase the participants' susceptibility to reporting biases or errors. Relevant to this, age was weakly correlated with LEC-5 scores ($r = .103$, $p = .020$; not reported in results) and, while this is not a large correlation, it seems logically reasonable to conclude that cumulative trauma exposure would increase with age; a limitation of the study in this respect was that there was no question included to determine how recently traumatic life events occurred.

Taking into consideration the limitations inherent in the current study, we can conclude that the mediation modeling and the PCR scaling results together implicate all three comorbidity hypotheses partially depending on participant sex, PTSD symptoms type, and substance class of abuse. Additional research is warranted with similar methodology in participants who are known to be trauma-exposed, substance using, and PTSD symptomatic.

5.0 Study 2 Methods

The clinical sample data for Study 2 were collected from two treatment centres, Westover Treatment Centre in Thamesville, Ontario, Canada and Quintin Warner House in London, Ontario, Canada. The sample is comprised of 12 participants, some of who were currently in treatment for substance use at the time of the interviews, and some of who had commenced from a substance use treatment program prior to the interviews. Participants from both treatment centres completed the PCR survey and identical additional questionnaires as the participants from Study 1, but with some modifications to the PCR method in order to shorten its length as these surveys were given in person instead of online (please see Appendix F for the questionnaire). Both during and after the questionnaires, the participants were able to elaborate on their answers, especially those centered around the nature of the cause and effect associations between symptoms of PTSD and specific substances each participant endorsed using during their active addiction. Similar to Study 1, participants rated the strength of the cause and effect associations between their symptoms, and were then prompted to elaborate on these relationships through such questions as “Symptom X was often seen as a cause of Y, can you tell me more about that?”. The interviews were to provide descriptive and qualitative data used to enhance discernment of findings from Study 1, such that personal experiences with substance use and PTSD symptoms were rated to enhance the *self-medication*, *high-risk*, and *vulnerability hypotheses* findings from Study 1.

The section that follows contains descriptions of each of the 12 participants in the clinical sample. In each, details from the phenomenological interviews are included. Additionally, Table 9 summarizes participant endorsement of both lifetime and childhood traumatic experienced,

trauma-related symptoms, and substance use. In order to protect the identity of each participant, pseudonyms have been used.

Table 9: Descriptive Statistics for Study 2

	Alan	Don	Craig	Dylan	Daniel	Sarah	Derek	Barry	Eric	Matt	Jordan	Kyle	Sample Total	Mean (SD)
Age	51	55	54	26	60	30	27	44	60	51	29	65	-	46.0 (14.33)
Natural disaster	N	N	N	N	Y	N	N	Y	N	Y	N	N	3 (25%)	-
Fire or explosion	N	N	Y	N	Y	N	N	N	N	N	N	N	2 (17%)	-
Transportation accident	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	10 (83%)	-
Serious accident	Y	N	Y	N	N	Y	N	N	Y	Y	N	N	5 (42%)	-
Exposure to toxin	Y	N	N	N	N	Y	Y	Y	N	Y	N	N	5 (42%)	-
Physical assault	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	9 (75%)	-
Assault with a weapon	Y	N	Y	Y	N	N	N	Y	Y	Y	N	N	6 (50%)	-
Sexual assault	N	N	N	N	N	Y	N	N	Y	Y	Y	N	4 (33%)	-
Other unwanted sexual experiences	N	N	N	N	N	Y	N	Y	Y	Y	Y	N	5 (42%)	-
Combat or war	N	N	N	N	N	N	N	N	N	N	N	N	-	-
Captivity	N	N	N	N	N	Y	N	Y	Y	N	Y	N	4 (33%)	-
Life-threatening illness	N	Y	N	Y	N	Y	N	Y	N	Y	N	N	5 (42%)	-
Severe human suffering	N	Y	N	N	N	Y	N	Y	N	Y	N	N	4 (33%)	-
Witness sudden violent death	Y	N	N	N	Y	N	N	N	N	N	Y	N	3 (25%)	-
Witness sudden accidental death	N	Y	Y	N	Y	N	N	N	N	Y	N	N	4 (33%)	-
Serious injury to other	N	N	N	Y	N	Y	Y	Y	N	Y	N	N	5 (42%)	-
Other experience	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	8 (67%)	-
LEC-5 Total	6	4	6	6	7	10	4	10	7	13	7	1	-	6.75 (3.166)
Psychological abuse	Y	Y	Y	Y	Y	Y	N	Y	N	Y	N	N	8 (67%)	-
Physical abuse	Y	Y	Y	N	Y	N	N	Y	N	N	N	N	5 (42%)	-
Sexual abuse	N	N	N	N	N	N	N	Y	N	Y	Y	N	3 (25%)	-
Emotional neglect	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	8 (67%)	-
Physical neglect	N	N	Y	N	N	Y	N	Y	N	N	Y	N	4 (33%)	-
Parental divorce/separation	N	N	Y	N	N	N	Y	Y	Y	N	Y	N	5 (42%)	-
Mother figure physically abused	N	N	Y	N	N	N	N	Y	N	N	N	N	2 (17%)	-

Lived with a problem alcohol or drug user	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	11 (92%)	-
Household mental health issues	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	10 (83%)	-
Household member in prison	Y	N	Y	Y	Y	N	Y	Y	N	N	N	N	6 (50%)	-
ACE Total	4	5	9	5	6	5	3	10	3	5	5	2	-	5.17 (2.329)
SSI-SA	3	3	2	4	3	3	3	3	8	3	3	2	-	3.33 (1.557)
PCL-5	0	15	3	4	10	32	13	52	43	58	57	0	-	23.92 (23.051)
Dissociative subtype	N	N	N	N	N	N	N	Y	Y	Y	Y	N	4 (33%)	-
Reexperiencing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	12 (100%)	-
Avoidance	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	12 (100%)	-
Dissociation	Y	Y	N	Y	N	N	Y	Y	Y	Y	N	Y	8 (67%)	-
Tobacco use	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	11 (92%)	-
Alcohol use	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	10 (83%)	-
Cannabis use	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	9 (75%)	-
Cocaine use	Y	N	Y	Y	Y	N	Y	Y	Y	N	Y	N	8 (67%)	-
Amphetamine use	Y	N	Y	Y	Y	Y	Y	N	Y	N	N	N	7 (58%)	-
Inhalant use	N	Y	N	N	N	N	N	Y	Y	N	N	N	3 (25%)	-
Sedative use	Y	N	N	Y	N	N	N	N	N	Y	Y	N	4 (25%)	-
Hallucinogen use	Y	N	Y	Y	Y	N	N	Y	Y	N	N	N	6 (50%)	-
Opioid use	Y	Y	Y	Y	Y	N	N	N	Y	N	Y	N	7 (58%)	-

6.0 Study 2 Results

6.1 Characteristics of Sample

As can be seen in Table 9, two (17%) participants were screened at a moderate to high risk of current disordered substance use, which suggests further assessment is required. One of these participants did admit to current active substance use whereas the other individual did not. One (8%) participant scored at no current risk, and nine (75%) scored at minimal current risk. Specific to items endorsed, 11 (92%) participants endorsed having gone for help for drinking and drug issues, one (9%) endorsed having their drinking or drug use causing problems with family and friends, and all 12 participants endorsed having had a drinking or drug problem at some point and having a family member who has had a drinking or drug problem. A few participants (three; 25%) indicated that they consider themselves to continue to have a substance use problem, even if they were not actively using.

For trauma history, all participants indicated experiencing at least one lifetime traumatic event on the LEC-5, and were more likely to endorse multiple events. Similarly, all participants endorsed experiencing at least one childhood adverse event on the ACE, but were more likely to endorse multiple events. Four (33%) participants met the recommended cut-off score for a probable diagnosis of PTSD on the PCL-5; these four also met the criteria for the dissociative sub-type of PTSD. Interestingly, two other participants also endorsed multiple dissociative experiences, although did not meet the recommended cut-off score for PTSD.

6.2 Perceived Causal Relations

In Table 10, the mean cause and effect PCR ratings can be found between trauma-related symptomatology and specific substances. The causal ratings between trauma symptoms or between specific substances were not investigated.

Table 10: Mean Cause and Effect Associations in Study 2

	Mean Cause (SD)	Mean Effect (SD)	<i>t</i>	<i>df</i>	<i>p</i>	<i>d_z</i>
Reexperiencing	6.640 (2.522)	4.108 (2.693)	2.599	9	.029	.822
Avoidance	6.079 (3.141)	3.882 (3.041)	1.653	10	.129	.498
Dissociation	5.487 (3.559)	3.731 (2.917)	1.481	7	.182	.524
Tobacco	1.242 (3.004)	4.970 (3.619)	3.787	10	.004	1.142
Alcohol	6.591 (3.821)	6.788 (3.825)	.143	10	.889	.043
Cannabis	3.685 (3.678)	4.444 (3.567)	.512	8	.623	.171
Cocaine	3.905 (2.515)	6.571 (3.459)	1.862	6	.112	.704
Amphetamine	4.861 (2.007)	7.361 (3.181)	2.484	5	.056	1.014
Inhalants ¹	4.668 (1.333)	4.668 (1.333)	---	---	---	---
Sedatives	2.500 (5.00)	6.250 (4.787)	1.567	3	.215	.783
Hallucinogens	4.875 (3.794)	5.875 (4.973)	.739	3	.514	.369
Opioids	4.222 (3.600)	6.611 (4.144)	1.081	5	.329	.441

Note: Mean cause and effect were only asked between trauma-related symptoms and substance use, such that questions exploring how trauma-related symptoms causally related to each other were not asked, nor were the causal relationships between substances investigated.

¹The inhalants mean cause and effect scores were calculated but the t-test was unable to be performed, as the standard error of the difference is 0.

Reexperiencing was perceived to be significantly more so a cause than effect of substance use, $t(9) = 2.599$, $p = .029$, $d_z = .822$; results were non-significant in the case of avoidance, $t(10) = 1.653$, $p = .129$, and dissociative experiences, $t(7) = 1.481$, $p = .182$. In contrast, use of tobacco, alcohol, cannabis, cocaine, amphetamine-type stimulants, sedatives, hallucinogens, and opioids were all perceived to be more so an effect than cause of trauma-related symptoms, although only tobacco was significant $t(10) = 3.787$, $p = .004$, $d_z = 1.142$, and amphetamines were trending toward significance.

All 12 participants interviewed provided further elaboration on their PCR ratings in the following section. It is important to note that all participants were asked to retrospectively think back to when their substance use was at its worst, but for most of these participants, there is no defining “worst” period. Many of them were chronic users over very long periods of time, and therefore could not meaningfully separate their substance use into discrete “worst” periods.

6.3 Alan

Alan is a 51-year old Caucasian man in a common-law relationship. He is currently employed with no psychiatric diagnoses, and has an undergraduate degree. Alan has undergone treatment for alcohol, drugs, and codependency, commencing from his last treatment program about 20 years ago. He indicated multiple stressful experiences throughout his life, such as transportation accidents, serious work injury, exposure to a toxic substance, physical assault, assault with a weapon, and witnessing a sudden and violent death when he witnessed an accident where “the steering part was sticking out of [the driver’s] chest”. Specific to his childhood, Alan endorsed experiencing psychological and physical abuse, and living with someone who was an alcoholic. However, he says of his mother’s alcoholism: “I don’t remember her drinking”. While he did not live with a member of his household in prison, he himself went to prison many times, often for substance-related charges: “I was shipped out many a time ... substance, yeah, I can always relate any time something went bad with a substance”.

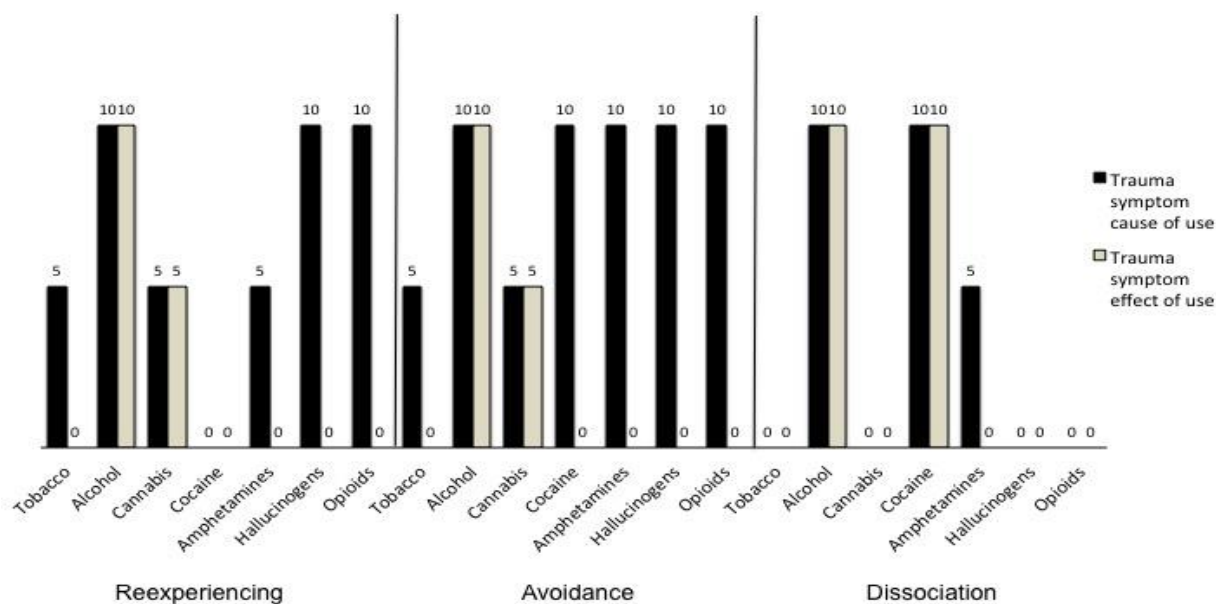
Within the past month, Alan did not endorse experiencing any PTSD or TRASC symptoms, nor did he report actively using any alcohol or drugs. He indicated on the SSI-SA that he is currently going for help because of his drinking and drug use; however, this is specific to his past use, not current use. He also indicated on the SSI-SA that both he and family members

have had a drinking or other drug problem at some point in their lifetimes. In reference to his drug use, he noted: “I did not know how to feel mentally, I knew how to feel chemically from a very young age, and when I say young age, I mean probably eight”. When Alan’s substance use was at its worst, he indicated using tobacco and alcohol on a daily basis, cocaine-related drugs every day for most of the day, amphetamines and sedatives almost daily, cannabis about once a week, hallucinogens two or three times, and opioids once in his lifetime. He also endorsed reexperiencing, avoidance, and dissociative symptoms daily or almost daily during his worst periods of substance use. However, he also attributed most of his dissociative experiences, as well as experiences of hallucinations and paranoia, directly to the effects of his drug use, and that he was not sure how much was not drug-induced. Nevertheless, when asked about the relationships between various substances and trauma-related symptoms, Alan responded that “everything I did was avoidance” and that he used substances to “avoid the consequences” of both his actions and his trauma.

Alan’s PCR ratings can be seen in Figure 6. In sum, trauma-related reexperiencing was rated as a strong cause of his hallucinogen and opioid use, and a moderate cause of his tobacco and amphetamine use. His alcohol use was rated as both a strong cause and effect of reexperiencing, and his cannabis use was rated as both a moderate cause and effect of reexperiencing. He also reported that avoidance was a strong cause of his cocaine, amphetamine, hallucinogen, and opioid use, whereas he attributed his avoidance as a moderate cause of his tobacco use. Alan rated alcohol as both a strong cause and effect of avoidance, and cannabis as both a moderate cause and effect of avoidance. Lastly, Alan considered his dissociation as a moderate cause of his amphetamine use, but a strong cause and effect of his alcohol and cocaine use.

Alan further explained his high PCR ratings associating his alcohol use and his trauma-related symptoms: “I’d say I got to quit this, I got to change my life, and I’d like, a beer, and I’d be in the crack house. I did everything I said I’d never do once I started drinking”. In comparison, he believed that he “had more control on drugs ... Alcohol would lead me to a loss of control and blacking out more so then drugs. Drugs I could manipulate and make work, and fit them into the feeling I was trying to get”. He reported: “cocaine was my ticket. That’s where I felt the best. When I use cocaine, I had a feeling of invincibility. I was right where I needed to be, nothing was negative, everything was positive in my life”. In addition, he felt that amphetamines helped: “to escape reality”. Overall, Alan reported self-medicating with more substances than he did having the substances cause his trauma-related symptoms. He also seemed to endorse using specific substances for specific causes, such that he could moderate his alcohol use with drugs “to be less drunk, to combat the way I felt”, and could “create a feeling through the substance, the behaviour of the substance and get to where I wanted to be, where I felt I needed to be”.

Figure 6: Summary of PCR Ratings for Alan in Study 2



6.4 Don

Don is a 55-year-old Caucasian man who has been married for almost 30 years. He currently has a diagnosis of major depression, has a college diploma, and is employed full-time. Don was in treatment for alcohol and drug addiction about two years ago, and has not used since. Over his lifetime, Don has experienced a couple of car accidents, a life-threatening illness, and witnessed severe human suffering in that “I saw a rape once”. He has also witnessed sudden accidental death. Specific to his childhood, Don reported psychological and physical abuse, emotional neglect, living with a mother who was a problem drinker, and at least one of his household members was mentally ill or suicidal. He spoke of a difficult relationship with his father, as his father “was very strict. You just didn’t want to cross him, he would, ah, he would hit you and, uh, worse than hitting was that he would sulk at you, and that could go on for days”.

On the PCL-5, Don scored 15 out of 80, indicating that he likely does *not* currently have PTSD. However, he endorsed being moderately bothered by having strong negative beliefs about himself, others, and the world as well as by having strong physical reactions at reminders of a stressful experience. In regards to the physical reactions, Don reported that:

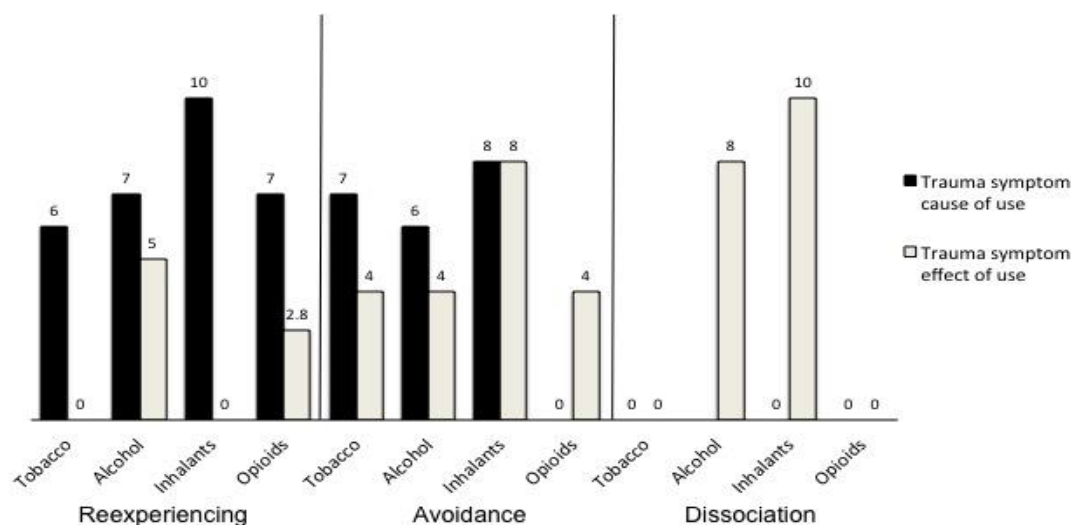
Two years ago, when I was hitting my bottom, this time of year reminds me of it, and I find that kind of stressful, and it's usually a feeling of anxiety, so kinda shortness of breath. It takes me back to how emotionally low I felt back then.

Additionally, Don indicated being a little bothered by a marked loss of emotion, but no other TRASC symptoms. On the SSI-SA, he endorsed going to meetings, having had a drinking or drug problem, and having a family member with a drinking or drug problem, but does not meet the recommended score for an investigation into a probable SUD. However, Don does “definitely identify as an alcoholic, recovering alcoholic”.

Don specified that he had more than one worst period or “rock bottom” where his substance use was at its worst, as “I was sober in AA for 19 years, and then went out for like two years, so I'm back for two years. So, um, there is kinda two bottoms”. For the purposes of causally relating trauma symptoms to his substance use, he decided to combine the two periods in his mind. When Don's substance use was at its worst, he reported using alcohol daily or almost daily for most of the day, tobacco and opioids multiple times daily or almost daily; he used inhalants two or three times in his lifetime. He also reported having trauma-related reexperiencing and avoidance about daily or almost daily, and dissociative experiences two or three times during these periods, although he indicated that the dissociation was likely drug-induced. Don's PCR ratings can be found in Figure 7.

When asked to make causal connections between his tobacco use and trauma-related symptoms, Don endorsed reexperiencing as a strong cause of his inhalant use and a moderate cause of his tobacco use. His reexperiencing was also rated as a strong cause of his alcohol use and his alcohol use a moderate cause of his reexperiencing, whereas his reexperiencing was rated as a strong cause of his opioid use and his opioid use was rated as a mild cause of his reexperiencing. Don perceived his avoidance to be a strong cause of his tobacco use, whereas his tobacco use was a moderate cause of his avoidance. Similarly, his avoidance was perceived to be both a strong cause and effect of inhalant use, and alcohol was perceived as both a moderate cause and effect of avoidance.

In general, Don reported that his tobacco, alcohol, inhalant, and opioid use were caused by reexperiencing and avoidance, such that he reported self-medicating his trauma symptoms with these specific substances. In fact, Don reported self-medicating more than just his trauma symptoms: “that’s the thing with me, there wasn’t just one stressful experience. With me, it was also like feelings of inadequacy that alcohol took away, um, and although I was diagnosed with anxiety and depression a couple years ago, I’m sure I suffered from that in the past and self-medicated it”. Don’s inhalant use was perceived to be equally a cause and effect of avoidance, and his alcohol and inhalant use were perceived to be stronger causes of dissociative experiences than dissociative experiences were of alcohol and inhalant use.

Figure 7: Summary of PCR Ratings for Don in Study 2

6.5 Craig

Craig is a 54-year-old Caucasian man who is currently single and self-employed. He has never had a psychiatric diagnosis, and never finished high school. He was in treatment for alcohol and drugs, and commenced from his last treatment program about seven years ago. Craig indicated experiencing many stressful experiences over his lifetime, such as a fire or explosion, transportation accident, serious work injury, physical assault, assault with a weapon, and witnessing a sudden accidental death. Of the accidental death, he stated, “found one of our members in our rooms drank himself to death. That was just this past year”. Specific to his childhood, he endorsed experiencing psychological and physical abuse, emotional and physical neglect, having parents separated, mother abused, living with problem alcoholics or drug addicts, having at least one family member suicidal and mentally ill, and having a family member go to prison. He said of trying to count the number of family members who went to prison, “you’re better off [counting] which ones didn’t go”. Craig came from a family with 12 siblings, and said of his childhood:

We had lots of foster homes. I don't know how many times the old man sold everything but his TV and a couple bags of clothes and away we'd go back to BC or Ontario.

Whenever my mom left, my dad've had a few months reprieve, and then we'd go chase her down.

In the past month, Craig endorsed a total of three out of 80 on the PCL-5 with being moderately bothered by concentration difficulties and a little bit bothered by feeling jumpy or easily started. There was no endorsement of any TRASC items. On the SSI-SA, Craig endorsed no substance use in the past month, and only indicated yes on the items asking about ever having a drinking or drug problem for himself and for family members. However, when his substance use was at its worst, Craig endorsed using tobacco, alcohol, cannabis, cocaine, and hallucinogens daily or almost daily for most of the day, and amphetamines daily or almost daily. Also during this period of time, he endorsed the trauma-related symptoms of reexperiencing and avoidance daily or almost daily, but no dissociative experiences. He says of his difficulties describing the frequency of his reexperiencing, "all it took was the wrong kind of conversation with someone to bring it up, so it's hard to find the right number for it". When asked to rate the causal relations between his substance use and trauma-related symptoms, he could only make sense of the relationships between tobacco and alcohol use, as ecstasy was more of a "if it was there, it was there. If someone walked in the room and that was all they had, that's what we used" and "any of the other ones were just part of the atmosphere, just what we were going to do that night".

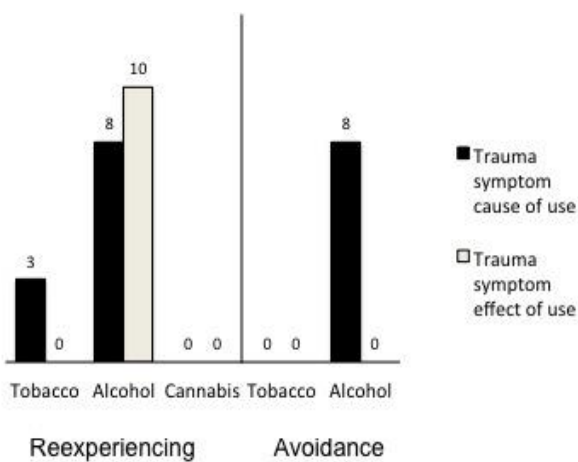
The PCR scores for tobacco and alcohol can be found in Figure 8. In sum, Craig perceived his trauma-related reexperiencing to be strongly causal of his alcohol use, and he perceived that his alcohol use was strongly causal of reexperiencing. Reexperiencing was also perceived to be mildly causal of tobacco use. Lastly, Craig rated his avoidance as a strong cause

of his substance use. When Craig discussed his alcohol use in relation to it causing his reexperiencing, he said:

If I didn't drink, it didn't bother me on a daily basis. If I drank, which I drank everyday, but then you got to remember where that state of drinking it. By midday, if I got six or eight beers in me, well, it doesn't bother me, but later in the evening, when you got that much more in you, my self worth and all those kind of issues surfaced because "why me, why me". They would surface more stronger when I had more booze in me.

He elaborated with, "Like, I drank every day, all day, but I wasn't drunk every day, all day. But when I got to my, uh, end of day kind of state and my childhood issues would surface big time." Craig seemed to have a threshold in which alcohol in the right amount could self-medicate, but any more than that and the alcohol would bring about his childhood issues and reexperiencing.

Figure 8: Summary of PCR Ratings for Craig in Study 2



6.6 Dylan

Dylan is a 26-year-old Caucasian man who is currently single and unemployed. He has been attending adult education to finish his high school diploma, and reported no past or current psychiatric diagnosis. However, later in the interview, he alluded to a past diagnosis of depression. Dylan has been out of treatment for alcohol and drug addiction for one year. He endorsed experiencing multiple stressful events over his lifetime, including a transportation accident in which he was knocked out, physical assault where he had “been stabbed, had [his] teeth knocked out”, assault with a weapon and “gotten bottled”, life-threatening injuries as a result of assault with a knife, and causing someone else serious injury or harm because he “assaulted a lot of people in active addiction”. In response to the open-ended item on the LEC-5 about any other stressful experience, he reported that many of his family members and close friends have overdosed, died, or disappeared for large periods of time. Specific to his childhood experiences, Dylan endorsed being psychologically abused by his uncle who raised him, emotionally neglected, living with an alcoholic or addict, living with a member of the household who was mentally ill, and living with a uncle who was in and out of prison. However, Dylan specifies that “my uncle Not prison I guess, he would just go to jail on weekends. I’ve done most of the jail time in my family I guess”.

On the PCL-5, Dylan scored a four out of 80, therefore far below the recommended cut-off score for a probable diagnosis of PTSD. He reported that he was a little bit bothered by having strong negative beliefs, having strong negative feelings, feeling irritable or acting aggressively, and taking too many risks. The negative beliefs and feelings were mostly directed at the trauma of being abandoned by his sister: “I have negative thoughts about, I ran into my little sister last week. She’s in active addiction. She’s got endocarditis, it affected me a little bit. I

have negative feelings toward [her]”. He also said, “I had PTSD, I’ve done counseling”. He also reported no current TRASC symptoms. On the SSI-SA, Dylan indicated attending meetings to help with his recovery, and that he has had a drinking or drug problem, as have at least one family member. He also endorsed the item about drinking or drug problems causing problems between himself and family or friends: “My uncle’s an alcoholic, sister is a drug addict alcoholic. Most of the people I grew up with and consider family are alcoholics or drug addicts. I don’t talk to them anymore”.

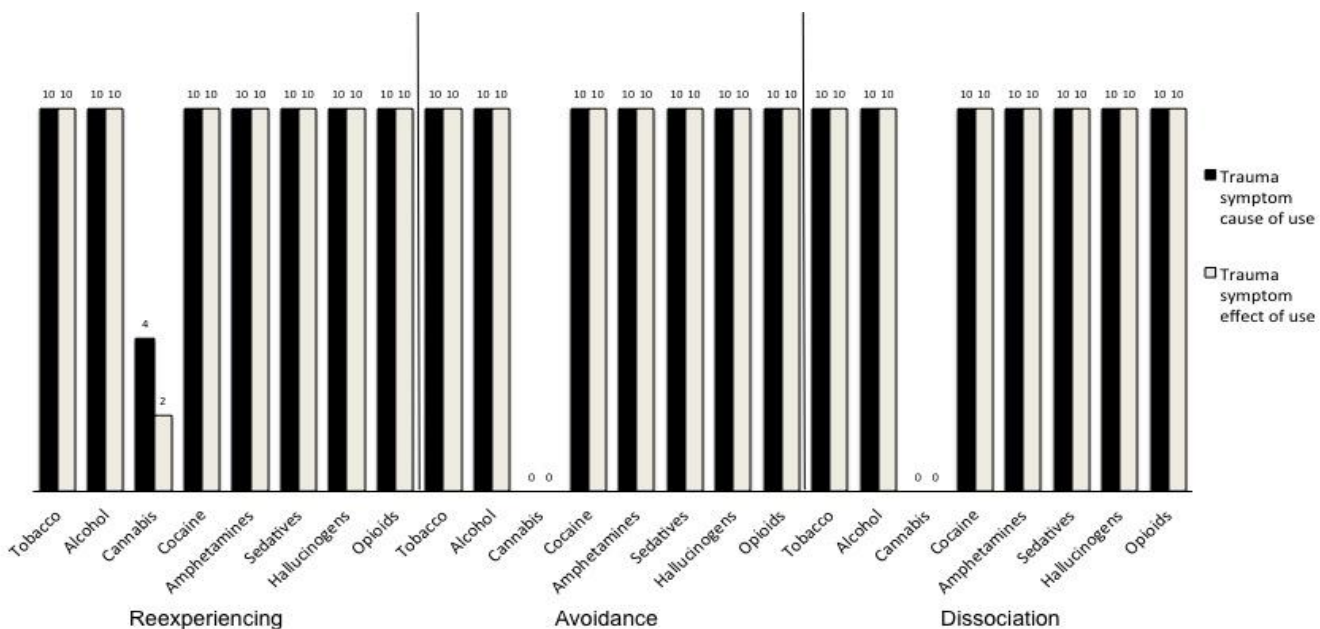
When his substance use was at its worst, Dylan endorsed using tobacco, sedatives, hallucinogens, and opioids daily or almost daily for most of the day, cocaine and amphetamines multiple times daily or almost daily, alcohol about once per week, and cannabis about two or three times during this period. He said of this time: “I was pretty much high for 10 years”. Derek also endorsed reexperiencing and avoidance symptoms as occurring daily or almost daily for most of the day, and dissociative experiences about daily or almost daily during the period of time when his substance use was at its worst.

Dylan’s PCR ratings are in Figure 9. He endorsed strong causal relationships between all three trauma-related symptoms and tobacco, alcohol, cocaine, amphetamines, sedatives, and hallucinogens, saying “these are pretty much all going to be 10”. Dylan specified that only cannabis was not a strong cause or effect of his trauma-related symptoms. He perceived his reexperiencing as a mild cause and effect of cannabis use, but there was no relationship between cannabis and avoidance or dissociation. When asked to clarify why he said almost all of his substance use was strongly caused by and a cause of his trauma-related symptoms, he said that he bounced from substance to substance because “it was just substitution. They all worked until they didn’t work [at suppressing trauma symptoms], and then I tried something new. It’s just

substitution”, suggesting he used substances until he gained tolerance, and then he moved on to something new.

In Dylan’s case, his PCR ratings did not give a clear indication of whether or not he self-medicated his trauma-related symptoms. However, when prompted to elaborate, he did endorse self-medicating with his aforementioned explanation on substituting drugs when the ones he was on stopped doing what he was taking them for.

Figure 9: Summary of PCR Ratings for Dylan in Study 2



6.7 Daniel

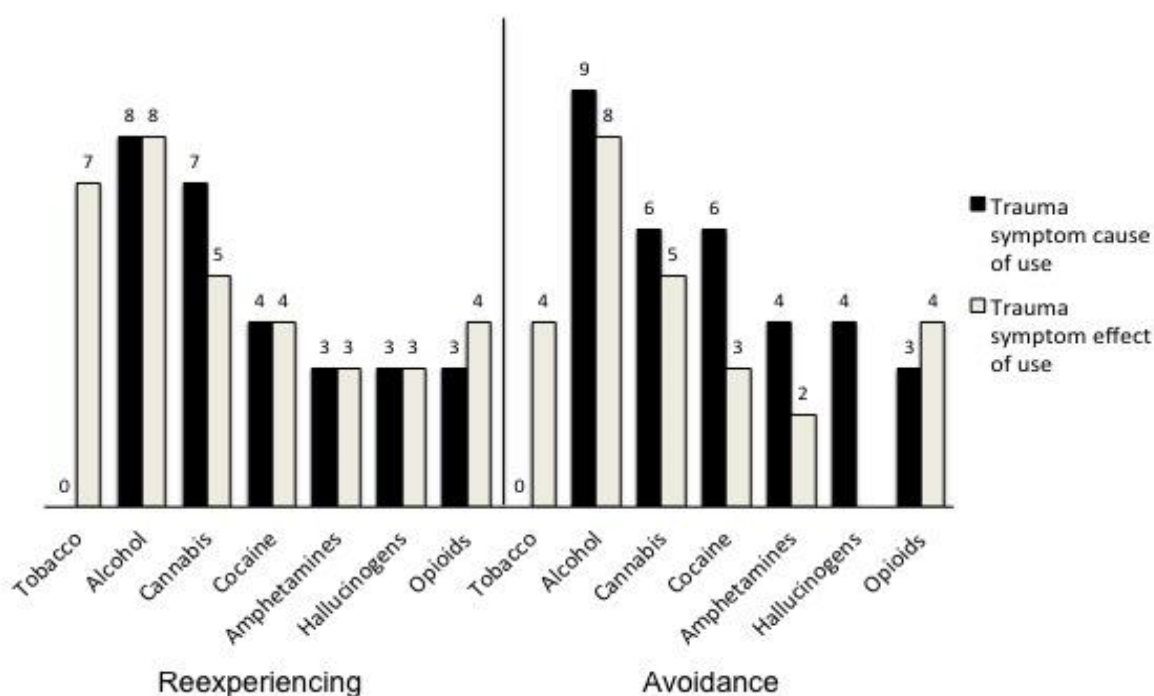
Daniel is a 60-year-old Caucasian man currently divorced and diagnosed with depression. In the past, he was in a snowplow accident that left him with a traumatic brain injury and some memory loss, but he reported that he felt “lucky to be alive”. Over his life, Daniel has witnessed fires and been near multiple tornados, been physically assaulted, and witnessed a violent death.

He was a volunteer fireman and “saw some pretty awful things”. Specific to his childhood, he reported psychological abuse, emotional neglect, and growing up with an alcoholic father. His dad “was an alcoholic. [He] was sexually abused for years, so [he] was depressed”. Daniel scored only seven on the PCL-5, far below the recommended cut-off score of 38 for a probable diagnosis of PTSD for the past month. He did however endorse being quite a bit bothered by repeated disturbing dreams of his past stressful experiences.

Having finished treatment five days prior to the interview, Daniel did not endorse using any substance use within the past month. However, Daniel has a lifetime history of using alcohol, tobacco, cannabis, cocaine, amphetamine-stimulants, hallucinogens, and opioids during multiple periods of his life: “I started drinking at the age of 13 to the age of, well, I’ll say 60. I’ve relapsed I couldn’t tell you how many times – lots”. He also said, “I’ve done every drug imaginable ... and I’m not ashamed to admit it”. The PCR ratings between Daniel’s endorsed substance use and trauma-related symptoms during the periods of time where his substance use was at its worst can be seen in Figure 10. Due to the nature of his traumatic brain injury, Daniel had difficulties remembering discrete periods of substance use, and so he was not always able to identify when he was using specific substances or which period was when his substance use was at its worst. As such, he spoke about all of his periods of substance use. In brief, PCR ratings varied significantly by substance class. Daniel’s reexperiencing was a perceived to be a strong cause and effect of his alcohol use, and perceived to be a mild to moderate cause and effect of his cocaine, amphetamine, hallucinogen, and opioid use. However, he perceived that his reexperiencing was strongly caused by tobacco use. Daniel’s avoidance was reported to be a strong cause and effect of his alcohol use, as well as moderate cause moderate of his cannabis and cocaine use. Cannabis and cocaine were also perceived to be moderately and mildly causal

of his avoidance, respectively. Lastly, his avoidance was perceived to be a moderate cause of his amphetamine and hallucinogen use whereas he considered his amphetamine use to be a mild cause of his avoidance, and he perceived that his avoidance mildly caused his opioid use and his opioid use moderately caused his avoidance. Overall, in the past Daniel had been self-medicating his trauma-related symptoms with tobacco and opioids, but an increased severity of reexperiencing and avoidance of stressful experiences may have been caused when he used other substances such as cannabis and amphetamines.

Figure 10: Summary of PCR Ratings for Daniel in Study 2



6.8 Sarah

Sarah is a 30-year-old Caucasian woman who is currently single and unemployed. She was diagnosed with an anxiety disorder in the past, and has completed some college or university courses. She says of her anxiety, “I obviously [felt] extreme anxiety when trying not to use

drugs”. She attended treatment for both addiction and codependency, and it has been seven months since she has used substances. She will be entering into a program for maintaining sobriety in the near future. On the LEC-5, Sarah endorsed experiencing a transportation accident, serious accident at work, exposure to toxic substances, physical assault, unwanted sexual experiences, emotional captivity by an ex lover, life-threatening illness (attempted suicide three times), witnessing severe human suffering, and that she had caused someone else serious injury or harm. Sarah indicated being unsure about a sexual assault, due to her circumstances: “When you're using, whenever you're doing stuff, I don't feel like it was [rape] but at the same time, like, at certain points I don't feel like it's forceful in any way, but Now that I'm not using ...”. On the open-ended last question, Sarah described her trauma on becoming pregnant while on drugs and having her child removed from her care when she relapsed. Specific to her childhood, Sarah reported psychological abuse, emotional and physical neglect, living with a problem alcoholic, and living with a mentally ill family member. For example, “I went to every party with my mom, mostly drinking, um, but still there'd be times I'd get in the car scared we were driving home”.

Sarah scored 32 out of 80 on the PCL-5, which is just below the recommended cut-off score of 38 for probable PTSD. With the 10 TRASC items, her score was 36 out of 120. She endorsed feeling quite a bit bothered by repeated and disturbing memories, repeated and disturbing dreams, feeling distant or cut off from people, having trouble experiencing positive feelings, and trouble falling or staying asleep. She reported being moderately bothered by feeling upset at reminders, having strong physical reactions to reminders of trauma, blame, strong negative feelings, loss of interest in activities, and having difficulties in concentrating. She reported some difficulty in responding to these questions, such that “I can't focus on them,

because they, like ... because [the items]'s are so deep, I start, like, it doesn't like it or something in my brain." For TRASC, she endorsed feeling a little bothered by flashbacks, feeling like what she is experiencing is not real, out of body experiences, and identity confusion such that "I feel like I put on many masks, still, and not intentionally" because she has had many different roles and jobs in her life. On the SSI-SA, Sarah did not meet the criteria for further investigation into a probable SUD diagnosis, although she endorsed going to meetings to maintain her sobriety, having had a drinking or drug problem, having a family member with a drinking or drug problem, and feeling as though she currently has a drinking or drug problem.

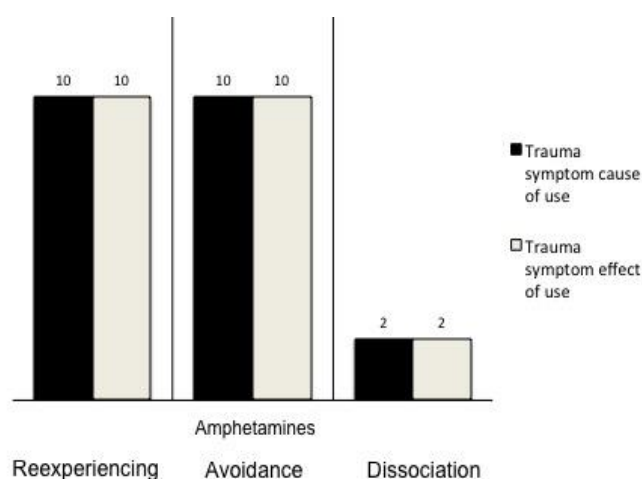
When Sarah's substance use was at its worst, she reported using amphetamines daily or almost daily for most of the day. Additionally, she reported experiences of reexperiencing and avoidance daily or almost daily for most of the day. When endorsing avoidance, without prompting, she said "well, that's why I would do the drugs I guess". She said of her substance use, "it was more like, I made it for what I want[ed] it to be, like, you would avoid everything and I would just do what I want". Sarah's PCR ratings can be seen in Figure 11. She endorsed both reexperiencing and avoidance as strong causes and effects of her amphetamine use. When elaborating on the relationship between amphetamine use and reexperiencing, she said:

It would create worse [dreams] But when I stopped using, the reason I have those dreams is because I felt like literally it's filing everything I didn't file because I didn't sleep ever. It made me stop, but it created a ton more Now it's just overwhelming, and is just a cycle on its own.

Similarly, "it wasn't always about the thoughts, but what do I do now ... I need to reuse again to get to where I [need to go]". She did not report any dissociative experiences during this time

period, but did subsequently report a mild causal relationship with amphetamine and dissociation. It is evident from her PCR ratings and elaborations that her amphetamine use was likely very cyclical with being a cause and an effect of the trauma-related symptoms of reexperiencing and avoidance.

Figure 11: Summary of PCR Ratings for Sarah in Study 2



6.9 Derek

Derek is a 27-year old Caucasian man. He did not wish to provide other details about his psychiatric diagnoses, education, or when he commenced from his treatment program for substance use. However, at one point, Derek mentioned that he has not used substances in 45 days. He endorsed experiencing multiple stressful events in his life, specifically, being hit by a car, being physically assaulted and “jumped a couple times and, I don’t know, about 50 fights I guess”, accidentally ingesting a toxic substance, and causing serious injury or harm to others during the numerous fights he has participated in. He mentions that “I enjoy the adrenaline rush, or I used to, I guess” and “I didn’t lose a lot [of fights]”. Derek also reported that, during his

childhood, his father, a drug addict, went to prison or chose to do drugs, of which he says “I always felt he didn’t love me because of that.” Additionally, he described:

When I was 16, I seen [dad’s] drug use; that kind of traumatized me a little bit. I watched him injecting heroin and smoking speed. He showed me how to make a light bulb into a speed pipe. Smoked a doobie with me, it was my first doobie ever, with many more to follow.

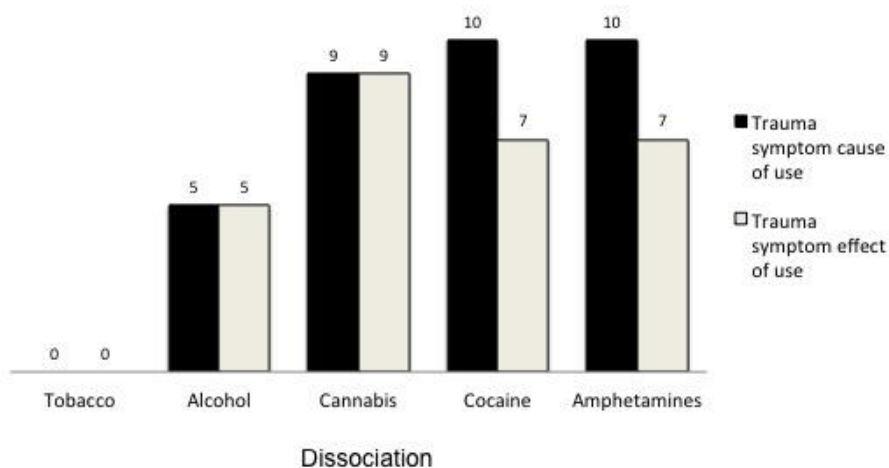
Derek scored 13 out of 80 on the PCL-5, therefore failing to meet the cut-off score for a likely diagnosis of PTSD. Derek endorsed being moderately bothered by irritability or anger in the past month, but endorsed being bothered only “a little bit” over the same time period by unwanted dreams and memories, feeling upset at reminders, avoidance of both internal and external reminders, having strong negative beliefs, blaming himself, having strong negative feelings, having trouble experiencing positive feelings, and taking too many risks; however, none of these endorsements meet the criteria for the symptom being present currently. On the 10 TRASC items, he endorsed being moderately bothered by out of body experiences, commenting: “I was up ... I felt like I was in space looking down on the world”. He also reported being “a little bit” bothered by feeling as though part of his body is not his own and divided or multiple senses of self.

In the past month, Derek did not indicate any substance use; he has been attending meetings, and did not meet the criteria for a current SUD on the SSI-SA. However, when his substance use was at its worst, Derek reported using tobacco almost daily for most of the day, using cannabis multiple times daily, using alcohol almost daily, and using cocaine or amphetamines about once a month. He mentioned that his worst period of substance use was

“within the last year, I guess, ‘cause that’s when I started using hard drugs”. During this time period, he also indicated that he was experiencing the trauma-related symptoms of dissociation about once per week, avoidance of stressful events two to three times, and reexperiencing once in his lifetime. When asked about how he thought his trauma-related symptoms related to his substance use, he reported that he used substances “to numb things, yeah, yeah, to numb things and to keep partying”. Derek’s PCR ratings between these symptoms can be seen in Figure 12.

In general, Derek rated his dissociation as a strong cause of his cocaine and amphetamine use, but also rated his cocaine and amphetamine use as moderate causes of his dissociation. He reported that his alcohol and cannabis use were both moderate or strong causes and effects of his dissociation, respectively. Derek stated that his reexperiencing and avoidance ratings were similar to his dissociative ratings but no other ratings were collected. Unfortunately, no additional questions were asked to clarify this statement. Although he did not give specific ratings for how these substances related to reexperiencing and avoidance, he reported that it was about the same as the dissociation ratings, in that his substance use was both a cause and an effect of his reexperiencing and avoidance.

Overall, Derek perceived his past substance use and trauma-related symptoms as having a cyclical relationship for the case of alcohol and cannabis use and dissociation. He rated that both his alcohol and cannabis use and his dissociation were equally a cause and an effect of each other. However, his ratings for cocaine and amphetamine use indicate that he seems to use these substances to self-medicate his dissociative experiences.

Figure 12: Summary of PCR Ratings for Derek in Study 2

6.10 Barry

Barry is a 44-year-old Caucasian single, unemployed man. He reported that he had nearly completed high school, and in the past, has indicated psychiatric diagnoses of anxiety, depression, and PTSD. He has been through treatment for alcohol and drug abuse multiple times, completing his latest treatment two months prior to the present research interview. Barry reported experiencing many lifetime stressful events, including a tornado, exposure to toxic substances such as “fumes and gases and ... asbestos”, physical assault, assault with a weapon, an unwanted and uncomfortable sexual experience, being in captivity or held against his will by a family member, life-threatening injuries such that he was “stabbed six times” with internal bleeding, witnessed severe human suffering during his addiction, and caused another person serious injury or harm “all in self-defense”. He also tried to commit suicide at least once, as he “drank a bunch of bleach there a couple years ago and lived”, has almost drowned, and recently learned that his sisters had been molested when they were younger. On the ACE measure, he

indicated in the affirmative to all ten adverse childhood experiences listed. He often felt psychological and physical abuse, emotional and physical neglect, his parents were separated and “we were separated from them too”, his mother was physically assaulted multiple times by his father, his immediate and extended family all abused alcohol or drugs, and his father was in and out of prison “constantly”. With regard to the level of mental illness and suicidal tendencies within his family he described: “I think we all tried to drink ourselves to death at some point in my family”.

On the PCL-5, Barry scored 52 out of 80, well above the recommended cut-off score for a probable diagnosis of PTSD. Including the 10 TRASC items, his total score was 73 out of 120. Of the 20 PCL-5 items, his highest rated symptoms involved extreme issues with being bothered by strong negative feelings, aggression, being “superalert”, feeling “jumpy”, concentration difficulties, and sleep disturbance. On the TRASC items, he indicated being extremely bothered by difficulties with loss of emotional feeling, identity confusion, and losing time for periods of at least 10 minutes. In the past month, he indicated no active addiction other than to using marijuana to manage some symptoms. On the SSI-SA he noted that he currently attends addiction support meetings to help maintain his sobriety, and endorsed that he and family members have had a drinking or drug problem, but did not score for a likely diagnosis of a current substance use disorder.

When Barry’s substance use was at its worst, he indicated using tobacco, alcohol, cannabis, and cocaine multiple times daily or almost daily, as well as inhalants and hallucinogens two to three times. Also during this period, Barry rated the trauma-related symptoms of reexperiencing and dissociation as having been present about daily or almost daily, and avoidance symptoms as daily or almost daily for most of the day. In terms of the causal

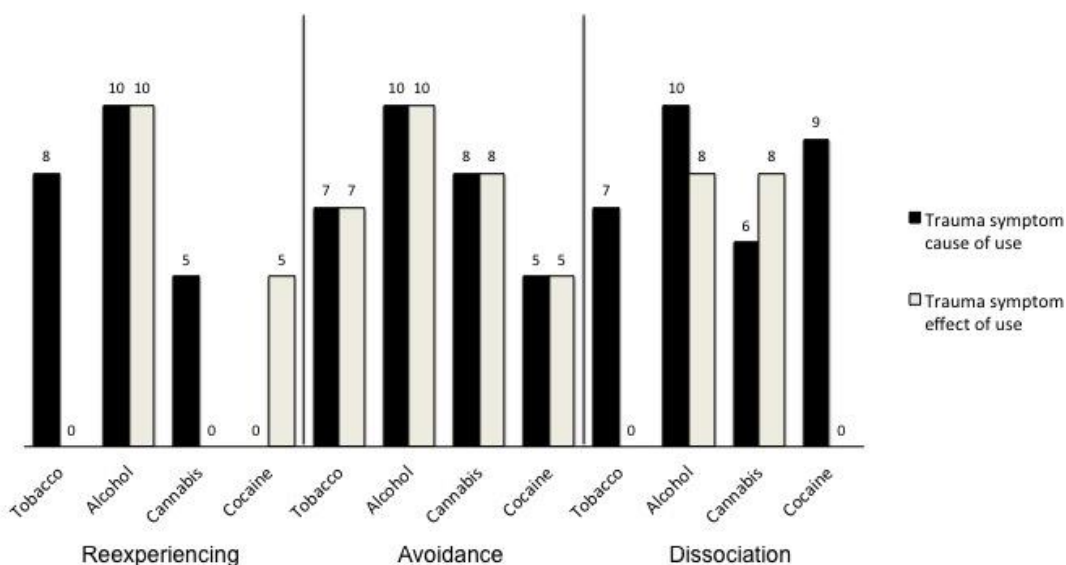
relationships between his substance use and trauma-related symptoms, Barry rated his inhalant and hallucinogen use as having no relationship with reexperiencing, avoidance, and dissociation. Inhalants were “something I tried, I wouldn’t say there is anything for inhalants” and hallucinogens were “just for the smile on the face, relaxing”. However, he perceived that his tobacco, alcohol, cannabis, and cocaine use were all related to his trauma-related symptoms. His PCR ratings can be found in Figure 13.

Referring first to his trauma-related reexperiencing, Barry reported reexperiencing as a strong cause of his tobacco use, and that both reexperiencing was both a strong cause and effect of his alcohol use. He says of his alcohol use and reexperiencing, “sometimes I’d have to [drink] to feel normal”. Similarly, reexperiencing was rated both a moderate cause and effect of his cannabis and cocaine use. In reference to Barry’s avoidance, he considered it to be a strong cause and effect of tobacco, alcohol, and cannabis use. He said of the nature of the relationship between his alcohol use and avoidance symptoms, “I’d try to avoid with drinking, you know what I mean, it would just work on both ends, it was the answer to everything”. He reported that his avoidance symptoms were a moderate cause and effect of his cocaine use as well. Lastly, in reference to his dissociative experiences, Barry attributed his dissociation to be a strong cause of his tobacco and cocaine use. He also rated dissociation as a strong cause and effect of his alcohol use, and a moderate cause but strong effect of his cannabis use.

Overall, in past periods of his life, Barry seems to have entered into a cycle where his trauma-related symptoms of reexperiencing and avoidance would lead him to drink, and drinking would also cause him to experience further trauma symptoms. Similarly, he considers his cannabis use to be a somewhat strong factor in his trauma-related avoidance behaviour. In the case of his use of tobacco, alcohol, and cocaine, he considers dissociative experiences to be more

likely causes of his substance use than vice versa whereas, in reference to his cannabis use, Barry considered the opposite to be true: he believed that his cannabis use was more so a cause of his dissociative experiences.

Figure 13: Summary of PCR Ratings for Barry in Study 2



6.11 Eric

Eric is a 60-year-old man who is Caucasian, divorced, and retired. He has some college or university experience, and is currently diagnosed with depression, anxiety, and PTSD. Eric has been out of treatment for a substance use disorder, but admitted to currently using substances. He reported experiencing numerous lifetime stressful events, such as transportation accidents, a serious accident where “I broke my leg, then it got infected ... I almost lost my leg”, assault with a weapon where “a fella did pull a revolver out”, sexual assault in adulthood, other unwanted or uncomfortable sexual experiences where “when I get high, I lose my inhibitions and do degrading acts”, and captivity. On the open-ended item on the LEC-5, Eric mentions being videotaped against his will. Eric also reported experiencing childhood adversity with divorced

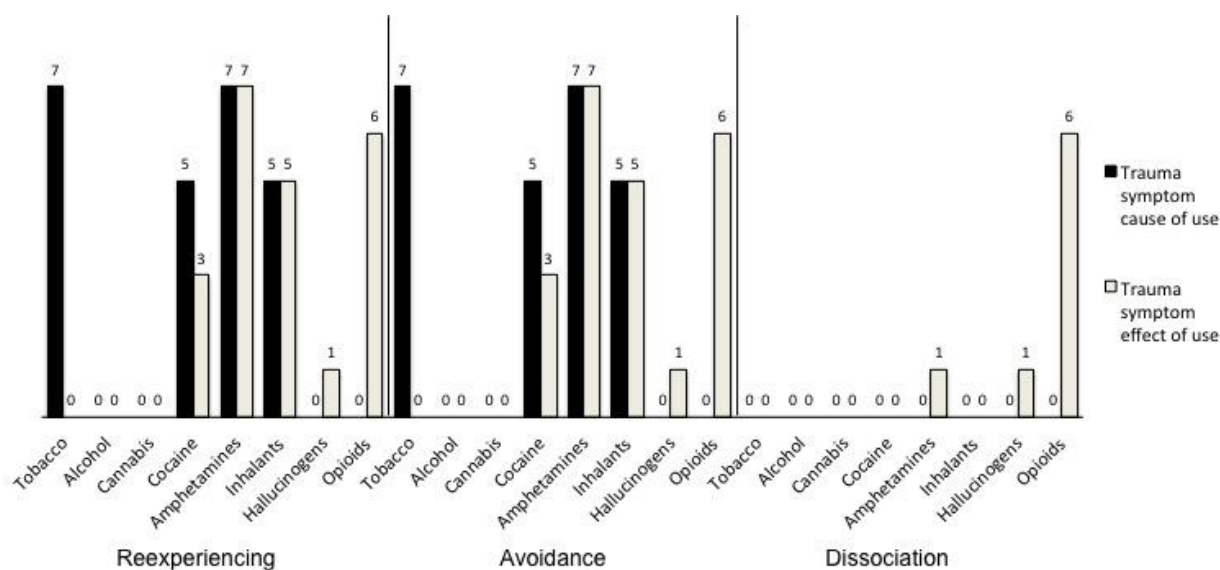
parents, living with a problem drinker or drug addict, and having a household member who was mentally ill or suicidal, but otherwise said “I had a pretty good childhood” even though “my father abandoned our family when I was 17”.

Overall, Eric scored 43 out of 80 on the PCL-5, but with an additional score of four on the TRASC items. He meets the criteria for current PTSD, which reflects his current diagnosis as mentioned earlier. His highest rated symptoms include feeling extremely bothered by disturbing and unwanted memories, flashbacks, having strong negative beliefs, and having strong negative feelings.

On the SSI-SA, Eric met the criteria for being at a moderate to high risk of substance use problems and should be assessed further for an SUD; he scored eight out of 14. During the interview, he admitted to currently using, as “before I only had lapses, but since coming out of treatment, I’ve had relapses ... I’ve got to change my behaviour” but also says that he is lucky that “I’ve got a real supportive family, kids ... they’re 100% behind me”. He also said of his family: “I’ve been open with them ... they understand that this is a process”. When his substance use was at its worst, Eric reported using tobacco multiple times daily or almost daily, amphetamines daily or almost daily, cocaine and opioids about once per week, and alcohol, cannabis, inhalants, and hallucinogens two or three times. Eric said, “I never had a drug problem prior to two years ago, and then my life turned upside down and everything” when he started “using them at times to avoid dealing with life issues and dealing with pain”. He mentions that “quite often I didn't know what I was getting” when he was buying drugs, and so his frequencies may not be fully accurate. He also endorsed reexperiencing and avoidance as occurring once per week, although he admits, “I didn't think I used to avoid”. Eric’s PCR ratings can be seen in Figure 14.

When asked about the causal relations between trauma-related symptoms and substance use, he said “to me, I would have been high, and not in a condition to [make judgments]”. However, to the best of his ability, Eric rated his reexperiencing symptoms as strong causes of tobacco and amphetamine use, although amphetamine use was also rated as a strong cause of his reexperiencing. His reexperiencing was also perceived to be a moderate cause of his cocaine and inhalant use, although his cocaine and inhalant use were perceived to be mild and moderate causes of his reexperiencing, respectively. However, Eric perceived his reexperiencing to be mildly caused by his hallucinogen use and moderately caused by his opioid use. In terms of his avoidance, Eric perceived avoidance to be a strong cause of tobacco and amphetamine use, and his amphetamine use was perceived to be a strong cause of his reexperiencing. Avoidance was also rated as a moderate cause of his cocaine and inhalant use, whereas his cocaine use was rated as a mild cause and his inhalant use a moderate cause of his avoidance. Similar to reexperiencing, Eric reported that his avoidance was moderately caused by opioid use, and mildly caused by his hallucinogen use. Lastly, his dissociative experiences were perceived to be moderately caused by his inhalant use and mildly caused by his amphetamine and hallucinogen use.

When he was talking about the differences in his PCR ratings, he explained that, “if I inject, it’s a stronger feeling than inhaling”. However, it is evident that for reexperiencing and avoidance, either the trauma symptoms were a strong cause or a strong effect, based on the drug. However, for Eric’s dissociative experiences, dissociation was always caused by his use of amphetamines, hallucinogens, and opioids.

Figure 14: Summary of PCR Ratings for Eric in Study 2

6.12 Matt

Matt is a 51-year-old university-educated Caucasian man currently two months into his treatment program for substance use. He is unemployed, separated “although he and his wife have not been in contact since the marriage broke up seven years ago”, and has current diagnoses of depression, anxiety, PTSD, and major dysthymia. Matt reported experiencing numerous lifetime stressful experiences on the LEC-5, such as a natural disaster in the form of an ice storm where “the army was policing the streets, people were out of power for a week”, a transportation accident, multiple serious accidents at work including at least five concussions, exposure to a toxic substance, physical assault and assault with a weapon. Matt also endorsed multiple sexual assaults in childhood by a paternalistic figure outside of the home where he said that he was “easily the twentieth person to come forward with charges against him” and “it’s only been in the last few years where I have acknowledged this in any way”. The figure was a notable public figure in his city, and he also reported feeling traumatized and betrayed by the elders in the

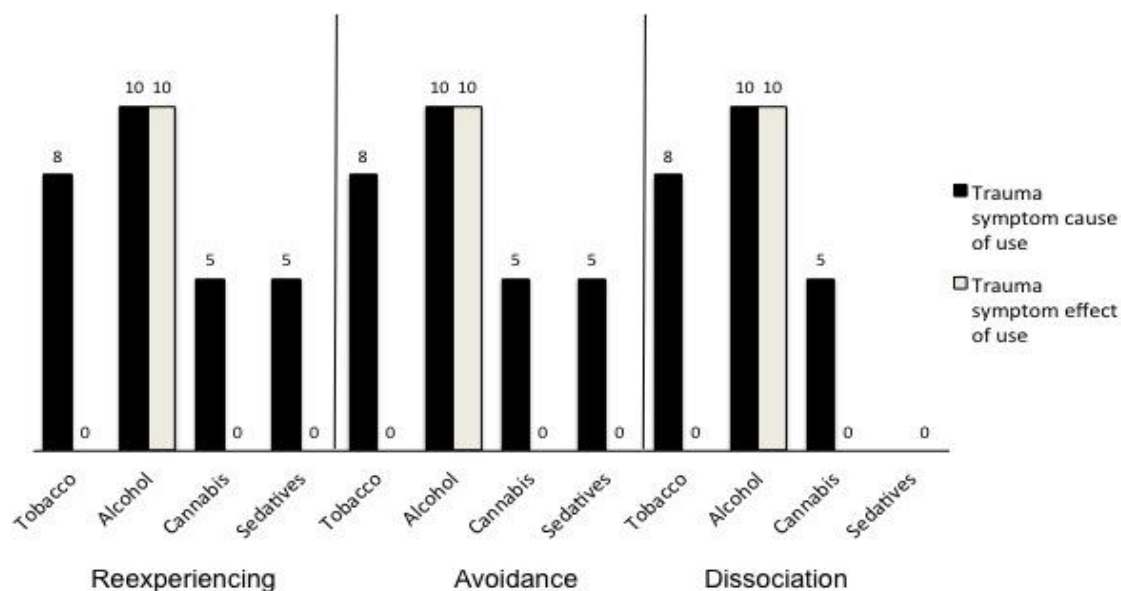
community who were aware of this happening but “felt that they might be held personally financially responsible” and so did not come forward. He also endorsed witnessing the aftermath of a sudden violent death where a woman he was in a relationship died in his home: “one morning I found her dead. She had died falling in my bathroom, she had died falling drunk”. On the open-ended question, Matt mentions coming to terms with the trauma of his addiction and the consequences of it, enhanced by the death of his loved one. During his childhood, Matt endorsed experiencing five items on the ACE: psychological abuse such that “I lived under the belief that I could be hurt by my father” which was further heightened by the “distrust of patriarchal figure[s]” from his sexual abuse, sexual abuse by a trusted elder, emotional neglect, livings with a problem alcoholic or drug addict, and living with a household member who was mentally ill.

On the PCL-5, Matt scored 58 out of 80, and he also had a high score of 28 on the TRASC items. He meets the criteria for a likely diagnosis of both PTSD and its dissociative subtype. He reported feeling extremely bothered by feeling upset at reminders, avoidance of both internal and external reminders, having strong negative feelings, being “superalert”, and an altered sense of time. He also reported being bothered quite a bit by repeated and unwanted memories, flashbacks, strong negative beliefs, blaming self or others, feeling distant or cut off, trouble experiencing positive emotions, feeling jumpy, concentration problems, derealization, out of body experiences, divided senses of self, lost time (amnesia), and hearing voices.

On the SSI-SA, Matt scored as a minimal risk, endorsing going for help, having had and currently having a substance problem as well as having a family member with a substance problem. When his substance use was at its worst, Matt reported using tobacco and alcohol daily or almost daily for most of the day, and sedatives multiple times daily. He also used cannabis about once a week because even though he “had no craving for cannabis” he used it “as a kind of

substitute for, say, going to [unnamed] detox”. He endorsed reexperiencing and avoidance symptoms as occurring daily or almost daily for most of the day, and dissociative symptoms multiple times daily although he said the dreamlike state of derealization he was experiencing was “invariably” caused by substance use.

Matt’s PCR ratings can be found in Figure 15. He said of attempting to make causal connections between his trauma-related symptoms and his substance use: “Well it’s difficult to know because, I, uh, that’s demanding a degree of objective judgment that I think I probably did not have”. In sum, all three of his trauma-related symptoms strongly caused his tobacco use and moderately caused his cannabis use. He says of his tobacco use and trauma-related symptoms, “on the one hand, I experienced reexperiencing when I was using tobacco products. On the other hand, I have not been using tobacco products since arriving here ... and yet I continue to have all of these symptoms”. Additionally, all three trauma-related symptoms were reported to be a strong cause and a strong effect of his alcohol use, but that “my memory of it will be severely distorted. I would say, alcoholism for me ... I really do get into chicken and egg” and so he was “loathe to put an objective” value on these relationships. Lastly, both reexperiencing and avoidance were perceived to be moderate causes of his sedative use. As such, Matt endorsed the self-medication hypothesis for tobacco, cannabis, and sedatives, but perceived his alcohol use to be cyclical in that it was caused by while also a cause of his trauma-related symptoms.

Figure 15: Summary of PCR Ratings for Matt in Study 2

6.13 Jordan

Jordan is a 29-year old mixed race man who is in treatment for substance use. He is not currently employed, is single, and has some college or university education. In the past, Jordan reported being diagnosed with generalized anxiety disorder, depression, and schizophrenia, although he said “the schizophrenia was drug-induced”. Jordan endorsed experiencing transportation accidents, physical assault “while on drugs and off”, sexual assault, other unwanted sexual experiences, captivity, witnessed a sudden violent death. Under the other category, Jordan mentioned childhood experiences such that “mom and dad divorced, I felt a little emotionally neglected”, although this is also reported on the ACE. Specific to the ACE, Jordan endorsed sexual abuse “at the age of 14”, physical neglect, parental divorce, living with an alcoholic or drug addict, and living with a mentally ill household member, such that “my mom, after the divorce, was depressed, drinking, hospitalized”.

Jordan currently meets the recommended cut-off score for a likely diagnosis of PTSD, as he scored 57 out of 80 on the PCL-5. He also scored 14 on the TRASC items. He reported being extremely bothered by repeated and disturbing memories, feeling upset at reminders, having strong negative beliefs, blaming himself or others, having strong negative feelings, having trouble experiencing positive feelings, and feeling irritable or angry. He said of a piece of clothing similar to his attacker's when he was sexually assaulted: "I walked past the bedroom last Friday, and my friend's sweater ... my mind filled in the blank and I felt under attack". Specific to TRASC, Jordan reported being quite a bit bothered by flashbacks, loss of emotional feeling, derealization, and losing time for periods of ten or more minutes (amnesia). He also said "I did isolate a lot towards the end, when I was at my worst", which he admitted made his symptoms worse.

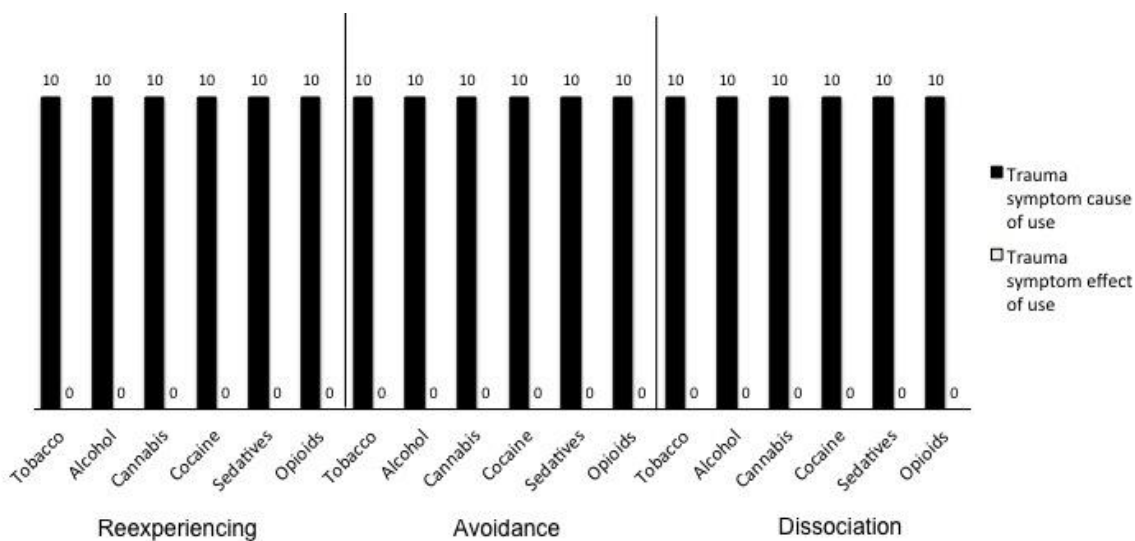
As Jordan is currently in an abstinence-only treatment program, he is not currently using substances and scores a minimal risk of substance abuse with 3 out of 14 on the SSI-SA. He endorsed going for help, having had a problem with substance use, currently having a problem with substance use, and having a family member with problem substance use. He says of his past substance use, "It was the best way I know how [to manage] at the time", "Drugs made me feel safe, soothing", and "It was to self-medicate, soothe, to comfort". When his substance use was at its worst, Jordan was using tobacco, alcohol, cocaine, sedatives, and opioids daily or almost daily for most of the day, and cannabis about or almost daily. Also during this time period, he endorsed reexperiencing as occurring once per week and avoidance two or three times. He said that "I didn't think about the sexual assault [consciously], but I would be worried about my safety". Figure 16 details Jordan's PCR ratings between his substance use and trauma-related symptoms.

At the beginning of the PCR causal relations questioning, Jordan rated his reexperiencing and avoidance to be strong causes of tobacco and sedative use, and mild to moderate causes of his alcohol, cannabis, cocaine, and opioid use. He says of his tobacco use: “It sometimes caused me anxiety” but that “it didn’t trigger my trauma or any event”, and that his alcohol use was “a distraction”. However, upon further reflection, Jordan said of attempting to make the causal connections between his substance use and trauma-related symptoms: “It’s hard for me to say. This is getting confusing for me because ... anytime that I would get upset, sure, I would probably get high ... I had a false sense of happiness [on drugs]” but that “I didn’t even think about this” in reference to attempting to create these causal connections. He then changed his answers to have all three trauma-related symptoms to be strongly causal of all of his substance use, and reported that none of his substances caused his trauma-related symptoms. He said of this change:

Learning now what we are learning in treatment, I know that even though I didn’t... it’s so buried and so forgotten and locked away that I didn’t realize that I’m, you know, I’m more predisposed to addiction and I, um, I didn’t realize [PTSD symptoms] has to do with my addiction.

Jordan further reported that he felt:

Predisposed to addiction through PTSD, and I know that now, I see how much it bled into every other area of my life, you know, relationships, job, school, drugs, crime, sex, really everything. It’s affected everything, and I didn’t know that ... I blame my whole life on the thing that happened when I was 14 [sexual assault]”.

Figure 16: Summary of PCR Ratings for Jordan in Study 2

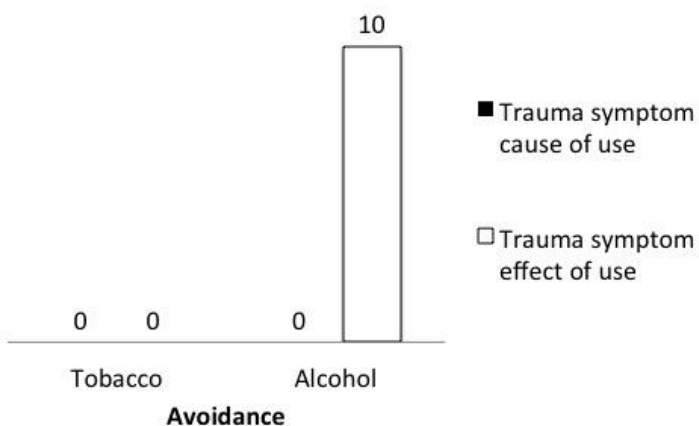
6.14 Kyle

Kyle is a 65-year old Caucasian man who is currently married and working full-time. He obtained a college diploma, and has never had a psychiatric condition as diagnosed by a clinician. Kyle reported experiencing no specific stressful event on the LEC-5, although under the “other category”, he classified his brother’s suicide. He said, “I haven’t witnessed [a death], but my brother killed himself”. Specific to the ACE, Kyle endorsed living with a problem drinker (“my older brother”), and having a family member commit suicide (“my other brother”).

On the PCL-5, Kyle did not report any current PTSD symptoms, or any TRASC symptoms. Additionally, he reported not currently using substances and scored at a minimal risk of substance abuse with 2 out of 14 on the SSI-SA. He endorsed going for help, having had a problem with substance use in the past, and having a family member with problem substance use. He admitted that he sometimes misses “family get-togethers and stuff like that. I don’t attend them because the alcohol is there”.

When Kyle's substance use was at its worst, he reported experiencing avoidance about once per week, and used tobacco and alcohol daily or almost daily for most of the day. He said, "well when I was drinking heavy, I started thinking of things that weren't very nice, people that bothered me at work, stressful feelings" and that he was bothered by these thoughts and feelings; however, he continued "drinking in the morning and drinking all day" regardless of the fact that alcohol caused him to experience these maladaptive patterns of thinking and feeling. Figure 17 details the PCR ratings obtained from Kyle. He reported that tobacco use did not cause his avoidance behaviours, nor did his avoidance behaviours cause his tobacco use. However, he reported that alcohol use caused him to have internal reminders about stressful events that he tried to avoid. In contrast, he reported that he never used alcohol to avoid these reminders.

Figure 17: Summary of PCR Ratings for Kyle in Study 2



7.0 Study 2 Discussion

There were many benefits inherent in the current study that addressed limitations from the online study. For example, with the clinical sample, we were able to gain a more comprehensive clinical history and understand more about the sample than we were able to do with the Study 1 online participants. Moreover, due to the nature of recruitment, all of the individuals interviewed had been or were currently in treatment for substance abuse, in comparison to the smaller percentage of individuals with substance abuse recruited online. While there was a lower rate of potential diagnosis of SUD in the clinical sample versus those participating online due to the success of current treatments, there was a similar rate of PTSD. However, both studies share the same limitation of assessing only trauma-related symptoms and substance use classes, rather than behaviours. Nonetheless, the ability to ask further questions of the individuals interviewed for the clinical sample provided more information about the behaviours each individual was engaging in during their active substance use, such as fighting or increased sexual behaviours.

In fact, the ability to gain follow-up information from the clinical sample was useful for exploring the relationships between each individual's perceptions of how their trauma symptoms and substance use related in a more in-depth manner. The current study was able to expand upon the online study in that more than a numerical rating of PCR was collected. The individuals in the current study were able to provide a detailed phenomenological account of the possible relationships between their trauma-related symptoms and SUD. Therefore, the inclusion of the clinical sample was useful in explaining *how* and *why* trauma symptoms related to substance use in addition to *how much* and *in which direction*, which was the extent to which Study 1 could provide details on the same perceived causal relationships.

Overall, every individual in the clinical sample endorsed multiple lifetime and childhood traumatic experiences, with many reporting experiencing a traumatic event very early in life. This evidences the self-medication hypothesis, which posits that an individual experiences a traumatic event and then progresses to substance abuse in order to manage the effects of the trauma. Almost all participants endorsed experiencing at least one trauma-related symptom on the PCL-5, although only a quarter met the criteria for a probable diagnosis of current PTSD. During their collective worst times of substance abuse, all participants endorsed experiencing trauma-related reexperiencing and avoidance, suggesting that even if the individual did not currently meet the recommended cut-off score for a probable diagnosis of PTSD, it is entirely possible that they would have met the criteria during the periods where their substance use was at its worst. As well, all participants endorsed at least one item on the SSI-SA. However, the nature of the SSI-SA items revealed that even an individual not actively using substances could meet the “moderate to high risk” designation and require further assessment for an SUD. The majority of the participants scored at a minimal risk, again, even without actively using a substance.

The PCR results from the clinical sample study provide partial support for the self-medication hypothesis (Brady, Back, & Coffey, 2004; Chilcoat & Breslau, 1998a; Khantzian, 1985); trauma-related reexperiencing was perceived to be significantly causal of overall substance use. As a group, however, the participants did not perceive avoidance or dissociative experiences to be significantly causal of their overall substance use. Additionally, trauma-related symptoms were perceived to be significantly causal of tobacco use. Amphetamine use trended toward also being caused by trauma-related symptoms. No other substances were reported to be significantly caused by trauma-related symptoms. However, alcohol use, cocaine use, sedatives

use, and opioid use were all perceived to be caused by more so than a cause of trauma-related symptoms, although these relationships were not significant across participants.

In the current study, participants generally endorsed substance use as caused by trauma-related symptoms, with one exception. Inhalants were perceived to be equally a cause and an effect of trauma-related symptoms. This does suggest that there is also evidence against the self-medication hypothesis. Similarly, it also evidences Khantzian's (1985, 1997) assertions that, given specific drug properties interact with a person's inner psychological state, and specific drugs would may be used in a goal-directed manner for suppressing or enhancing particular states. Specifically, tobacco was perceived to be significantly more of an effect than a cause of trauma-related symptoms, and the majority of other substances had a similar but non-significant relationship with the trauma-related symptoms. However, as was suggested in Study 1, the use and reason for use of each substance varied significantly among the participants, and this should influence the interpretation of these group-level results.

Apart from the significant results and trends that were identified in the current study, certain general conclusions can be drawn. In the case of trauma-related symptoms, reexperiencing trauma, but not trauma-related avoidance and dissociation, was generally perceived to be causal of substance use. It can also be concluded that the relations between trauma-related symptoms and general or specific substance use were often perceived to be bidirectional and somewhat intercausal, such that although many substances were seen to be caused by trauma-related symptoms, individuals often clarified that they entered into cycles of substance use where there was intercausality between trauma-related symptoms and their substance use. These findings are generally indicative of the self-medication hypothesis, which is

consistent with most literature, as the self-medication hypothesis was a framework developed in clinical settings to explain substance abuse (Brady et al., 2004; Chilcoat & Breslau, 1998a).

There were limitations to the current study that were also inherent in the online study. Retrospection of when substance use was at its worst and then deriving causal connections from these time periods may be impaired by the substance abuse that was ongoing during these periods. Indeed, many participants expressed a high level of uncertainty regarding how they might most appropriately answer certain PCR questions, claiming their degree of intoxication prevents much insight into the causes and consequences of their behaviour. It is likely that, given the number and degree to which substance abuse was reported by the clinical sample, many individuals' abilities to recall the causal situations between specific substances used and specific trauma-related symptoms was impaired by whichever substances they were currently taking, particularly in the case of dissociative experiences (e.g., derealization or depersonalization).

Additionally, it should be noted that many of the mean cause and effect PCR ratings between substance use and trauma-related symptoms are stronger in the clinical study than those from the online study. It is possible that this is due to differences in test-taking approaches when answering questions online as opposed to face to face. Further, in the online study, the order of the PCR items was such that the causal symptom being investigated stayed constant through all of the different symptoms investigated as an effect. For example, if reexperiencing was investigated as a cause, all of the substances would be presented for rating as an effect before another causal symptom, such as avoidance, would replace reexperiencing. Conversely, for the clinical sample, participants' causal ratings were queried in what was felt to be a more fluid manner. For example, reexperiencing was investigated as a cause of alcohol use, and then immediately the reverse question was asked, specifically, alcohol use was investigated as a cause

of reexperiencing. This allowed for a more natural progression through the PCR questions, and may have impacted the stronger mean cause and effect ratings.

Considering the limitations present in the current study, we can conclude that the PCR ratings and personal experiences reported generally support the self-medication hypothesis to explain the comorbidity between substance use and trauma-related symptoms. Further research in the area of comorbidity should focus on situations in which sex difference and substance use behaviours and trauma-related symptoms causally relate. Additionally, a more sensitive measure of substance abuse, such as the WHO ASSIST measure (WHO ASSIST Working Group, 2002), should be used to determine active substance use and the presence of an SUD.

8.0 General Discussion

This thesis examined the perceived causal relations (PCR) between substance use, substance use disorders, and trauma-related symptoms in both an online convenience sample (Study 1) and a sample of individuals who had attended or were currently attending treatment for a substance use disorder (Study 2). The thesis results were consistent with the literature detailing the comorbidity between trauma and stressor-related disorders, such as PTSD and SUD. The results provided evidence of the frequency of comorbidity that was consistent with literature, as well as implicating the self-medication hypothesis partly as an explanation of comorbidity such that most individuals experiencing a traumatic or stressful experience indicated using substances in order to manage the psychological effects of the traumatic experience, in particular, trauma-related reexperiencing and avoidance. In contrast, many participants, and particularly the treatment-seeking sample of Study 2, also acknowledged the capacity of their substance use to invoke dissociative experiences. These results suggest that clients who present with traumatic experiences, SUDS, PTSD or other trauma-related disorders, or any combination should be screened for comorbidity and dissociative tendencies (e.g. Carlson et al., 2012).

The present results tend to affirm the potential usefulness of the PCR methodology in parsing individual experiences in order to understand, diagnosis, and treat comorbid disorders. For treatment, the PCR methodology can be used to create case profiles for individuals presenting with multiple symptoms and comorbid disorders as was illustrated in the case descriptions compiled from participants in Study 2. PCR can aid clinicians in understanding the subjective and idiographic nature of various clients' symptom presentations such as the perceived relations between symptoms, the temporal trajectory of the various symptoms or disorders, and the differences in which symptoms or disorders may need to be treated first.

Additionally, PCR scaling could be used at pre-treatment, during treatment, and post-treatment to examine the maintenance and relapse of each client. In fact, many of the clinical participants in Study 2 reported that although their trauma experiences may have preceded a diagnosis of PTSD or subsequent substance use, their trauma-related symptoms and substance use came to form a cycle in which both trauma-related symptoms and substance use became causal of the other. This suggests that the comorbidity between the two conditions can often be extremely complex and difficult to treat, especially in terms of whether the trauma symptoms or the substance use should be managed first, separately, or concurrently, and given the fact that treatment outcomes for this specific comorbidity are worse than other dually-diagnosed disorders (e.g. Greenfield, Back, Lawson, & Brady, 2010; Najavits & Hien, 2013; Ouimette, Ahrens, Moos, & Finney, 1998; Ouimette, Finney, & Moos, 1999). Research has also shown that individuals with substance use and comorbid anxiety disorders are more likely to perceive a need for professional intervention and actually seek help than those with substance use disorders and no comorbidity (Mojtabai, Olfson, & Mechanic, 2002) and those with anxiety or major depression and comorbid substance use disorders are also likely to perceive a need for help and seek out professional intervention (Grella, Karno, Warda, Moore, & Niv, 2009; Oleski, Mota, Cox, & Sareen, 2010). Given that PTSD was previously classified as an anxiety disorder (DSM-IV-TR; APA, 2000), and many of the individuals in the clinical sample report diagnoses of anxiety and depression along with PTSD and SUD, it is possible that the individuals who entered into in-patient treatment did so due to this comorbidity and perceived need for help.

8.1 Limitations and Future Directions

As previously detailed, there are multiple limitations that need to be considered when interpreting the results of this thesis. The SSI-SA and PTSD measures used for both studies are

self-report measures and likely diagnoses of either were based on recommended cut-off scores. These recommended scores do not provide a definitive diagnosis, but rather merely indicate the possible presence of these disorders. The measures used, especially the PCR, are retrospective and therefore are reliant on the individuals correctly remembering and interpreting past events, something that may be difficult when the defining characteristic of the individuals was general or clinically relevant substance abuse. As well, the measures were completed at a single time point and therefore lack the longitudinal evidence that would be useful to determine the causal relations between trauma-related symptoms and substance use over time. Additionally, while the inclusion of a clinical sample in Study 2 was meant to ameliorate the concerns from Study 1 limitations, the sample was small and consisted mostly of men, precluding further analysis of sex differences.

Future studies with the PCR would benefit from longitudinal studies where the ratings are collected as baseline, during treatment, and post-treatment to follow how each individual changes across treatment and to track if certain symptom changes predict relapse. Similarly, while the substance classes were useful in determining how trauma symptoms related to a specific substance, it would also be useful to examine how trauma symptoms relate to substance use behaviours such as risk-taking, social isolation, or imprisonment. Lastly, it would be useful to assess other personal characteristics, especially if used in a clinical setting. For example, Khantzian (1985, 1997) has posited that personality traits may impact substance of choice along with inner psychological states. In a clinical setting, it would be useful to understand more about a client in order to design and implement a customized treatment based on their clinical presentation and the causal interrelationships between their symptoms. Additionally, it would be further beneficial to include items that discriminate between the number of traumas an individual

has experienced versus the number of exposures and severity of each of the traumas, to better aid in appraisal. Having other raters, such as family members, confirm the chronicity of these events would also be beneficial to aiding in appraisal, although this may be more difficult for family members to accurately assess if the individual is more prone to internalizing versus externalizing symptomatology.

8.2 Conclusion

Psychological trauma, PTSD and related symptoms, as well as substance abuse are common presentations in many individuals and are unfortunately often difficult to treat. This thesis contributes to the literature concerning the comorbidity between PTSD and SUD by examining the causal interrelationships between trauma-related symptoms and substance use in both men and women in an online community sample and in men and women who are currently in or have been treated for SUDs. In general, it was found that comorbidity between PTSD and SUD can be partially explained by the self-medication hypothesis in which individuals attempt to manage their trauma-related symptoms with substance abuse, which then creates an increasingly difficult addictive cycle. In particular, it was shown that trauma-related reexperiencing was perceived to be more so a cause than an effect of substance use, and that tobacco is a substance perceived to be more so caused by than a cause of trauma-related symptoms. The combined results from both the online sample and the clinical sample however underscore the complex bidirectional relationship often present between trauma exposure, trauma-related symptoms and substance abuse. The PCR methodology can be used to create a client-centered and idiographic approach to parsing this complexity and aid in the planning and maintenance of treatment for comorbid PTSD and SUD treatment, due to the ability to adapt the methodology to fit the unique presentation of each client.

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10.0 Appendices

Appendix A

Life Events Checklist (LEC-5)

Listed below are a number of difficult or stressful things that sometimes happen to people. Please indicate whether each event happened to you personally during the time period indicated with either YES or NO.

1. Natural disaster (for example, flood, hurricane, tornado, earthquake) during anytime in your life.
2. Fire or explosion during anytime in your life.
3. Transportation accident (for example, car accident, boat accident, train wreck, plane crash) during anytime in your life.
4. Serious accident at work, home, or during recreational activity during anytime in your life.
5. Exposure to toxic substances (for example, dangerous chemicals, radiation) during anytime in your life.
6. Physical assault (for example, being attacked, hit, slapped, kicked, beaten up) during anytime in your life.
7. Assault with a weapon (for example, being shot, stabbed, threatened with a knife, gun, bomb) during anytime in your life.
8. Sexual assault (rape, attempted rape, made to perform any type of sexual act through force or threat or harm) during anytime in your life.
9. Other unwanted or uncomfortable sexual experience during anytime in your life.
10. Combat or exposure to a war-zone (in the military or as a civilian) during anytime in your life.
11. Captivity (for example, being kidnapped, abducted, held hostage, prisoner of war) during anytime in your life.
12. Life-threatening illness or injury during anytime in your life.
13. Severe human suffering during anytime in your life.
14. Witnessed sudden violent death (for example, homicide, suicide) during anytime in your life.
15. Witnessed sudden accidental death during anytime in your life.
16. Serious injury, harm, or death you caused to someone else during anytime in your life.
17. Any other very stressful event or experience during anytime in your life.

Appendix B

Adverse Childhood Experiences (ACE)

While you were growing up, during your first 18 years of life:

(Yes or no)

1. Did a parent or other adult in the household often or very often... Swear at you, insult you, put you down, or humiliate you? **OR** Act in a way that made you afraid that you might be physically hurt?
2. Did a parent or other adult in the household often or very often... Push, grab, slap, or throw something at you? **OR** Ever hit you so hard that you had marks or were injured?
3. Did an adult or person at least 5 years older than you ever... Touch or fondle you or have you touch their body in a sexual way? **OR** Attempt or actually have oral, anal, or vaginal intercourse with you?
4. Did you often or very often feel that ... No one in your family loved you or thought you were important or special? **OR** Your family didn't look out for each other, feel close to each other, or support each other?
5. Did you often or very often feel that ... You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? **OR** Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?
6. Were your parents ever separated or divorced?
7. Was your mother or stepmother: Often or very often pushed, grabbed, slapped, or had something thrown at her? **OR** Sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? **OR** Ever repeatedly hit at least a few minutes or threatened with a gun or knife?
8. Did you live with anyone who was a problem drinker or alcoholic or who used street drugs?
9. Was a household member depressed or mentally ill, or did a household member attempt suicide?
10. Did a household member go to prison?

Now add up your "Yes" answers:

This is your ACEs score

Appendix C

Posttraumatic Checklist (PCL-5) & Trauma-related Altered States of Consciousness (TRASC)

Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month.

0 = Not at all

1 = A little bit

2 = Moderately

3 = Quite a bit

4 = Extremely

In the past month, how much were you bothered by:

1. Repeated, disturbing, and unwanted memories of the stressful experience?
2. Repeated, disturbing dreams of the stressful experience?
3. Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?
4. Feeling very upset when something reminded you of the stressful experience?
5. Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?
6. Avoiding internal reminders of the stressful experience (for example, thoughts, feelings, or physical sensations)?
7. Avoiding external reminders of the stressful experience (for example, people, places, conversations, objects, activities, or situations)?
8. Trouble remembering important parts of the stressful experience?
9. Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)?

10. Blaming yourself or someone else strongly for the stressful experience or what happened after it?
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?
12. Loss of interest in activities that you used to enjoy?
13. Feeling distant or cut off from other people?
14. Having trouble experiencing positive feelings (for example, being unable to have loving feelings for those close to you, or feeling emotionally numb)?
15. Feeling irritable or angry or acting aggressively?
16. Taking too many risks or doing things that cause you harm?
17. Being “superalert” or watchful or on guard?
18. Feeling jumpy or easily startled?
19. Having difficulty concentrating?
20. Trouble falling or staying asleep?
21. Flashbacks of a Traumatic Event - Feeling as if a traumatic event from the past is happening in the present. Feeling like you are RELIVING the event, rather than only remembering it.
22. Altered Sense of Time - Having little sense of the passage of time, or feeling like time has slowed down, speeded up, or seems like it is stopped or standing still.
23. Marked Loss of Emotional Feeling - Feeling completely numb, hollow, and lifeless inside, as if you are already dead.
24. Feeling like What You are Experiencing is Not Real - A change in the way you perceive or experience the world or other people, so that things seem dreamlike, strange or unreal.
25. Out of Body Experience - Feeling detached or separated from your body, for example, feeling like you are looking down on yourself from above, or like you are an outside observer of your own body.
26. Feeling like a Part of Your Body is Not Your Own - For example, like your hands or feet are strange, unfamiliar, disconnected, not there, or that they do not belong to you.
27. Identity Confusion - Having an extremely unstable sense of self; feeling like you don't know who you are.

28. Divided or Multiple Senses of Self - Feeling like your sense of self is divided into different parts, that who you are seems to change across time, or feeling like you are made up of two or more different people.
29. Losing time for periods of at least 10 minutes, so that you have very little (if any) awareness or memory for what happened during the missing periods of time.
30. Hearing voices inside your head that seem different from your own voice, and different from your own thoughts.

Appendix D

Simple Screening Instrument for Substance Abuse (SSI-SA)

Simple Screening Instrument for Substance Abuse Self-Administered Form

Directions: The questions that follow are about your use of alcohol and other drugs. Your answers will be kept private. Mark the response that best fits for you. Answer the questions in terms of your experiences in the past month.

During the last month...	YES	NO
1. Have you used alcohol or other drugs? (Such as wine, beer, hard liquor, pot, coke, heroin or other opioids, uppers, downers, hallucinogens, or inhalants)		
2. Have you felt that you use too much alcohol or other drugs?		
3. Have you tried to cut down or quit drinking or using alcohol or other drugs?		
4. Have you gone to anyone for help because of your drinking or drug use? (Such as Alcoholics Anonymous, Narcotics Anonymous, Cocaine Anonymous, counselors, or a treatment program.)		
5. Have you had any health problems? For example, have you: <input type="checkbox"/> Had blackouts or other periods of memory loss? <input type="checkbox"/> Injured your head after drinking or using drugs? <input type="checkbox"/> Had convulsions, delirium tremens ("DTs")? <input type="checkbox"/> Had hepatitis or other liver problems? <input type="checkbox"/> Felt sick, shaky, or depressed when you stopped? <input type="checkbox"/> Felt "coke bugs" or a crawling feeling under the skin after you stopped using drugs? <input type="checkbox"/> Been injured after drinking or using? <input type="checkbox"/> Used needles to shoot drugs?		
6. Has drinking or other drug use caused problems between you and your family or friends?		
7. Has your drinking or other drug use caused problems at school or at work?		
8. Have you been arrested or had other legal problems? (Such as bouncing bad checks, driving while intoxicated, theft, or drug possession.)		
9. Have you lost your temper or gotten into arguments or fights while drinking or using other drugs?		
10. Are you needing to drink or use drugs more and more to get the effect you want?		
11. Do you spend a lot of time thinking about or trying to get alcohol or other drugs?		

12. When drinking or using drugs, are you more likely to do something you wouldn't normally do, such as break rules, break the law, sell things that are important to you, or have unprotected sex with someone?		
13. Do you feel bad or guilty about your drinking or drug use?		

The next questions are about your lifetime experiences.

YES NO

14. Have you ever had a drinking or other drug problem?		
15. Have any of your family members ever had a drinking or drug problem?		
16. Do you feel that you have a drinking or drug problem now?		

Thanks for filling out this questionnaire.

Scoring for the Simple Screening Instrument for Substance Abuse

Name/ID No.: _____ Date: _____

Place/Location:

Items 1 and 15 are not scored. The following items are scored as 1 (yes) or 0 (no):

- | | | |
|--------------------------|--------|--------|
| ___ 2 | ___ 7 | ___ 12 |
| ___ 3 | ___ 8 | ___ 13 |
| ___ 4 | ___ 9 | ___ 14 |
| ___ 5 (any items listed) | ___ 10 | ___ 16 |
| ___ 6 | ___ 11 | |

Total score: ____ Score range: 0-14

Preliminary interpretation of responses:

<u>Score</u>	<u>Degree of Risk for Substance Abuse</u>
0-1	None to low
2-3	Minimal
>4	Moderate to high: possible need for further assessment

Appendix E

PCR Items For Study 1

In the past month, how much were you bothered by:

Answer Key:

Not at all in the past month

Once in the past month

Two or three times in the past month

About once per week in the past month

About once daily or almost daily

Multiple times daily or almost daily

Daily or almost daily for most of the day

Skip this question

1. Repeated, Disturbing, and Unwanted Memories of a Stressful Experience: Repeated, disturbing, and unwanted memories of a stressful experience
2. Feeling Very Upset When Something Reminded You of a Stressful Experience: Feeling very upset when something reminded you of a stressful experience.
3. Avoiding Internal Reminders of a Stressful Experience: (For example, thoughts, feelings, or physical reactions).
4. Avoiding External Reminders of a Stressful Experience: (For example, people, places, conversations, objects, activities, or situations).
5. Flashbacks of a Traumatic Event: Feeling as if a traumatic event from the past is happening in the present. Feeling like you are RELIVING the event, rather than only remembering it.
6. Marked Loss of Emotional Feeling: Feeling completely numb, hollow, and lifeless inside, as if you are already dead.
7. Feeling like What You are Experiencing is Not Real: A change in the way you perceive or experience the world or other people, so that things seem dreamlike, strange or unreal.
8. Out of Body Experience: Feeling detached or separated from your body, for example, feeling like you are looking down on yourself from above, or like you are an outside observer of your own body.
9. Feeling like a Part of Your Body is Not Your Own: For example, like your hands or feet are strange, unfamiliar, disconnected, not there, or that they do not belong to you.

10. Hearing Voices Inside your Head: (That seem different from your own voice, and different from your own thoughts).
11. Anxiety: Feeling nervous, anxious, or on edge.
12. Worrying: Not being able to stop or control worrying.
13. Depression: Feeling down, depressed, or hopeless.
14. Lack of Interest or Pleasure: Little interest or pleasure in doing things.
15. Use of Tobacco Products: (Cigarettes, Chewing Tobacco, Cigars, etc.).
16. Use of Alcoholic Beverages: (Beer, Wine, Spirits, etc.).
17. Use of Cannabis: (Marijuana, Pot, Grass, Hash, etc.).
18. Use of Cocaine and related drugs: (Coke, Crack, etc.).
19. Use of Amphetamine Type Stimulants: (Speed, Diet pills, Ecstasy, etc.).
20. Use of Inhalants: (Nitrous, Glue, Petrol, Paint thinner, etc.).
21. Use of Sedatives or Sleeping Pills: (Valium, Serepax, Rohypnol, etc.).
22. Use of Hallucinogens: (LSD, Acid, Mushrooms, PCP, Special K, etc.).
23. Use of Opioids: (Heroin, Morphine, Methadone, Codeine, etc.).

Appendix F

PCR Items for Study 2

How frequently did you experience this problem when your substance use was at its worst?

Not at all in your history/experiences (0)

Once in your history/experiences (1)

Two or Three times in your history/experiences (2)

About Once per Week in your history/experiences (3)

About Daily or Almost Daily (4)

Multiple Times Daily or Almost Daily (5)

Daily or Almost Daily for Most of the Day (6)

Skip this Question

- _____ 1. Repeated, disturbing, and unwanted memories of a stressful experience AND/OR feeling very upset when something reminded you of a stressful experience.
- _____ 2. Avoiding internal reminders of the stressful experience (for example, thoughts, feelings, or physical reactions) AND/OR avoiding external reminders of the stressful experience (for example, people, places, conversations, objects, activities, or situations).
- _____ 3. A change in the way you perceive or experience the world or other people, so that things seem dreamlike, strange or unreal AND/OR feeling detached or separated from your body, for example, feeling like you are looking down on yourself from above, or like you are an outside observer of your own body.
- _____ 4. Use of Tobacco Products (Cigarettes, Chewing Tobacco, Cigars, etc.).
- _____ 5. Use of Alcoholic Beverages (Beer, Wine, Spirits, etc.).
- _____ 6. Use of Cannabis (Marijuana, Pot, Grass, Hash, etc.).
- _____ 7. Use of Cocaine and related drugs (Coke, Crack, etc.).
- _____ 8. Use of Amphetamine Type Stimulants (Speed, Diet pills, Ecstasy, etc.).
- _____ 9. Use of Inhalants (Nitrous, Glue, Petrol, Paint thinner, etc.).
- _____ 10. Use of Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.).
- _____ 11. Use of Hallucinogens (LSD, Acid, Mushrooms, PCP, Special K, etc.).
- _____ 12. Use of Opioids (Heroin, Morphine, Methadone, Codeine, etc.).

		Reexperiencing Reminders	Avoidance	Dissociation (Depersonalization & Derealization)
Tobacco Products (Cigarettes, chewing tobacco, cigars, etc.)	cause			
	effect			
Alcoholic Beverages (beer, wine, spirits)	cause			
	effect			
Cannabis (marijuana, pot, grass, hash, etc.)	cause			
	effect			
Cocaine & related drugs (coke, crack, etc.)	cause			
	effect			
Amphetamine-type Stimulants (Speed, diet pills, ecstasy, etc.)	cause			
	effect			
Inhalants (Nitrous, glue, petrol, paint thinner, etc.)	cause			
	effect			
Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)	cause			
	effect			
Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)	cause			
	effect			
Opioids (heroin, morphine, methadone, codeine, etc.)	cause			
	effect			

Cause = how much the substance use is seen as a cause of another symptom

Effect = how much the substance use is seen as the effect of another symptom

Rating Scale:

0 – Not at all

5 – Moderate cause

10 – Strong cause

11.0 Curriculum Vitae

Name: Emily Boughner

Post-secondary Education and Degrees: University of Guelph
Guelph, Ontario, Canada
2009-2013 B.A.

Honours and Awards: Western Graduate Scholarship
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Social Science and Humanities Research Council (SSHRC)
Canadian Graduate Scholarship – Master’s
2015-2016

Related Work Experience Teaching Assistant
The University of Western Ontario
2014-2015, 2015-2016

Publications:

Boughner, Emily, Thornley, Elizabeth, Kharlas, Daniel, & Frewen, Paul. (2016). Mindfulness related traits partially mediate the association between lifetime and childhood trauma exposure and PTSD and dissociative symptoms in a community sample assessed online. *Mindfulness*, 1-8.

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