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Violence among Cocaine and Simultaneous Cocaine and Alcohol Abusers: Results from a Cross-sectional Study of Treatment Clients

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Graduate Program in Epidemiology and Biostatistics
A thesis submitted in partial fulfillment of the requirements for the degree in Master of Science
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VIOLENCE AMONG COCAINE AND SIMULTANEOUS COCAINE AND ALCOHOL ABUSERS: RESULTS FROM A CROSS-SECTIONAL STUDY OF TREATMENT CLIENTS

Thesis format: Monograph

by

Sameer Imtiaz

Graduate Program in Epidemiology and Biostatistics

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science

The School of Graduate and Postdoctoral Studies
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Abstract

A population known for substantial violence is the substance abuse treatment population. This study assessed: (1) extent of violence, (2) personality and mental health correlates of violence, and (3) sex differences in correlates of violence. Data were obtained from the Patterns and Consequences of Cocaine and Alcohol Use for Substance Abuse Treatment Clients Study (N = 403). Logistic regression with backward elimination procedures and modified Poisson regression were used to assess the study objectives. Violence was reported by 44% of treatment clients. Furthermore, number of other drugs used per week (RR: 1.124, 95% CI: 1.063 - 1.189) and aggressive personality (RR: 1.043, 95% CI: 1.031 – 1.055) were significantly associated with an increased likelihood of violence. Finally, there was no evidence for sex-differences in correlates of violence. These findings suggest that screening for violence and addressing pertinent risk factors during treatment may be needed to reduce violence within this population.

Keywords

Violence, physical aggression, substance abuse treatment, substance use disorder treatment, cocaine, alcohol, simultaneous use, drugs, aggressive personality and sex-differences

Dedication

“Let me hide in You

From everything that distracts me from You,

From everything that comes in my way

When I want to run to You.”

– Rabia Al-Adawiyya

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Chapter 1

1 Introduction

Violence is an important public health problem that results in significant costs for society. It often results in consequences for an individual's health, as it affects all of the physical, mental, interpersonal and occupational domains (Chermack et al., 2009). A population known for extensive violence is the substance abuse treatment population. Epidemiological evidence indicates that individuals in treatment for substance use problems report violence in greater proportions as compared to other populations. For example, violence during the past 6 months prior to entering treatment was reported by 50% of 178 substance use disorder treatment clients in one study (Chermack, et al., 2010).

The assessment of correlates of violence within this population has been the focus of a number of studies. These studies have substantiated the independent roles of demographics and drug consumption measures in explaining violence. However, results from these studies have been limited due to a number of methodological concerns. More importantly, a knowledge gap remains with respect to other domains of risk, particularly personality traits and mental health indicators. Furthermore, evidence pertaining to sex-differences in correlates of violence within this population is also limited.

The underlying aims of this present study were to characterize the extent violence and assess correlates of violence across various domains of risk. Data for the present study were obtained from the Patterns and Consequences of Cocaine and Alcohol Use for Substance Abuse Treatment Clients Study. A total of 403 treatment clients with primary cocaine or simultaneous cocaine and alcohol abuse problems were analyzed using statistical techniques including logistic regression with backward elimination procedures and modified Poisson regression. The results of this study may have important implications for the assessment and screening of violence in substance abuse treatment. Additionally, the results may be considered in the development and implementation of prevention and intervention initiatives (Chermack et al., 2009).

This thesis is presented in five chapters: chapter 1 presents a brief overview of the present study; chapter 2 provides a critical appraisal of the literature, study rationale and study objectives; chapter 3 describes the study methodology; chapter 4 reports results for the study objectives; and chapter 5 discusses the main findings and conclusions.

Chapter 2

2 Literature review, rationale and objectives

2.1 Violence in substance use disorder treatment population

Violence is an important public health problem, which results in considerable social and health costs (Chermack, Walton, Fuller, & Blow, 2001). The World Health Organization (2002) defines interpersonal violence as "the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation." As such, violence can be measured in numerous ways and various typologies can be constructed that characterize specific features of violence including relationship type (partner or non-partner), role (perpetration or victimization) and severity (no injury or injury). However, the present study focuses on a general assessment of violence that does not distinguish between relationship type, role or severity.

A population known for extensive violence is the substance abuse/substance use disorder treatment population. Epidemiological evidence indicates that violence within this population is substantially higher as compared to other populations including community samples and emergency department patients (Cunningham et al., 2007; Cunningham et al., 2009; Kramer et al., 2012; Walton et al., 2009). For example, two general population surveys illustrated that the past-year prevalence estimates of any violence were 8% and 9% (Wells, Giesbrecht, Ialomiteanu, & Graham, 2011a; Wells & Graham, 2003). These estimates are in stark comparison to those obtained from samples of substance use disorder treatment clients. In one study of substance use disorder treatment clients, violence during the past 12 months was reported by 32% of 1,019 participants (Macdonald, Erickson, Wells, Hathaway, & Pakula, 2008). Yet, violence was even more pronounced in another study, as 50% of 178 substance use disorder treatment clients reported violence during the past 6 months before entering treatment (Chermack et al., 2010). The results of additional studies examining the extent of violence within this

population are presented in Table 1 for any violence and Table 2 for specific violence typologies. A wide range of studies that also examined different violence typologies were reviewed in the present study to gain an understanding of the current knowledge regarding violence in the substance use disorder treatment population. Overall, the range for any violence during the past 3 - 12 months extends from 32% to 50% among individuals that belong to this population.

Furthermore, some evidence indicates that treatment clients with cocaine-related problems are particularly likely to experience violence as compared to treatment clients with other substance use problems (Macdonald et al., 2008; Paim Kessler et al., 2012). In one study, powder cocaine and crack cocaine abusers reported statistically significant greater rates of violent and illegal activities perpetration as compared to other polyactive substance abusers. For example, 23% and 32% of powder cocaine and crack cocaine abusers reported threatening or assaulting someone during the past 6 months compared with 15% of other polyactive substance abusers (Paim Kessler et al., 2012). On the other hand, 13% and 18% of powder cocaine and crack cocaine abusers reported assault without a weapon compared with 9% of other polyactive substance abusers (Paim Kessler et al., 2012). These findings underscore the potentially elevated levels of particular forms of violence among this subset of the substance use disorder treatment population.

Table 1. Results of studies reporting proportions of any violence in substance use disorder treatment clients

Study	Findings
(Chermack & Blow, 2002)	85% and 32% of 252 treatment clients reported incidents of interpersonal conflicts and conflicts involving physical aggression during the past 3 months before entering treatment respectively.
(Chermack, Wryobeck, Walton, & Blow, 2006)	84% and 32% of 250 treatment clients reported significant interpersonal conflict and conflict involving physical aggression during the past 3 months before entering treatment respectively.
(Macdonald et al., 2008)	32% of 1,019 treatment clients reported violence during the past 12 months.
(Chermack, et al., 2010)	50% of 178 treatment clients reported violence during the past 6 months before entering treatment.

Table 2. Results of studies reporting proportions of violence in substance use disorder treatment clients by violence typologies

Study	Role	Relationship Type	Findings
(Lee, Gottheil, Sterling, Weinstein, & Serota, 1997)	Violence perpetration	Partner violence	38% of 77 male treatment clients reported ever battering their sexual partners during their lifetime.
(Chermack, Fuller, & Blow, 2000)	Violence perpetration	Overall, partner and non-partner violence	75% of 252 treatment clients reported incidents of violence during the past 12 months before entering treatment. 57% of 252 treatment clients reported incidents of partner violence (27% minor violence and 30% severe violence) during the past 12 months before entering treatment. 53% of 252 treatment clients reported non-partner violence (18% minor violence and 35% severe violence) during the past 12 months before entering treatment.
(Chermack et al., 2001)	Violence perpetration and victimization	Partner and non-partner violence	28% of males and 26% of females among 252 treatment clients reported expressing moderate partner violence, while 26% of males and 34% of females among the sample reported expressing severe partner violence during the past 12 months before entering treatment.

Table 2 (Continued)

Study	Role	Relationship Type	Findings
(Chermack et al., 2001)	Violence perpetration and victimization	Partner and non-partner violence	18% of males and 19% of females among 252 treatment clients reported expressing moderate non-partner violence, while 49% of males and 21% of females among the sample reported expressing severe non-partner violence during the past 12 months before entering treatment. 22% of males and 22% of females among 252 treatment clients reported receiving moderate partner violence, while 39% of males and 43% of females among the sample reported receiving severe partner violence during the past 12 months before entering treatment. 21% of males and 25% of females among 252 treatment clients reported receiving moderate non-partner violence, while 54% of males and 20% of females among the sample reported receiving severe non-partner violence during the past 12 months before entering treatment.
(Walton, Chermack, & Blow, 2002)	Violence perpetration and victimization	Overall, partner and non-partner violence	20% and 30% of 174 substance abuse treatment clients reported lifetime moderate and severe violence perpetration respectively prior to entering treatment. Additionally, 6% and 14% of 178 substance abuse treatment clients reported moderate and severe violence perpetration respectively after two years post treatment.

Table 2 (Continued)

Study	Role	Relationship Type	Findings
(Walton et al., 2002)	Violence perpetration and victimization	Overall, partner and non-partner violence	20% and 20% of 177 substance abuse treatment clients reported lifetime moderate and severe partner violence perpetration respectively prior to entering treatment. Additionally, 4% and 10% of 179 substance abuse treatment clients reported moderate and severe partner violence perpetration respectively after two years post treatment. 9% and 19% of 177 substance abuse treatment clients reported lifetime moderate and severe non-partner violence perpetration respectively prior to entering treatment. Additionally, 3% and 7% of 179 substance abuse treatment clients reported moderate and severe non-partner violence perpetration respectively after two years post treatment. 11% and 48% of 178 treatment clients reported lifetime moderate and severe violence victimization respectively prior to entering treatment. Additionally, 7% and 22% of 177 treatment clients reported moderate and severe violence victimization respectively after two years post treatment.

Table 2 (Continued)

Study	Role	Relationship Type	Findings
(Walton et al., 2002)	Violence perpetration and victimization	Overall, partner and non-partner violence	11% and 36% of 178 treatment clients reported lifetime moderate and severe partner violence victimization respectively prior to entering treatment. Additionally, 5% and 12% 178 of treatment clients reported moderate and severe partner violence victimization respectively after two years post treatment. 7% and 28% of 179 treatment clients reported lifetime moderate and severe non-partner violence victimization respectively prior to entering treatment. Additionally, 3% and 13% of 179 treatment clients reported moderate and severe non-partner violence victimization respectively after two years post treatment.
(Chase, O'Farrell, Murphy, Fals-Stewart, & Murphy, 2003)	Violence perpetration and victimization	Partner violence	68% and 50% of 103 female substance use disorder treatment clients reported violence and severe violence perpetration respectively during the past 12 months prior to treatment. 64% and 22% of 103 female substance use disorder treatment clients reported violence and severe violence victimization respectively during the past 12 months prior to treatment.

Table 2 (Continued)

Study	Role	Relationship Type	Findings
(Chermack et al., 2008)	Violence perpetration and victimization	Partner violence	54% and 23% of 489 treatment clients reported physical aggression and injury perpetration respectively towards their partners during the past 12 months prior to treatment initiation. 51% and 33% of 489 treatment clients reported physical aggression and injury victimization respectively from their partners during the past 12 months prior to initiating treatment.
(Murray et al., 2008)	Violence perpetration and victimization	Non-partner violence	61% and 47% of 489 treatment clients reported physical aggression and injury perpetration respectively against non-partners during the past 12 months. 56% and 46% of 489 treatment clients reported physical aggression and injury victimization respectively by a non-partner during the past 12 months.
(Eggleston et al., 2009)	Violence victimization	Overall violence	47% of 105 female treatment clients reported lifetime physical abuse.
(Schneider, Burnette, Ilgen, & Timko, 2009)	Violence victimization	Partner violence	20% of 6,233 treatment clients (10% males and 47% females) reported lifetime partner violence victimization.

Table 2 (Continued)

Study	Role	Relationship Type	Findings
(Chermack et al., 2010)	Overall violence	Partner and non-partner violence	19% of 178 treatment clients reported violence involving partners during the past 6 months before entering treatment. 31% of 178 treatment clients reported violence involving non-partners during the past 6 months before entering treatment.
(Paim Kessler et al., 2012)	Violence perpetration	Overall violence	32%, 23% and 15% of 738 crack-cocaine, powder cocaine and polyactive substance users reported threatening or assaulting someone, while 5%, 2% and 2% of 738 crack-cocaine, powder cocaine and polyactive substance users reported assaulting someone with a weapon respectively during the past 30 days.

2.2 Consequences of violence

Violence affects several domains of an individual's functioning including, but not limited to, impacts on physical, mental, interpersonal and occupational health (Chermack et al., 2009). However, the most immediate public health outcome of involvement in violence is the potential for injuries. Macdonald et al. (2003) documented in their literature review on injuries a consistent relationship between cocaine use and violence. They concluded that the relationship between cocaine use and violence with injury was clearly evident among substance use disorder treatment clients, although this was based on a relatively small number of studies available in the literature (Macdonald et al., 2003).

Indeed findings from recent epidemiological studies examining injuries among substance use disorder treatment clients provide support to this conclusion (Chermack et al., 2010; Murray et al., 2008). For example, violence with and without injury was examined in a sample of 489 substance use disorder treatment clients (Murray et al., 2008). Descriptive analyses indicated that 61% and 47% of the sample reported perpetration of past year non-partner violence and violence with injury respectively, while 56% and 46% of the sample reported past year non-partner violence and violence with injury victimization respectively (Murray et al., 2008). These proportions were further complemented by correlational and multivariable regression analyses, which highlighted associations between cocaine use days and both non-partner injury perpetration and victimization (Murray et al., 2008). These findings emphasize the notion echoed previously by Macdonald et al. (2003) that cocaine use among this population is undoubtedly associated with violence with injuries.

The impact of injuries is twofold as they have repercussions for both individuals and society. Injuries are detrimental to individuals as they negatively affect various health indices. Additionally, injuries are harmful to society as they cause unfavorable economic outcomes such as productivity losses, work loss days and burden on the health care system. It is difficult to precisely estimate the extent of injuries and their respective costs as attributable to substance abuse specifically. However, a recent economic evaluation within the Canadian context estimated that illegal substance abuse accounted for 1,695

deaths and $8.2 billion in 2002 (Rehm et al., 2006). Undoubtedly, a proportion of these statistics reflect the individual contribution of violence with injuries as attributable to substance abuse.

Overall, violence is an important problem among the substance use disorder treatment population, particularly for treatment clients with problems pertaining to cocaine, as it results in significant harms. This necessitates an examination of why the rates of violence are high among this population.

2.3 Correlates of violence

Correlates of violence can be broadly organized into four domains: demographics, drug consumption measures, personality traits and mental health indicators. Demographics and drug consumption measures have been subject to extensive attention previously in the literature. The associations between variables belonging to these domains and violence have already been substantiated. For example, considerable evidence demonstrates the association between cocaine use and violence. Hence, demographics and drug consumption measures serve as control variables within the present study. However, relatively less is known regarding the associations between other correlates and violence including personality traits and mental health indicators. Therefore, personality traits and mental health indicators constitute as the primary explanatory variables of interest within the present study. The theoretical conceptualization of the present study is presented in Figure 1.

2.3.1 Primary explanatory variables

2.3.1.1 Personality traits

2.3.1.1.1 Impulsivity/risk-taking

Studies of general population samples have exemplified positive associations between levels of impulsivity/risk-taking and injuries (Cherpitel, 1993, 1999). These findings are suggestive of potential associations between impulsivity/risk-taking and other negative

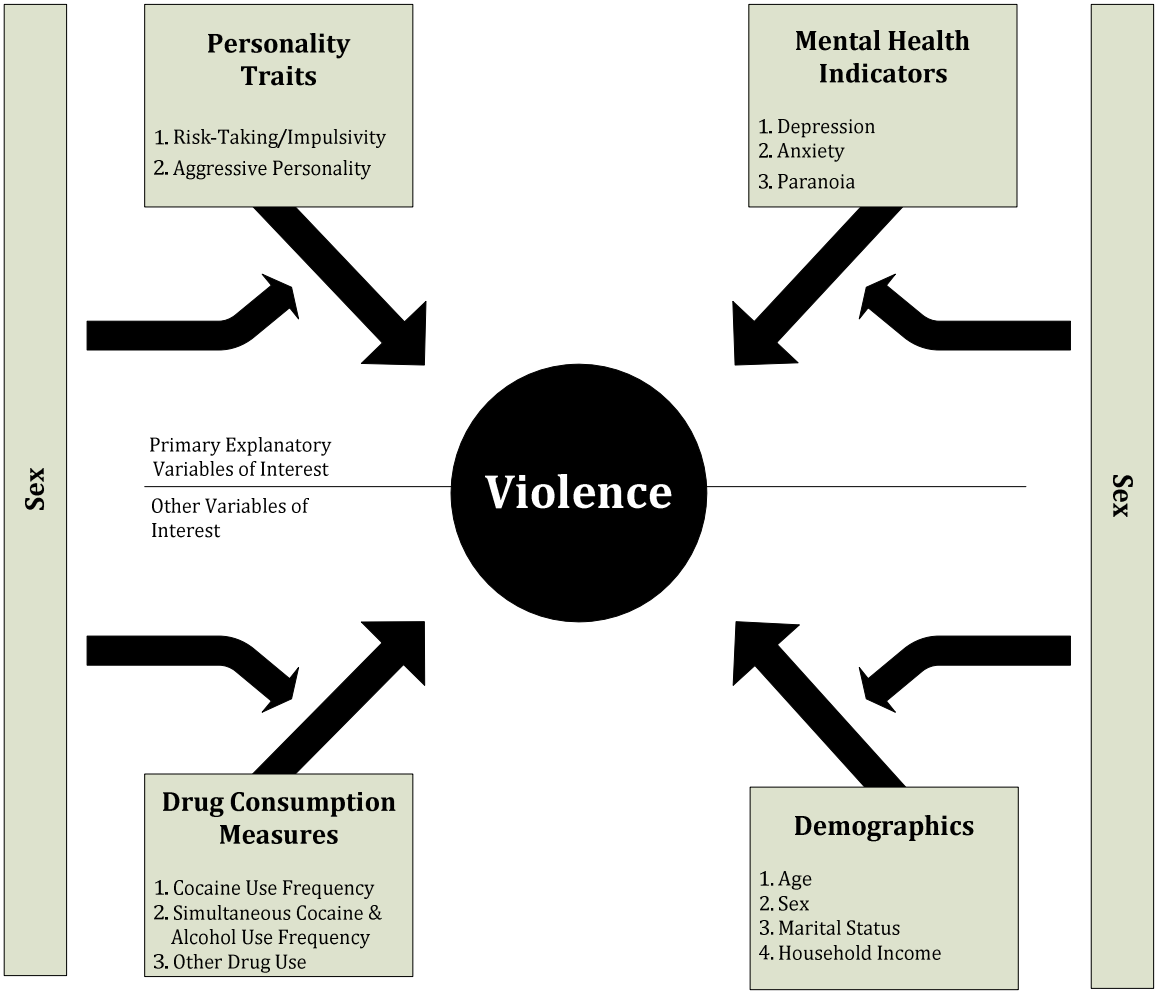

Figure 1. Theoretical conceptualization of violence in substance use disorder treatment clients

physical health outcomes including violence within the substance use disorder treatment population. These associations are conceptually plausible as impulsivity/risk-taking is characteristic of psychiatric problems including antisocial personality disorder, which in itself is associated with violence (American Psychiatric Association. Task Force on DSM-IV., 1995; Lewis, 2011).

To this end, few studies have explored this association in descriptive analyses, and even fewer in multivariable analyses. Overall, it has been suggested that higher levels of impulsivity/risk-taking are associated with violence in the substance use disorder

treatment population. For example, Roozen et al. (2011) illustrated that higher levels of impulsivity in detoxified cocaine dependent patients were associated with trait aggression independent of levels of craving. In another study, scores on a test of impulse control were compared across three categories: treatment clients with codependence on nicotine and alcohol that reported perpetration of partner violence, treatment clients with codependence on nicotine and alcohol that did not report perpetration of partner violence, and nicotine dependent controls (Easton, Sacco, Neavins, Wupperman, & George, 2008). Treatment clients with codependence on nicotine and alcohol scored significantly higher on this test irrespective of the occurrence of partner violence as compared to the nicotine dependent controls (Easton et al., 2008). In particular, strongest impairments on this personality trait were observed for those treatment clients who reported partner violence perpetration (Easton et al., 2008). These relationships were demonstrated in another study conducted by Macdonald et al. (2008) of 1,019 substance use disorder treatment clients. In their analyses, treatment clients who reported violence had significantly higher mean scores on measures of impulsivity/risk-taking than their non violent counterparts ($p < 0.001$) (Macdonald et al., 2008). However, this relationship failed to reach statistical significance in multivariable models that adjusted for other covariates (OR: Not reported, $p = 0.594$) (Macdonald et al., 2008).

2.3.1.1.2 Aggressive personality

Aggressive personality has been significantly associated with various violence typologies in different populations including bar-going and general population samples (Verrity, 2007; Wells, Graham, Tremblay, & Magyarody, 2011b). The findings of such studies indicate increased likelihood of violence for individuals with higher scores on measures of trait aggression even after controlling for other covariates such as heavy episodic drinking (defined as the consumption of more than five drinks on a single drinking occasion). Therefore, assessment of this personality trait for the risk of violence within the substance use disorder treatment population is critical. This association is also theoretically possible, as one would logically expect increased likelihood of violence in individuals with greater predisposition towards hurting or harming others.

Indeed, epidemiological literature pertaining to this association among substance use disorder treatment clients is consistent with these postulations. For example, Schumm et al. (2009) demonstrated several direct and indirect pathways leading from antisocial/generalized behaviours (including measures of aggressive personality) to partner violence in their structural equation modeling analysis of 277 women in substance use disorder treatment. Furthermore, in a study conducted by Macdonald et al. (2008), treatment clients who reported violence during the past 12 months had significantly higher trait aggression scores as compared to their non-violent counterparts ($p < 0.001$). This relationship remained significant even after adjustment for other correlates in multivariable models (OR: Not reported, $p < 0.001$) (Macdonald et al., 2008). These findings were replicated in another study of 102 participants (including treatment clients) with concomitant posttraumatic stress disorder and substance use disorders (Barrett, Mills, & Teesson, 2011). Significant differences were observed between the violent and non-violent participants with respect to levels of trait aggression in the descriptive analyses ($p < 0.001$) (Barrett et al., 2011). These differences were found in various multivariable models as well that adjusted for other correlates. For example, in one such model an odds ratio of 1.16 (95% CI: 1.04-1.30) was reported (Barrett et al., 2011).

2.3.1.2 Mental health indicators

2.3.1.2.1 Depression

Studies examining substance use disorder treatment clients, including those receiving treatment for cocaine, have depicted strong, positive associations between depression symptomatology and violence. However, causal mechanisms of this relationship are unclear due to the cross-sectional nature of these studies. It has been postulated that elevated levels of anger among people suffering from depression may explain the association between depression symptomatology and violence (Painuly, Sharan, & Mattoo, 2005). Alternatively, heightened negative mood has been found to be a consequence of experiencing violence as well (Devries et al., 2013)

Studies of substance use disorder treatment population have demonstrated a link between depression symptomatology and violence. For example, perpetrators of partner violence

reported statistically significant higher scores than non-perpetrators on the Symptom Checklist 90-R Depression subscale in a sample of 77 males entering treatment for cocaine dependence (p = 0.008) (Lee et al., 1997). These findings are in agreement with other comprehensive assessments of depression symptomatology in partner violence (Chermack et al., 2008; Schneider et al., 2009). For example, depression symptomatology was associated with occurrence of violence perpetration (OR: 0.39, 95% CI: 0.25-0.59), injury perpetration (OR: 0.48, 95% CI: 0.30-0.76) and violence victimization (OR: 0.51, 95% CI: 0.33-0.77) in multivariable models[1] examining partner violence among 489 substance abuse treatment clients (Chermack et al., 2008). Moreover, depression symptomatology has been implicated for its role in violence among non-partner relationships as well (Murray et al., 2008). In an examination of 489 substance abuse treatment clients, depression symptomatology was associated with occurrence of non-partner violence perpetration (0.58, 95% CI: 0.37-0.91), injury perpetration (OR: 0.50, 95% CI: 0.32-0.78), violence victimization (OR: 0.57, 95% CI: 0.37-0.89) and injury victimization (OR: 0.58, 95% CI: 0.37-0.90) in multivariable models[1] (Murray et al., 2008).

2.3.1.2.2 Anxiety

There is scarcity in the literature regarding assessments of the association between anxiety and violence in the substance use disorder treatment population. The relationship between anxiety and violence is thought to exist due to the abnormalities in emotional regulation as attributable to the heightened anxiety itself (Neumann, Veenema, & Beiderbeck, 2010).

Unfortunately, pertinent literature on this association within the substance use disorder treatment population presents mixed findings from a limited number of studies. Studies

[1] Zero-Inflated Poisson (ZIP) regression models were utilized in these analyses, which predict odds ratios for the occurrence of an outcome. Therefore, odds ratios < 1 indicate direct, positive associations between predictors and occurrence of outcomes. These models are also utilized to predict frequency with which the outcomes occur. Therefore, odds ratios > 1 indicate direct, positive associations between predictors and frequency of occurrence of outcomes.

such as the one conducted by Lee et al. (1997) found no statistically significant differences in mean scores between treatment seeking cocaine batterers and non-batterers on the Symptom Checklist 90-R Anxiety subscale. Moreover, Barrett et al. (2011) were also unable to document an association between state or trait anxiety and violence perpetration. On the other hand, statistically significant associations were observed between anxiety symptomatology and partner violence victimization for males (OR: 1.78, 95% CI: 1.44-2.20) and females (OR: 1.58, 95% CI: 1.27-1.96) among multivariable models in the study conducted by Schneider et al. (2009) of 6,233 substance use disorder treatment clients. Yet, there are other studies such as the one conducted by Perron et al. (2008) of 259 adolescents in substance abuse treatment that have reported mixed results within the same sample. Descriptive analyses demonstrated statistically significant differences between lifetime ($p < 0.01$) and high severity victimization ($p < 0.001$) groups, unlike the past 90-days victimization group, in terms of diagnosis of generalized anxiety disorder (Perron, Gotham, & Cho, 2008). These contradictions were further exemplified in correlation analyses that illustrated a clinically meaningful association between diagnosis of generalized anxiety and high severity victimization ($\varphi = 0.26$), unlike lifetime and past 90 days victimization (Perron et al., 2008).

2.3.1.2.3 Paranoia

Boles and Miotto (2003) noted in their literature review that short or long term usage of substances might bring about paranoia symptomatology. It has been suggested that individuals with paranoid personality disorder may act violently as a consequence of the distorted interpretations and exaggerated reactions produced by the illness (Esbec & Echeburua, 2010). This may be particularly true when an action is perceived as a personal attack by the individual suffering from paranoid personality disorder (Esbec & Echeburua, 2010). Another recent review examined the contribution of various personality dimensions to violence across specific mental disorders (Nestor, 2002). This particular review concluded that substance abuse may lead to impairments in personality dimensions such as affective regulation and impulse control, which may explain violence within substance abusers (Nestor, 2002). Therefore, other affected personality dimensions such as paranoia may also contribute towards violence within this population. Hence, Lee

et al's. (1997) findings regarding elevated paranoia symptomatology among cocaine dependent batterers as compared to cocaine dependent non-batterers on the Symptom Checklist 90 Paranoid subscale in a sample of treatment clients is not entirely surprising.

2.3.2 Control variables

2.3.2.1 Drug consumption measures

Research indicates that majority of substance use occurs in non-violent individuals (Boles & Miotto, 2003). However, numerous documented incidents of violence indicate the presence of substances in both the victims and perpetrators (Boles & Miotto, 2003). Hence, a robust association between substance use and violence has been observed in the literature (Boles & Miotto, 2003; Hoaken & Stewart, 2003). Evidence indicates that this relationship is moderated by the presence of individual and environmental factors (Boles & Miotto, 2003). Additionally, the relationship between substance use and violence not only differs for different classes of substances, but also for different doses of particular substances (Hoaken & Stewart, 2003). Hence, this relationship is extensively complex, multifactorial and interactional (Boles & Miotto, 2003; Hoaken & Stewart, 2003).

In particular, a consistent relationship between cocaine use and violence is documented in the literature (Boles & Miotto, 2003; Hoaken & Stewart, 2003; Macdonald et al., 2003). The results of both experimental and observational studies provide support to this notion (Boles & Miotto, 2003; Hoaken & Stewart, 2003). Hence, experts have acknowledged the existence of this relationship even though there is considerable debate regarding the underlying causal mechanisms (Hoaken & Stewart, 2003).

Substance use and violence can be linked with each other through three potential models as dictated by Goldstein's tripartite conceptual framework: psychopharmacological, economically compulsive and systemic (Goldstein, 1985). Ideally, these models are thought of as being theoretically distinct from each other (Goldstein, 1985). However, there is considerable overlap between these three models as will be evident by further discussion. The relationships between violence and various licit and illicit substances as according to Goldstein (1985) tripartite conceptual framework are summarized in Table 3.

Table 3. The relationship of licit and illicit substances to violence

Substance	Type of violence			
	Pharmacological	Economic compulsive	Systemic	None
Alcohol	x			
Nicotine				x
Benzodiazepines/ sedative - hypnotics	x			
Marijuana	x			x
Amphetamines/ methamphetamines	x		x	
Cocaine	x	x	x	
Opioids		x		
PCP	x			
Hallucinogens				x

Note. Taken from "Substance abuse and violence: A review of the literature" by S. M. Boles and K. Miotto, 2003, *Aggression and Violent Behavior, 8*(2)*,* p. 162.

The psychopharmacological model dictates that violence results due to ingestion of certain substances, which lead to excitability, irrationality and violent behaviour (Goldstein, 1985). Violence can also be an outcome of impairments in cognitive functioning, intensified emotional states and disruptions of hormonal or physiological functions as attributed to substance use (Boles & Miotto, 2003). Substance use by the victim or perpetrator may be included within this model (Goldstein, 1985). That is to say, substance use may lead an individual to behave violently towards others, or it may change an individual's behaviour that leads to violent victimization (Goldstein, 1985). Specific substances implicated in this model include alcohol, stimulants (cocaine and amphetamines), barbiturates and phencyclidine (Goldstein, 1985).

The economically compulsive model dictates that substance users perpetrate violence to support their costly substance use (Goldstein, 1985). The primary motivation to act violently is to obtain money for substances through criminal activities such as robberies (Goldstein, 1985). Violence may result from factors in the social context such as perpetrator's nervousness, victim's reaction, involvement of weapons and reaction of bystanders (Goldstein, 1985). Additionally, anyone can be potentially a victim of violence under this model (Goldstein, 1985). However, research indicates that mostly victims tend to reside in the same neighbourhoods as the perpetrators, and victims are

often involved in such criminal activities themselves as well (Goldstein, 1985). Substances implicated in this model include all illicit substances, which have no legal markets (Boles & Miotto, 2003). However, cocaine and heroin have been most commonly implicated due to their expensiveness and compulsive patterns of use (Goldstein, 1985).

The systemic model dictates that violence is inherent to involvement with illicit substances (Goldstein, 1985). Violence results from interacting with the culture of substance use and distribution (Goldstein, 1985). Examples of violence include, but are not limited to, territorial disputes between rival drug dealers, eliminating informers and retaliation for selling faulty drugs (Goldstein, 1985). Moreover, victims of violence under this model usually include individuals involved with substance use and trafficking (Goldstein, 1985). However, sometimes such violence also includes innocent, uninvolved individuals (Goldstein, 1985).

There is overlap among these three models in real life incidents of violence even though theoretically they are thought of as being distinct (Goldstein, 1985). For example, a heroin user may consume some stimulants before robbing a drug dealer to build up courage (Goldstein, 1985). Such an incident of violence would have elements of all psychopharmacological, economically compulsive and systemic models of Goldstein's tripartite conceptual framework (Goldstein, 1985).

Erickson, Macdonald & Hathaway (2009) employed Goldstein's tripartite conceptual framework approach in their examination of past year substance related incidents of violence among a sample of substance abuse treatment clients. Their results indicated that the classification of incidents of violence was 80% pharmacological, 8% economically compulsive and 12% systemic (Erickson, Macdonald, & Hathaway, 2009).

2.3.2.1.1 Cocaine use frequency

A substantial amount of literature indicates a potent relationship between cocaine use and violence in the substance use disorder treatment population. This relationship may be explained through all of psychopharmacological, economically compulsive and systemic

models of the Goldstein's tripartite conceptual framework (Goldstein, 1985). The link between these two variables has upheld its statistical significance irrespective of the violence typology examined (Chermack & Blow, 2002; Chermack et al., 2010; Chermack et al., 2008; Chermack et al., 2009; Macdonald et al., 2008; Murray et al., 2008). For example, Chermack et al's. (2001) study of 252 substance abuse treatment clients highlighted the association between cocaine use days and each of expressed partner violence, received partner violence and expressed non-partner violence (Chermack et al., 2001). These results were replicated among another sample of 178 substance use disorder treatment clients, as acute cocaine use was associated with violence without injury (OR: 11.26; 95% CI: 5.10-24.86) and violence with injury (OR: 6.72, 95% CI: 2.12-21.30) in multivariable models (Chermack et al., 2010). This relationship further maintained statistical significance even after dissecting the outcome further by partner violence and non-partner violence (Chermack et al., 2010).

2.3.2.1.2 Simultaneous cocaine and alcohol use frequency

A substance known as cocaethylene is produced when cocaine and alcohol are consumed together, which produces a longer and more intense high than either substance alone (Pennings, Leccese, & Wolff, 2002). A recent review thoroughly examined the negative consequences of combined usage of cocaine and alcohol that included violence (Pennings et al., 2002). Generally, the studies reviewed indicated a synergistic additive interaction between cocaine and alcohol in terms of their association with violence, with the exception of one study that demonstrated synergistic multiplicative effects (Pennings et al., 2002). However, these discrepancies may be better explained by the severity of the violence being assessed i.e. violent thoughts vs. physical violence vs. homicide. Chermack et al. (2002) quantified the combined effects of cocaine and alcohol on violence in a study of 250 substance abuse treatment clients. Specifically, a statistically significant synergistic multiplicative interaction between cocaine and alcohol use frequency was documented on the occurrence of violence (β: 0.18, $p = 0.036$) (Chermack & Blow, 2002).

2.3.2.1.3 Other drug use

Boles and Miotto (2003) summarized relationships between various substances and violence extensively in their literature review. Substances shown to have positive links with violence included sedative hypnotics (such as tranquilizers), methamphetamines, opioids (such as heroin) and hallucinogens (such as lysergic acid diethylamide) (Boles & Miotto, 2003). On the other hand, the authors conceded towards a null or protective association between marijuana use and violence (Boles & Miotto, 2003). Epidemiological literature involving substance abuse treatment clients is generally consistent with these conclusions, with the exception of the association between marijuana use and violence (Chermack et al., 2010; Chermack et al., 2008; Chermack et al., 2009; Murray et al., 2008). Some studies document an association between marijuana use and violence across violence typologies in both unadjusted and adjusted models (Chermack et al., 2000; Chermack et al., 2001; Macdonald et al., 2008; Murray et al., 2008). For example, marijuana use days were associated with frequency of non-partner violence perpetration (OR: 1.02, 95% CI: 1.00-1.04), violence victimization (OR: 1.02, 95% CI: 1.00-1.04) and injury victimization (OR: 1.02, 95% CI: 1.00-1.04) in Zero Inflated Poisson regression analyses (Murray et al., 2008). This relationship may be better explained by the economically compulsive and systemic models of violence as explained by Goldstein (1985) in his tripartite conceptual framework. Overall, increased use of other substances may be indicative of problem severity, which may be associated with a greater likelihood of violence.

2.3.2.2 Demographics

2.3.2.2.1 Age

Age has been found to be a strong correlate of violence within the substance use disorder treatment population. Studies have documented an inverse association between age and violence within this population, i.e. younger treatment clients report violence more frequently as compared to their older counterparts.

This relationship holds true irrespective of the violence typology constructed or analytic technique utilized (Chermack & Blow, 2002; Chermack et al., 2000; Chermack et al.,

2008; Chermack et al., 2001; Macdonald et al., 2008; Murray et al., 2008). For example, Chermack et al. (2002) illustrated in a study of 250 substance abuse treatment clients that age was significantly associated with violence irrespective of whether general substance use measures or specifically conflict day substance use measures were examined (β: -0.16, p = 0.014; β: -0.16, p = 0.009 respectively) (Chermack & Blow, 2002). Moreover, younger age was also associated with partner violence perpetration in a structural equation modeling analysis among 252 substance abuse treatment clients (Chermack et al., 2000). Finally, Murray et al. (2008) replicated these two findings in Zero Inflated Poisson multivariable models examining occurrence of non-partner violence perpetration (OR: 1.04, 95% CI: 1.02-1.06), injury perpetration (OR: 1.04, 95% CI: 1.02-1.07), violence victimization (OR: 1.04, 95% CI: 1.02-0.07) and injury victimization (OR: 1.04, 95% CI: 1.02-1.06) (Murray et al., 2008).

2.3.2.2.2 Sex

Evidence also indicates that sex is an important correlate of violence for substance use disorder treatment clients. Specifically, evidence suggests that male treatment clients display increased rates and likelihood of violence as compared to their female counterparts. For example, Chermack et al. (2001) documented in their study of 252 substance abuse treatment clients significantly higher proportions of non-partner violence perpetration and victimization reported by males across the overwhelming majority of violence severity measures and relationship types examined. These findings have been further exemplified in multivariable analyses examining various violence typologies (Chermack et al., 2000; Chermack et al., 2010; Chermack et al., 2009; Chermack et al., 2001). In another study of 178 substance use disorder treatment clients conducted by Chermack et al. (2010), it was found that males in comparison to females had significantly increased odds for violence without injury (OR: 6.21, 95% CI: 1.66-23.63) and violence with injury (OR: 6.45, 95% CI: 1.31-31.34). These findings were upheld in further analyses examining partner violence and non-partner violence specifically (Chermack et al., 2010).

2.3.2.2.3 Marital Status

Several studies of substance use disorder treatment clients have established an association between marital status and violence. However, the nature of this association differs depending on the violence typology being examined. Studies of partner violence demonstrate that being married or living together is associated with violence (Chermack et al., 2000; Chermack et al., 2008; Schneider et al., 2009). For example, Chermack et al. (2008) illustrated that living with a spouse was associated with occurrence of violence perpetration (OR: 0.62, 95% CI: 0.39-0.98) and frequency of violence perpetration (OR: 0.60, 95% CI: 0.42-0.85) and injury perpetration (OR: 0.53, 95% CI: 0.31-0.92) in Zero Inflated Poisson regression models examining partner violence among 489 substance use disorder treatment clients. On the other hand, studies of non-partner violence indicate null or protective associations between married or living together and violence (Chermack et al., 2009; Cunningham et al., 2009). For example, living with a spouse/partner was only associated with partner injury perpetration (OR: 2.42, 95% CI: 1.11-5.28) and partner injury victimization (OR: 2.34: 95% CI: 1.10-4.96), unlike either of non-partner injury perpetration or victimization or both partner and non-partner injury perpetration or victimization in a multinomial logistic regression analysis involving 489 substance use disorder treatment clients (Chermack et al., 2009).

2.3.2.2.4 Income

Some studies of substance use disorder treatment clients suggest an association between income levels and violence. It has been observed that lower income levels are associated with an increased likelihood of violence. However, this association may differ depending on the violence typology being examined i.e. partner violence or non-partner violence (Chermack et al., 2000; Chermack et al., 2001). For example, Chermack et al. (2000) illustrated in their structural equation modeling analysis that lower levels of income predicted non-partner violence perpetration unlike partner violence perpetration in a study of 252 substance abuse treatment clients. Likewise, another study conducted by the same group of authors demonstrated similar results among 252 substance abuse treatment clients (Chermack et al., 2001). This study also found that lower levels of income were associated with an increased likelihood of non-partner violence perpetration and

victimization, unlike partner violence perpetration and victimization (Chermack et al., 2001). Finally, Chase et al's. (2003) study of partner violence also echoed similar findings, as the associations between lower levels of income and partner violence perpetration and victimization were diminished after adjustment for other correlates. Goldstein's tripartite conceptual framework can explain these findings, as treatment clients with lower income levels may experience violence with non-partners more frequently through the economically compulsive model.

2.4 Sex differences in correlates of violence

The majority of the studies among substance use disorder treatment population report the extent of violence for both males and females. However, studies that focus on correlates of violence within this population rarely examine sex differences in these associations. This appears to be an important gap in the literature given that the experiences of violence may be different for males and females, and thus, the variables that explain violence among them may also be sex specific (Wells, 2005). For example, in their literature review, Boles and Miotto (2003) identified general population studies that found modification of the relationship between alcohol use and violence by sex. Other studies of non-treatment samples have also yielded similar results illustrating sex differences in correlates of violence (Chermack, Booth, & Curran, 2006). These findings demonstrating sex differences in correlates of violence may extend to the substance use disorder treatment population as well.

To our knowledge, only few of studies have examined sex differences in the correlates of violence among the substance use disorder treatment population. Two of these studies assessed sex differences through formal tests of multiplicative interaction (Chermack et al., 2010; Chermack et al., 2001), while one study stratified the sample by sex to assess such differences (Schneider et al., 2009). According to these studies, there were no sex differences in the correlates of violence with respect to demographic factors including age, marital status and income across violence typologies (Chermack et al., 2001; Schneider et al., 2009). These findings were upheld irrespective of whether the sample

was stratified by sex or formal tests of multiplicative interaction were conducted (Chermack et al., 2001; Schneider et al., 2009). Moreover, the assessment of acute substance use and violence conducted by Chermack et al. (2010) failed to demonstrate any statistically significant multiplicative interactions between acute alcohol, cocaine, heroin and marijuana use and violence by sex. Furthermore, we are not aware of studies that have examined sex differences in the associations between personality traits and violence. Finally, the sex-stratified assessment of violence conducted by Schenider et al. (2009) did not suggest differences between males and females in terms of the associations between mental health indicators and violence. For example, the magnitude of the odds ratio for the association between depression and violence was 1.74 (95% CI: 1.35-2.23) and 1.54 (95% CI: 1.21-1.96) for males and females respectively (Schneider et al., 2009). On the other hand, the magnitude of the odds ratio for the association between anxiety and violence was 1.78 (95% CI: 1.44-2.20) and 1.58 (95% CI: 1.27-1.96) for males and females respectively (Schneider et al., 2009). Therefore, while it appears that males and female substance abuse treatment clients may not differ in correlates of violence, more research is needed to confirm these findings.

2.5 Limitations of existing research

Previous research on this topic has several limitations despite the breadth of studies already in the literature. It is essential to adequately address these limitations in order to provide sufficient confidence in our findings.

To begin with, the majority of the studies on this topic have utilized heterogeneous samples, which include participants receiving treatment for a range of substances (Chermack & Blow, 2002; Chermack et al., 2010; Macdonald et al., 2008). To our knowledge no previous study has examined correlates of any violence exclusively among the cocaine abuse treatment population in multivariable models, despite the handful of studies that have described general measures of this outcome within this subpopulation. What's more, several studies involve similar groups of authors using the same datasets to construct different violence typologies (Chermack & Blow, 2002; Chermack et al., 2000;

Chermack et al., 2010; Chermack et al., 2008; Chermack et al., 2001; Murray et al., 2008). The utilization of heterogeneous samples of substance use disorder treatment clients to examine this relationship is conceptually problematic because classes of substances differ on numerous aspects including social processes and psychopharmacodynamics, which may possibly obscure the respective relationships with violence (Boles & Miotto, 2003). Therefore, findings from studies that include heterogeneous samples of treatment clients may not necessarily be applicable to cocaine use disorder treatment clients specifically.

Furthermore, three independent reviews on this topic have emphasized the importance of assessing personality traits including impulsivity/risk-taking and aggressive personality (Boles & Miotto, 2003; Hoaken & Stewart, 2003; Macdonald et al., 2003). These reviews recognize that violence within this population is not solely a consequence of psychopharmacological effects of substances, but rather a constellation of factors including personality traits. To our knowledge, only a fraction of studies have examined such personality traits in relation to violence among this population (Barrett et al., 2011; Easton et al., 2008; Macdonald et al., 2008; Mattson, O'Farrell, Lofgreen, Cunningham, & Murphy, 2012; Roozen, van der Kroft, van Marle, & Franken, 2011; Schumm, O'Farrell, Murphy, Murphy, & Muchowski, 2011). However, some of these studies assessed the role of personality traits exclusively in partner violence among single sex samples (Mattson et al., 2012; Schumm et al., 2011), while others did not adjust for the effects of other correlates (Easton et al., 2008; Roozen et al., 2011). These impediments not only hinder an understanding of the relative importance of personality traits in relation to other correlates, but also represent an important gap with respect to other violence typologies. Studies free from such impediments include those performed by Macdonald et al. (2008) and Barrett et al. (2011). However, the aggregated results reported in these studies do not provide sufficient distinction to make conclusions regarding cocaine abuse treatment clients specifically (Barrett et al., 2011; Macdonald et al., 2008). This lack of knowledge is particularly concerning as cocaine users are distinct from other substance users on multiple personality traits. Hence, it is imperative to further assess these traits to replicate findings across studies, which will assist in quantifying their independent contributions to this outcome among this subpopulation.

Moreover, associations between mental health indicators and violence have been highlighted in both substance use disorder and cocaine use disorder treatment clients (Barrett et al., 2011; Chermack et al., 2008; Chermack et al., 2001; Lee et al., 1997; Martin, Kilgallen, Dee, Dawson, & Campbell, 1998; Murray et al., 2008; Paim Kessler et al., 2012; Perron et al., 2008; Schneider et al., 2009). This is particularly the case for commonly assessed indicators of psychiatric health including depression and anxiety, but a knowledge gap still exists with respect to other indicators such as paranoia. Regardless, many of these studies have examined the associations only in descriptive and bivariate analyses only, thereby making it impossible to assess their independent contributions in multivariable models (Lee et al., 1997; Paim Kessler et al., 2012; Perron et al., 2008). Furthermore, studies assessing these indicators in multivariable models are also limited as they have utilized composite measures of psychiatric distress or focused exclusively on the role of depression (Chermack et al., 2008; Chermack et al., 2001; Murray et al., 2008). To our knowledge, only two studies conducted by Schnedier et al. (2009) and Barrett et al. (2011) examined both depression and anxiety individually in multivariable models among this population. However, findings from these studies are also questionable given the assessment of sexual violence and strict inclusion criteria of the study performed by Barrett et al. (2011) and failure to utilize validated instruments in the study performed by Schnedier et al. (2009). Above all, we are only aware of one study that assessed the role of mental health indicators in relation to personality traits towards explaining violence within this population (Barrett et al., 2011). Therefore, reexamination of these associations addressing the abovementioned limitations is necessary to quantify the independent explanatory roles of each of these indicators in multivariable models among this subpopulation.

Finally, sex differences in violence are a relatively understudied element among the substance use disorder treatment population. Most studies of this population report results on the extent of violence for both males and females. However, very few studies have examined sex differences in the correlates of violence among this population (Chermack et al., 2010; Chermack et al., 2001; Schneider et al., 2009). Furthermore, results from these studies are also limited as some findings have been obtained through stratification of the sample by sex rather than formal test of interaction, while others are prone to

issues pertaining to lack of statistical power (Chermack et al., 2010; Schneider et al., 2009). More importantly, some of these studies (Chermack et al., 2010; Chermack et al., 2001) have utilized variants of the Conflicts Tactics Scale to assess violence, which have been criticized in the literature due to their mitigation of sex differences in violence (Graham, Bernards, Flynn, Tremblay, & Wells, 2012). Above all, there is a lack of assessment of sex differences across other correlates of violence including personality traits and mental health indicators. This limits our understanding regarding the degree to which correlates of violence differ by sex (Chermack et al., 2001). This is particularly troublesome because men and women may differ with respect to the correlates of violence as a consequence of their unique experiences of violence. Identification of such sex differences would assist in the identification and treatment of individuals with an increased likelihood of involvement in violence (Chermack et al., 2001).

2.6 Thesis rationale

The frequency of violence reported among substance use disorder treatment clients is unacceptably high as demonstrated by numerous studies. A follow-up study of 180 substance abuse treatment clients was conducted by Walton et al. (2002). It was not possible to compare pre- and post- treatment rates of violence in this study due to methodological impediments (Walton et al., 2002). However, substance use during the follow-up period was associated with violence persistence, with substance use during follow-up preceding violence during follow-up in the overwhelming majority of the cases (Walton et al., 2002).

These findings highlight the necessity to assess violence within the substance use disorder treatment population. It is imperative to specifically assess correlates of violence within this population to identify treatment clients at an increased risk of this outcome. Moreover, assessment of such correlates can also guide the design, testing and implementation of appropriate prevention and intervention initiatives (Chermack et al., 2009). For example, some evidence has indicated that targeting of specific risk domains during treatment is associated with reductions in subsequent substance use and/or

violence as discussed by Chermack et al. (2009). For example, the impact of alcoholism treatment on partner violence was examined longitudinally in a study of 301 married or cohabitating males with a matched nonalcoholic comparison sample (O'Farrell, Fals-Stewart, Murphy, & Murphy, 2003). The results of the study indicated significant decrease in the proportion of partner violence reported at one-year follow-up, with comparable rates observed with the nonalcoholic sample for the alcohol remitted patients at one year follow up (O'Farrell et al., 2003). Therefore, these findings provide perhaps the greatest incentive to conduct this study, as results will have implications for targeting specific risk domains during treatment.

2.7 Thesis objectives

The overarching aim of the present thesis project is to assess violence in a sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients in the Canadian context. The specific objectives of the thesis project are as follows,

Objective 1: To conduct an assessment of the extent of violence in a sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients.

Objective 1.1: To provide an estimate of the proportion of cocaine and simultaneous cocaine and alcohol abuse treatment clients reporting violence during the past 12 months.

Objective 1.2: To characterize objective 1.1 further by sex.

Objective 2: To identify factors associated with violence in a sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Objective 2.1: To identify characteristics associated with violence among cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Objective 2.2: To quantify unadjusted risks of violence associated with each of demographics, drug consumption measures, personality traits and mental health indicators in cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Objective 2.3: To quantify adjusted risks of violence associated with personality traits and mental health indicators while controlling for demographics and drug consumption measures in cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Objective 2.4: To test for multiplicative interactions of sex by demographics, drug consumption measures, personality traits and mental health indicators in models explaining violence among cocaine and simultaneous cocaine and alcohol abuse treatment clients.

Chapter 3

3 Methods

Data for the present study were obtained from the Patterns and Consequences of Cocaine and Alcohol Use for Substance Abuse Treatment Clients Study. This cross-sectional study was conducted by Dr. Scott Macdonald and funded by the Canadian Institutes of Health Research (MOP- 185750-PSB-CABA-54565).

The primary aims of the study were to 1) examine patterns, functions and contexts of cocaine and alcohol use among substance abuse treatment clients; and 2) identify differences among substance abuse treatment clients receiving treatment for cocaine abuse, alcohol abuse and simultaneous cocaine and alcohol abuse. The investigators were also interested in sex and gender differences in the health profiles of treatment clients with cocaine and alcohol problems. In order to achieve these aims, the investigators chose to employ a sex-stratified quota sampling methodology to obtain a sample of approximately 200 cocaine abusers, 200 alcohol abusers and 200 simultaneous cocaine and alcohol abusers.

Before implementing the full scale project, the research team conducted a pilot study involving qualitative interviews with substance abuse treatment clients. This pilot study facilitated refinement of the study questionnaire and data collection procedures.

3.1 Participants

The target population for this study was individuals 18 to 65 years of age in residential treatment for 1) cocaine abuse, 2) alcohol abuse and 3) simultaneous cocaine and alcohol abuse. Study participants were recruited from three treatment agencies in Ontario (Newport Centre, Bellwood Health Services, Jean Tweed Centre) and two treatment agencies in British Columbia (Aurora Treatment Centre and Peardonville House Treatment Centre). Three of these residential treatment agencies (Jean Tweed Centre, Aurora Treatment Centre and Peardonville House Treatment Centre) catered exclusively

to a female clientele, which assisted in recruiting the desired number of females for the study. Further details on treatment agencies can be found in Appendix A.

3.2 Exclusion criteria

Participants were excluded from the study if they reported primary substance abuse problems for substances other than cocaine or alcohol. These participants were excluded by the study design to control for any potential confounding by other substance abuse.

As noted previously in Chapter 2, rates of violence are particularly high among treatment clients with problems pertaining to cocaine use. Therefore, the aim of the present study was to better understand correlates associated with violence in this high-risk subpopulation. As such, the present analyses were restricted to cocaine abuse and simultaneous cocaine and alcohol abuse treatment clients only. Thus, alcohol abuse treatment clients (N = 200) were excluded from the analyses.

3.3 Data collection procedures

All treatment clients who had problems with cocaine or alcohol use were approached by study personnel and asked to participate in the study. Those who agreed to participate were asked to complete a consent form. This consent form highlighted the study's purpose, procedures, risks and benefits, compensation, anonymity, limits to confidentially and contact information (see Appendix B).

Subsequently, treatment clients were administered a screening form, which aimed to determine study eligibility. Responses from the screening forms of eligible participants were used to assign group membership. In particular, participants were categorized into one of three study groups: 1) primarily cocaine abusers only, 2) primarily alcohol abusers only and 3) simultaneous cocaine and alcohol abusers based on their self-reported, patterns of cocaine and alcohol use. Participants who reported using cocaine or alcohol less than 50% of the time when the other substance was used were categorized into the

primarily cocaine abusers only group or primarily alcohol abusers only group. Participants who reported using cocaine or alcohol more than 50% of the time when the other substance was used were categorized into the simultaneous cocaine and alcohol abusers group. This treatment group classification methodology was based on the pilot-testing phase of this study. A copy of this screening form is shown in Appendix C.

After eligibility and group membership had been determined, treatment clients completed an anonymous questionnaire. On average, the questionnaire took approximately 45 minutes for treatment clients to complete. Therefore, participants were given the option to book appointments to complete the questionnaire at a later time if they were not able to complete it at that moment.

3.4 Questionnaire

A self-administered questionnaire was completed by the participants. The research team selected this method of administration because it eliminated the potential for interviewer bias given that this study was conducted at five treatment agencies across two provinces by different study personnel. Moreover, self-administration was preferred given the sensitive nature of some items in the questionnaire. Assessing these items in a personal interview format would have created discomfort for the treatment clients, possibly producing socially desirable responses (Nederhof, 1985).

The questionnaire included items on patterns, functions and contexts of substance use as well as measures of acute physical, mental and social health indicators. There were three versions of this questionnaire that tailored specifically to the participant's assigned treatment group (i.e., primarily cocaine abusers only, primarily alcohol abusers only and simultaneous cocaine and alcohol abusers). However, these versions only differed with respect to the items that assessed reasons and contexts of substance use (not included in the present analyses).

3.5 Incentives

Participants were given gift certificates valued at $20 for their involvement in the study. This method of compensation was selected as opposed to direct cash payments, as many treatment agencies prohibit clients from carrying money due to its potential to act as a trigger for relapse.

3.6 Response rate

The response rate for the study was calculated by ascertaining the proportion of treatment clients who agreed to participate from the total number of treatment clients who were invited to participate. It was not possible to calculate the response rate based on a sampling frame of eligible treatment clients, as consent preceded screening for study eligibility. A total of 616 treatment clients agreed to participate from 627 that were approached. This translated into a response rate of 97.8%.

3.7 Measures

The research team employed validated scales in the questionnaire wherever possible.

3.7.1 Outcome variable

3.7.1.1 Violence

The Patterns and Consequences of Cocaine and Alcohol Use for Substance Abuse Treatment Clients Study assessed several physical health indicators including experiences of violence. Specifically, treatment clients were asked, “In the past 12 months before treatment, have you been personally involved in an incident where someone was pushing, grabbing, hitting, kicking, threatening with a weapon or being physically aggressive in any other way?” Responses to this item were coded dichotomously (yes/no). This measure of violence has been used in previous research including studies conducted on

the general population (Wells, Graham, & West, 2000) and substance use disorder treatment population (Macdonald et al., 2008).

3.7.2 Primary explanatory variables

3.7.2.1 Personality traits

3.7.2.1.1 Impulsivity/risk-taking

Impulsivity/risk-taking was assessed using the Impulsivity/Risk-Taking Scale developed by Cherpitel (1993). This scale assessed a person's levels of impulsivity and risk-taking tendencies through five items: "I often act on the spur of the moment without stopping to think", "I get a real kick out of doing things that are a little dangerous", "You might say I act impulsively", "I like to test myself every now and then by doing something a little chancy" and "Many of my actions seem to be hasty." Treatment clients were asked to rate each item on a five point response scale: "1 = Strongly Disagree", "2 = Disagree", "3 = Neither", "4 = Agree" and "5 = Strongly Agree." The scores on these five items were summed together to provide a total score for the Impulsivity/Risk-Taking Scale, which ranged from 5 – 25. This scale has been shown to have good internal consistency reliability (Cronbach's alpha = 0.80) as described by Cherpitel et al. (1993).

A simple imputation procedure was executed for missing data on items from the Impulsivity/Risk-Taking Scale. Specifically, mean scores were imputed for missing values based on averages of other valid responses on the scale for treatment clients that responded to at least 80% of the items on the scale. Tests of internal consistency yielded a Cronbach's alpha of 0.840 based on the present data, which compared favorably with results of Cherpitel's (1993) earlier work.

3.7.2.1.2 Aggressive personality

Another personality trait of interest for violence examined within this study was aggressive personality. This construct was measured using the Physical Aggression subscale of the Aggression Questionnaire, which has been found to be a psychometrically sound instrument used to measure trait aggression (Buss & Perry, 1992). The Aggression Questionnaire comprises of four subscales: Physical Aggression, Verbal Aggression,

Anger and Hostility (Buss & Perry, 1992). However, it should be noted that the Physical Aggression subscale correlates well with the Verbal (r = 0.45) and Anger (r = 0.48) subscales of the Aggression Questionnaire as well (Buss & Perry, 1992). Most importantly, it has also been found to be strongly associated with aggressive behaviour in other pertinent studies of violence (Tremblay & Ewart, 2005; Wells et al., 2011). Furthermore, this subscale has displayed good internal consistency reliability as indicated by a Cronbach's alpha of 0.85 (Buss & Perry, 1992).

The Physical Aggression Subscale used ten items to assess a person's propensity for hurting or harming others (Buss & Perry, 1992). Examples of these items included, "When I really lose my temper I am capable of hitting or slapping someone," "If I have to resort to violence to protect my rights I will," and "I can think of no good reason for ever hitting a person." Responses to each item on the scale were recorded on a five point response scale: "1 = Very Unlike Me", "2 = Unlike Me", "3 = Possible", "4 = Like Me" and "5 = Very Much Like Me." The scores on these ten items were summed together to provide a total score for the Physical Aggression subscale, which ranged from 10 – 50.

Simple missing imputation procedures were used for missing data on items belonging to the Physical Aggression subscale as well. These procedures were the same as those discussed previously for the Impulsivity/Risk-Taking Scale. Results from our sample demonstrated excellent internal consistency on this scale (Cronbach's alpha = 0.906), which is in agreement with the original study by Buss & Perry (1992) and other studies of substance use disorder treatment clients (Macdonald et al., 2008).

3.7.2.2 Mental health indicators

3.7.2.2.1 Depression

Depression was one of the primary mental health indicators examined within this study. It was measured using the Depression subscale of the TCU Self-Rating Form, which assesses various psychosocial and motivational factors (Simpson, 1992). The brief items on each subscale are meant to facilitate screening within community programs and research settings (Knight, Holcom, & Simpson, 1994). The psychosocial and motivational factors assessed by the TCU Self-Rating Form can be further divided into

three conceptual domains: psychological functioning, social functioning and treatment motivation (Knight et al., 1994). Specific factors included in the psychological functioning domain include self-esteem, depression, anxiety and decision-making confidence (Knight et al., 1994). In the present study, only the Depression and Anxiety subscales were included in the questionnaire. Both scales have performed satisfactorily on tests of psychometric properties including internal consistency (Knight et al., 1994).

The Depression subscale collected information on depressive symptomatology during the past year, as opposed to a clinical diagnosis, through six items that asked, “You feel sad or depressed”, “You have thoughts about committing suicide”, “You feel lonely”, “You feel interested in life”, “You feel extra worried or run down” and “You worry or brood a lot.” Responses to these items were coded on a five point response scale with “1 = Never”, “2 = Rarely”, “3 = Sometimes”, “4 = Often” and “5 = Always.” The scores on these items were summed together to provide a total score on the Depression subscale, which ranged from 6 – 30.

Simple imputation procedures described previously were also used for missing items belonging to the Depression subscale as well. Additionally, statistical tests indicated an acceptable internal consistency as demonstrated by a Cronbach’s alpha of 0.736, which was in agreement with results from previous studies (Knight et al., 1994).

3.7.2.2.2 Anxiety

Anxiety was assessed within the present study through the Anxiety subscale of the TCU Self-Rating Form. The Anxiety subscale sought to examine anxiety symptomatology during the past year rather than a clinical diagnosis. The Anxiety subscale consisted of seven items, including the following example items: “You have trouble sleeping”, “You feel anxious or nervous”, and “You feel afraid of certain things, like elevators, crowds, or going out alone”. The responses to these items were coded on a five point response scale (“1 = Never”, “2 = Rarely”, “3 = Sometimes”, “4 = Often” and “5 = Always”) and summed together to provide a total score on the Anxiety subscale that ranged from 7 – 35.

Simple imputation procedures were also used as described above for the other scales. Additionally, a good internal consistency was recorded as demonstrated by a Cronbach's alpha of 0.813, which was also in agreement with results from previous studies (Knight et al., 1994).

3.7.2.2.3 Paranoia

Another primary mental health indicator of interest for violence assessed within this study was paranoia. This mental health indicator was assessed using the Paranoia subscale of the Minnesota Multiphasic Personality Inventory (MMPI). The MMPI was first published in 1943 with a primary aim to assign diagnostic labels to patients (Hathaway & McKinley, 1943). It comprised of ten subscales spanning different aspects of psychopathology including Hypochondriasis, Depression, Conversion Hysteria, Psychopathic Deviate, Masculinity-Feminity, Paranoia, Psychasthenia, Schizophrenia, Hypomania and Social Introversion (Hathaway & McKinley, 1943). However, only the Paranoia subscale was included from the MMPI in the study's questionnaire.

The Paranoia subscale of the MMPI included forty items, which assessed symptoms associated with the condition such as suspiciousness, feelings of persecution and grandiose self-concept (Hathaway & McKinley, 1943). In the present study only five items were included that have been shown to load onto a broad measure of paranoia, and one that does not necessarily correspond to an abnormal mental state (Comrey, 1958). These items of paranoia symptomatology during past month included, "Someone has it in for me", "If people had not had it in for me I would have been much more successful", "I am sure I am being talked about", "No one seems to understand me" and "I believe I am being plotted against." These responses were coded on a five point response scale: "1 = Never", "2 = Rarely", "3 = Sometimes", "4 = Often" and "5 = Always." The scores on these five items were summed together to provide a total score for the Paranoia subscale, which ranged from 5 – 25.

Simple imputation procedures described previously were used for this scale as well. Additionally, internal consistency based on our data was shown to be good (Cronbach's alpha = 0.854).

3.7.3 Control variables

3.7.3.1 Drug consumption measures

3.7.3.1.1 Cocaine use frequency

To assess the frequency of cocaine use, treatment clients were provided the prompt, "How many days per month would you normally: Snort cocaine, Smoke crack and Inject cocaine."

Responses from these variables were pooled together to form a composite measure of cocaine use frequency irrespective of method of administration. The rationale for pooling was the control nature of cocaine use frequency variable within the present analyses, which was dictated by our study objectives. This decision was considered to be appropriate given that a previous study of a nationally representative sample failed to demonstrate differences in the likelihood of violence for crack cocaine users as compared to powder cocaine users (Vaughn, Fu, Perron, Bohnert, & Howard, 2010).

As noted above, derivation of the cocaine use frequency variable involved summing across number of days snorting cocaine, smoking crack and injecting cocaine per month to quantify total cocaine usage. However, this summation resulted in some values that were greater than 31 days. Therefore, modifications were made to the coding scheme to provide ease of interpretation. Specifically, midpoints were calculated between the total cocaine usage and maximal cocaine usage for any given method of administration. These midpoints were then added to the maximal cocaine usage to provide a measure of monthly cocaine use frequency. Resulting values were further truncated down to 31 if they exceeded this limit. For example, a treatment client would have obtained a value of 26 days per month if they reported snorting cocaine 2 days a month, smoking crack 23 days a month and injecting cocaine 4 days a month based on our coding scheme (total cocaine usage = 29, maximal cocaine usage = 23, midpoint = 3). This coding scheme not only facilitated an easier interpretation of the responses, but also demonstrated statistical conservatism as the midpoints potentially accounted for use on the same day. As a result of this coding scheme, the range of responses for this variable extended from 0 – 31 days per month.

3.7.3.1.2 Simultaneous cocaine and alcohol use frequency

Treatment clients were asked to complete a section of the questionnaire on simultaneous cocaine and alcohol use during the past 12 months before treatment. Simultaneous use was defined as usage of cocaine or alcohol within three hours of each other on a single occasion (Barnwell & Earleywine, 2006).

Treatment clients were initially asked the question, "When you use cocaine, how often did you also use alcohol on the same occasion?" Responses to this question included, "Never", "Sometimes", "About half the time", "Most of the time" and "Always." Treatment clients who responded with "Never" were asked to skip the remaining questions on simultaneous use and proceed to the next section on the questionnaire. The remainder of the treatment clients were asked the question, "On an average week, how many days per week would you normally use both cocaine and alcohol." The answers to this question included only non-zero values. However, treatment clients who reported never using cocaine and alcohol simultaneously in the initial question were assigned a value of zero. Hence, the range of responses for this variable included 0 – 7 days per week.

3.7.3.1.3 Use of other substances

Other substances used by treatment clients were assessed by the question, "How many days per week on average did you use the following substances in the past year?" A list of substances was provided for treatment clients to fill out their usage in days per week. Specific items on the list included "Marijuana or hash", "Sleeping pills", "Pep pills, stimulants", "Tranquilizers such as valium", "LSD/acid/mushrooms", "Methamphetamine/crystal meth", "Heroin" and "Other psychoactive drugs." Substances for which the treatment clients endorsed any usage during a given week in the past year were summed together to provide the number of other substances used per week. Therefore, the range for this variable extended from 0 – 8 other substances used per week. It should be noted that this variable only reflected information on other substance use as supposed to abuse or dependence.

3.7.3.2 Demographics

3.7.3.2.1 Age

Age was assessed in the questionnaire by asking the treatment clients “How old are you?” Participants responded to this question by providing their age in years.

3.7.3.2.2 Sex

Treatment clients were asked to indicate their biological sex with the question, “What is your sex?” Responses to this dichotomous item included “Male” and “Female.”

3.7.3.2.3 Marital status

Marital status of treatment clients was assessed through the question, “What is your current marital status?” Responses to this categorical item included, “Married”, “Living with a Partner”, “Widowed”, “Divorced”, “Separated” and “Single/Never Married.” However, in the present study this variable was recoded into three categories to provide sufficient cell sizes while maintaining granularity in the marital status variable. These categories included, “Married or Living Together”, “Widowed or Divorced or Separated” and “Single or Never Married.”

3.7.3.2.4 Household income

Participants were asked to indicate their household income through the question, “What is your household income from all sources last year?” Participants were required to select one of seven categories that included, “under 10,000”, “10,000 to 19,999”, “20,000 to 29,999”, “30,000 to 39,999”, “40,000 to 49,999”, “50,000 to 99,9999” and “100,00 or more.” These seven categories were recoded into three categories: “Under 20,000”, “Equal or greater than 20,000 and less than 50,000” and “Equal or more than 50,000.” This variable recoding ensured sufficient cell sizes while maintaining the desired granularity in the household income variable.

3.8 Ethics approval

The Patterns and Consequences of Cocaine and Alcohol Use for Substance Abuse Treatment Clients Study obtained ethics approval from the Research Ethics Board at the University of Victoria. Ethics approval was also sought from research ethics boards of participating treatment agencies that were affiliated with hospitals.

3.9 Statistical analyses

All statistical analyses in the present study were conducted using SAS Version 9.3 (SAS Institute, Cary, NC). The analyses involved calculation of a combination of descriptive, bivariate and multivariable statistics. Descriptive statistics were calculated for the outcome, primary explanatory variables and control variables. Analyses were also conducted to assess the associations among all study variables of interest. Moreover, bivariate analyses between the outcome and study variables of interest were conducted using modified Poisson regression analyses to quantify the magnitude of these associations and calculate the corresponding confidence intervals. Furthermore, logistic regression with backward elimination procedures were carried out to assess associations between the outcome and primary study variables of interest while controlling for control variables and to test for the presence of pre-specified multiplicative interactions. Finally, statistically significant models from the logistic regression with backward elimination procedures were incorporated into the modified Poisson regression analyses to provide relative risk estimates of the associations. A detailed description of these analytic techniques is provided in the sections to follow.

3.10 Analytic strategy

3.10.1 Modified Poisson regression

Modified Poisson regression analyses were utilized in the present study to assess the bivariate relationships and present the final models from the logistic regression analysis

with backward elimination procedures. An assessment of risk is at the core of epidemiological studies. This risk is usually quantified through linear regression in the form of relative risk when the outcome is continuous, and logistic regression in the form of odds ratio when the outcome is binary (Koepsell & Weiss, 2003). Odds ratios can be estimates of the relative risks when the outcome in question is rare, as dictated by the rare disease assumption (Koepsell & Weiss, 2003). However, relative risks are favored over odds ratios in the epidemiological literature as the preferred method for the quantification of risks due to their ease of interpretation (Zou, 2004). In the present study it was not possible to calculate relative risks directly given the binary nature of the outcome. Additionally, it would have been methodologically incorrect to apply the rare disease assumption in our study, as the proportion of treatment clients that reported violence was 44.17% (N = 178). Hence, modified Poisson regression analyses were undertaken to calculate the relative risks as suggested by Zou (2004). This analytic technique uses a modified Poisson regression coupled with robust error variance to provide estimates of relative risks (Zou, 2004).

3.10.2 Logistic regression

In the present study, logistic regression with backward elimination procedures were used to identify statistically significant correlates of the outcome and test for the presence of pre-specified interaction effects. Backward elimination is a form of automated stepwise regression procedures, which can be used to quantify the independent explanatory roles of correlates associated with the outcome in multivariable models. This stepwise regression procedure starts with all candidate variables in the initial model, which are sequentially eliminated in further steps based on the highest p-value (Vittinghoff, 2012). The primary advantage of this analytic technique over other stepwise regression procedures, such as forward and stepwise selection, is its reduced likelihood of eliminating negatively confounded sets of variables (Vittinghoff, 2012). This distinguishing quality can be attributed to the initial model in the backward elimination procedure, which contains all the variables of interest (Vittinghoff, 2012). Given that backward elimination procedures are not available for modified Poisson regression, the

resulting final models from this analytic procedure were analyzed using the modified Poisson regression analyses.

3.11 Preliminary analyses

A series of preliminary analyses were conducted to contribute towards an understanding of the distributions of the variables and the underlying relationships between them. First, descriptive statistics were calculated for all study variables of interest. These statistics were further assessed by sex in order to elucidate potential sex differences. Statistical methodologies used to evaluate these sex differences included t-tests for continuous variables and Pearson's chi-square tests for categorical variables. Overall, these analyses aided in our understanding of the distribution of the study variables and characterized these distributions further by sex. Next, relationships between study variables of interest were examined with each other for the total sample, males and females by means of Pearson correlation for continuous variables, Spearman's Rank correlation for ordinal variables and continuous variables, and analysis of variance for nominal and continuous variables. These analyses were helpful in interpreting the results obtained in the final multivariable models.

3.12 Analyses per study objectives

Objective 1: To conduct an assessment of the extent of violence in a sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients.

Objective 1.1: To provide an estimate of the proportion of cocaine and simultaneous cocaine and alcohol abuse treatment clients reporting violence during the past 12 months.

This study objective was accomplished by calculating the proportion of cocaine and simultaneous cocaine and alcohol abuse treatment clients that reported violence during the past 12 months.

Objective 1.2: To characterize objective 1.1 further by sex.

The proportion estimate of cocaine and simultaneous cocaine and alcohol abuse treatment clients reporting violence during the past 12 months was further characterized by sex through cross tabulations with the sex variable. A Pearson's chi-square test was also conducted to assess differences between proportions of males and females.

Objective 2: To identify factors associated with violence in a sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Objective 2.1: To identify characteristics associated with violence among cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Characteristics associated with violence experienced during the past 12 months in cocaine and simultaneous cocaine and alcohol abuse treatment clients were assessed through descriptive statistics for all study variables of interest by the outcome for total sample and separately for males and females. These analyses included t-tests for continuous variables and Pearson's chi-square tests for categorical variables.

Objective 2.2: To quantify unadjusted risks of violence associated with each of demographics, drug consumption measures, personality traits and mental health indicators in cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

The unadjusted relative risks of violence during past 12 months associated with each of demographics, drug consumption measures, personality traits and mental health indicators in cocaine and simultaneous cocaine and alcohol abuse treatment clients were computed through modified Poisson regression analyses conducted for the total sample and separately for males and females. Violence was modeled as the dependent variable and the demographic variables, drug consumption measures, personality traits and mental health indicators served as the independent variables.

Objective 2.3: To quantify adjusted risks of violence associated with personality traits and mental health indicators while controlling for demographics and drug consumption measures in cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

The adjusted relative risks of violence during past 12 months associated with personality traits and mental health indicators while controlling for demographics and drug consumption measures in cocaine and simultaneous cocaine and alcohol abuse treatment clients were quantified through a combination of logistic regression with backward elimination procedures and modified Poisson regression analyses for the total sample and separately for males and females. Again, violence was modeled as the dependent variable and the demographic variables, drug consumption measures, personality traits and mental health indicators served as the independent variables.

First, logistic regression with backward elimination procedures were used to identify statistically significant models associated with the outcome. The demographics and drug consumption measures were forced in the models given that their associations with the outcome were demonstrated in the literature. However, the backward elimination procedure permitted removal of the personality traits and mental health indicators based on an alpha level of 0.05. This method facilitated the quantification of the independent explanatory roles of the personality traits and mental health indicators over and above the effects of demographics and drug consumption measures. The final statistically significant models from the logistic regression with backward elimination procedures were then analyzed and presented using modified Poisson regression analyses to provide the relative risks.

Objective 2.4: To test for multiplicative interactions of sex by demographics, drug consumption measures, personality traits and mental health indicators in models explaining violence among cocaine and simultaneous cocaine and alcohol abuse treatment clients.

Multiplicative interactions of sex by demographics, drug consumption measures, personality traits and mental health indicators were assessed through logistic regression with backward elimination procedures and modified Poisson regression analyses.

Specifically, demographics, drug consumption measures, personality traits and mental health indicators were forced into the logistic regression with backward elimination procedures model, while the respective interactions between sex and each of demographics, drug consumption measures, personality traits and mental health indicators were permitted to be eliminated from the model based on an alpha level of 0.05. The final statistically significant model from the logistic regression with backward elimination procedure was then analyzed using modified Poisson regression analysis to obtain the corresponding estimates of relative risks for the interaction terms.

3.13 Data management and final sample size

The original study consisted of 616 substance abusers in residential treatment for cocaine abuse, alcohol abuse and simultaneous cocaine and alcohol abuse. However, as noted previously, alcohol abusers who also did not have a problem with cocaine were excluded from the present study. As such, the sample size was reduced to 417 treatment clients (46.28% primarily cocaine abusers only and 53.72% simultaneous cocaine and alcohol abusers). However, only treatment clients with data on the outcome variable were included in the present study, which translated to a sample size of 403.

All the available valid data were used in the presentation of descriptive and bivariate analyses. This methodology ensured maximal utilization of the available data despite the changes in sample sizes based on the missingness of the variables being examined. However, a complete case analysis (N = 370) was carried out in the multivariable models, which only included treatment clients with valid data on all study variables of interest.

Chapter 4

4 Results

The Patterns and Consequences of Cocaine and Alcohol Use for Substance Abuse Treatment Clients Study sampled a total of 616 treatment clients (response rate of 97.8%) from five residential treatment agencies. However, the present study only included 403 treatment clients from the original sample based on our methodological exclusion of the primarily alcohol abusers only treatment group.

All available valid data were used in the calculation of descriptive and bivariate analyses. However, only complete data sets were used in multivariable models. These complete data sets only included treatment clients who provided valid response to the outcome variable and were not missing data on any of the study variables of interest. Overall, 370 treatment clients were included in the multivariable analyses based on the criteria discussed above. Figure 2 provides a detailed breakdown of this sample size derivation for the present study.

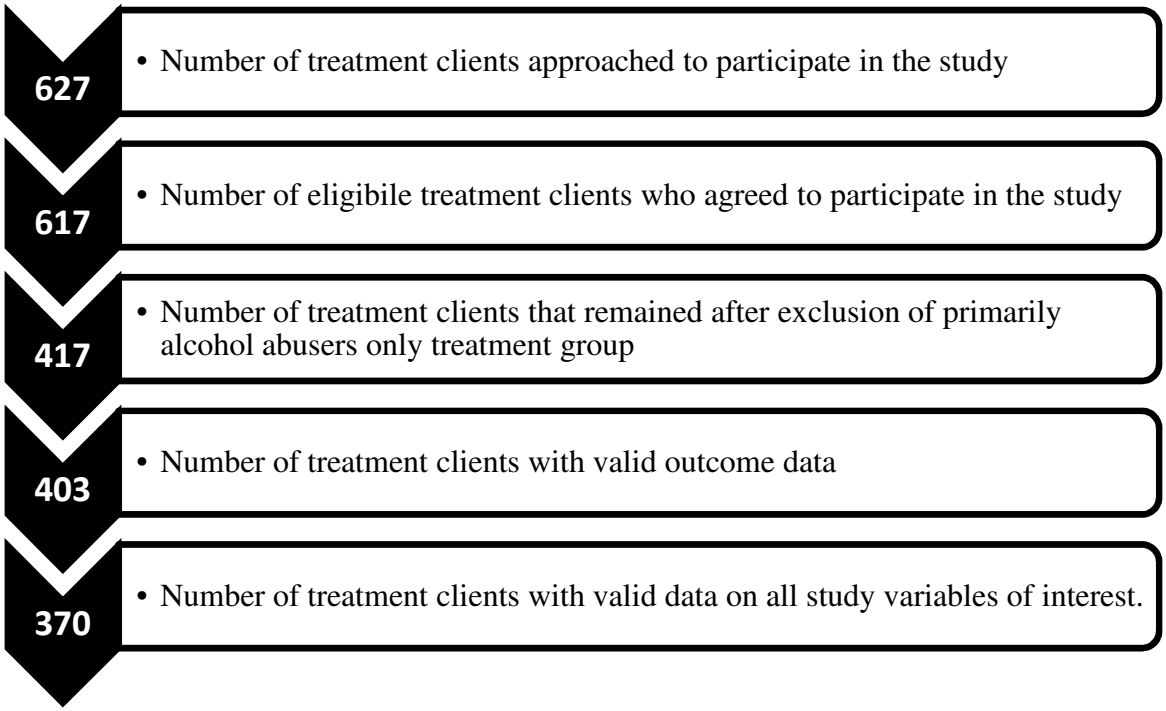

Figure 2. Sample size derivation

4.1 Extent of missingness

The present study assessed missingness on study variables of interest only for those treatment clients who provided valid outcome data (N = 403, N_{Male} = 195 and N_{Female} = 207). A detailed analysis of the missingness by study variables of interest is provided in Table 4. Overall, missingness was not a concern in this study as evident by the low rates of missingness for the study variables of interest. The highest rate of missingness was observed for the Simultaneous Cocaine and Alcohol Use Frequency variable (4.22% total, 3.08% males and 5.31% females). However, all other remaining study variables of interest had missingness rates below 3%. Moreover, only 33 treatment clients (8.92% total, 6.15% males and 9.66% females) did not have complete data on all study variables of interest.

Table 4. Missingness on study variables of interest for treatment clients with valid outcome data by total sample, males and females

	Total Sample (N = 403)			Males (N = 195)			Females (N = 207)		
	N Valid	N Missing	%	N Valid	N Missing	%	N Valid	N Missing	%
Demographic Factors									
Age	401	2	0.50	194	1	0.51	207	0	0
Sex	402	1	0.25	-	-	-	-	-	-
Marital Status	401	2	0.50	195	0	0	206	1	0.48
Household Income	393	10	2.48	192	3	1.54	201	6	2.90
Drug Consumption Measures									
Cocaine Use Frequency	401	2	0.50	195	0	0	205	2	0.97
Simultaneous Cocaine & Alcohol Use Frequency	386	17	4.22	189	6	3.08	196	11	5.31
Number of Other Drugs Used Per Week	399	4	0.99	193	2	1.03	205	2	0.97
Personality Traits									
Impulsivity/Risk-Taking	403	0	0	195	0	0	207	0	0
Aggressive Personality	403	0	0	195	0	0	207	0	0
Mental Health Indicators									
Depression	402	1	0.25	194	1	0.51	207	0	0
Anxiety	402	1	0.25	195	0	0	206	1	0.48
Paranoia	403	0	0	195	0	0	207	0	0

4.2 Sample characteristics

The results of the analyses assessing sample characteristics by total sample and males and females separately are presented in Table 5.

The sample in the present study was composed of 49% males and 51% females. The mean age of treatment clients was 34.06 years (SD: 9.59). The two sex groups were similar to each other in terms of age, as no statistically significant difference was observed between them (p = 0.068). A large proportion of treatment clients were single/never married (51.37%; 49.23% and 53.40% for males and females respectively), while the remaining were married/living together (23.94%; 22.56% and 25.24%) or widowed/divorced/separated/separated and living together (24.69%; 28.21% and 21.36%). There was no statistically significant difference present between males and females in terms of marital status either (p = 0.281). A large proportion of the treatment clients were in the < $20,000 household income category (41.98%), while about 25.19% had incomes between $20,000 and less than $50,000 and 32.82% had incomes of $50,000 and over. There was a statistically significant difference present in household income between males and females (p <.001). Specifically, there were more men than women in the higher income categories i.e. =/> $20,000 but < $50,000 (27.60% vs. 22.89%) and =/> $50,000 (42.71% vs. 23.38%), while there were more women than men in the lower income category i.e. < $20,000 (53.73% vs. 29.69%).

An assessment of the drug consumption measures indicated that treatment clients used cocaine an average of 18.95 days per month (SD: 10.53). In terms of simultaneous use of cocaine and alcohol, participants normally used both substances simultaneously 2.25 days (SD: 2.27) per week on average. The mean number of other drugs used per week was 2.12 drugs (SD; 1.73). There were no statistically significant sex differences present between males and females on any of these drug consumption measures (p = 0.604, p = 0.653 and p = 0.847 respectively).

The maximum possible scores on the impulsivity/risk-taking and physical aggression scales were 25 and 50 units, respectively. The mean score on the impulsivity/risk-taking

scale was 18.95 units (SD: 4.02), while the mean score for the physical aggression subscale was 30.55 units (SD: 9.91). No significant sex differences were found between males and females on scores for either of these personality traits ($p = 0.386$ and $p = 0.302$ respectively).

The mean score on the TCU Self-Rating Form's Depression and Anxiety subscales were 20.75 units (SD: 4.03) and 24.29 units (SD: 5.13), respectively, while the mean score on the Paranoia subscale of Minnesota Multiphasic Personality Inventory was 13.45 units (SD: 4.92). The maximum possible scores on these scales were 30, 35, and 25 units respectively. There were significant differences observed between males and females on two of these mental health indicators. Specifically, females reported higher mean scores than men on both the Depression [21.35 (SD: 3.94) vs. 20.11 (SD: 4.05); $p = 0.002$] and Anxiety [24.80 (SD: 4.98) vs. 23.79 (SD: 5.23); $p = 0.048$] subscales. However, men and women had mean scores for the Paranoia scale that were not significantly different.

Table 5. Characteristics of total sample, males and females by study variables of interest

	Total	Sex Stratified			
	(N = 403)	Males (N = 195)	Females (N = 207)	Test Statistic[b]	P-Value
	Mean (SD) or N (%)	Mean (SD) or N (%)	Mean (SD) or N (%)		
Demographic Factors					
Age	34.06 (9.59)	34.97 (10.30)	33.21 (8.82)	1.83	0.068
Sex[a]					
Female	207 (51.49)	-	-	-	-
Male	195 (48.51)	-	-	-	-
Marital Status[a]					
Married/Living Together	96 (23.94)	44 (22.56)	52 (25.24)	2.54	0.281
Widowed/Divorced/Separated/Separated & Living Together	99 (24.69)	55 (28.21)	44 (21.36)		
Single/Never Married	206 (51.37)	96 (49.23)	110 (53.40)		
Household Income[a]					
=/> 50,000	129 (32.82)	82 (42.71)	47 (23.38)	25.56	**<.001**
=/> 20,000 but < 50,000	99 (25.19)	53 (27.60)	46 (22.89)		
< 20,000	165 (41.98)	57 (29.69)	108 (53.73)		
Drug Consumption Measures					
Cocaine Use Frequency	18.95 (10.53)	18.67 (10.41)	19.22 (10.68)	-0.52	0.604
Simultaneous Cocaine & Alcohol Use Frequency	2.55 (2.27)	2.60 (2.23)	2.49 (2.32)	0.45	0.653
Number of Other Drugs Used Per Week	2.12 (1.73)	2.10 (1.83)	2.13 (1.61)	-0.19	0.847

[a] Denotes categorical variables.

[b] T-statistics and chi-square statistics are presented for results of analyses involving continuous and categorical variables respectively

Table 5 (Continued)

	Total	Sex Stratified			
	(N = 403)	Males (N = 195)	Females (N = 207)	Test Statistic[b]	P-Value
	Mean (SD) or N (%)	Mean (SD) or N (%)	Mean (SD) or N (%)		
Personality Traits					
Impulsivity/Risk-Taking	18.95 (4.02)	18.80 (3.93)	19.14 (4.07)	-0.87	0.386
Aggressive Personality	30.55 (9.91)	31.12 (9.83)	30.10 (9.96)	1.03	0.302
Mental Health Indicators					
Depression	20.75 (4.03)	20.11 (4.05)	21.35 (3.94)	-3.12	**0.002**
Anxiety	24.29 (5.13)	23.79 (5.23)	24.80 (4.98)	-1.98	**0.048**
Paranoia	13.45 (4.92)	13.79 (5.04)	13.17 (4.76)	1.27	0.203

[a] Denotes categorical variables.
[b] T-statistics and chi-square statistics are presented for results of analyses involving continuous and categorical variables respectively

4.3 Association among study variables

4.3.1 Total sample

Pearson's correlations were computed for associations between continuous variables (see Table 6 for total sample and Table 7 for males and females separately), Spearman's Rank correlation for associations between continuous and ordinal variables (see Table 8) and one-way analysis of variance tests for associations between continuous and categorical variables (see Table 9).

There were many small, positive and statistically significant associations obtained from the Pearson's correlation analyses involving the total sample. More importantly, there were four medium, positive and statistically significant correlations between impulsivity/risk-taking and aggressive personality ($r = 0.346$; $p < .001$), impulsivity/risk-taking and anxiety ($r = 0.342$; $p < .001$), depression and paranoia ($r = 0.336$; $p < .001$) and anxiety and paranoia ($r = 0.483$; $p < .001$). However, the strongest correlation was observed between depression and anxiety ($r = 0.508$; $p < .001$). Next, Spearman's Rank ordinal correlation analyses illustrated a negative association between aggressive personality and household income (rho = -0.103; $p = 0.041$), with higher scores on the physical aggression subscale associated with lower levels of income. Furthermore, a positive finding was also obtained from the one-way analysis of variance tests conducted for the associations between continuous and categorical variables. A significant association between age and marital status ($p < .001$) was found, with age for those who were single/never married being considerably lower as compared to those who were married/living together or those who were widowed/divorced/separated/separated and living together (30.46 years vs. 34.84 and 40.51 years respectively).

4.3.2 Males

The results for males pertaining to Pearson's correlation analyses for associations between continuous variables demonstrated many small, positive and statistically significant correlations. Moreover, medium, positive and statistically significant correlations were observed between impulsivity/risk-taking and aggressive personality (r

= 0.319; p <.001) and impulsivity/risk-taking and anxiety (r = 0.319; p <.001). Unsurprisingly, large, positive and statistically significant correlations were observed between the mental health indicators including depression and anxiety (r = 0.502; p <.001) and anxiety and paranoia (r = 0.550; p <.001). The one-way analysis of variance tests focusing on associations between continuous and categorical variables demonstrated two significant associations. It was shown that age was associated with marital status (p <.001), as the mean age for the single/never married group was substantially lower as compared to the other two groups (30.66 years vs. 36.66 and 41.05 years). Additionally, an association between impulsivity/risk-taking and marital status was observed, as the married/living together group scored the lowest on this variable followed by the single/never married and widowed/divorced/separated/separated and living together groups. Overall, the pattern of findings for males was similar to the total sample, with slight differences observed in the magnitude of the results. However, there were some discrepancies observed with the total sample in the results for males, as no statistically significant associations were observed between simultaneous cocaine and alcohol frequency and impulsivity/risk-taking, number of other drugs used per week and depression, number of other drugs used per week and anxiety and aggressive personality and household income. On the other hand, the association observed between impulsivity/risk-taking and marital status among males was not observed for the total sample.

4.3.3 Females

Similarly, considerable small, positive and statistically significant Pearson's correlations were observed in the analyses focusing on associations between continuous variables for females. There were also four medium, positive and statistically significant correlations: Impulsivity/risk-taking and aggressive personality (r = 0.366; p <.001), impulsivity/risk-taking and anxiety (r = 0.351; p <.001), depression and paranoia (r = 0.409; p <.001) and anxiety and paranoia (r = 0.426; p <.001). Most noteworthy was the high, positive and statistically significant correlation observed between depression and anxiety (r = 0.504; p <.001). Moreover, negative and statistically significant associations were observed between household income and aggressive personality (rho = -0.161; p = 0.022) and

household income and paranoia (rho = -0.180; p = 0.011) in analyses involving Spearman's rank ordinal correlations. Furthermore, one-way analysis of variance tests for associations between continuous and categorical variables illustrated two significant findings. An association between age and marital status was observed (p <.001), as the single/never married group was considerably younger than the other two groups (30.29 years vs. 33.31 and 39.82 years), which was similar to their male counterparts. Also, an association between aggressive personality and marital status was highlighted, as females single/never married reported the highest mean score followed by the married/living together and widowed/divorced/separated/separated and living together categories. Overall, there were several discrepancies in the results obtained for females in comparison to the total sample. There was a lack of associations for females between a number of variables including age and number of other drugs used per week, age and paranoia, cocaine use frequency and simultaneous cocaine and alcohol use frequency, cocaine use frequency and number of other drugs used per week, cocaine use frequency and anxiety, cocaine use frequency and paranoia, simultaneous cocaine and alcohol use frequency and number of other drugs used per week, simultaneous cocaine and alcohol use frequency and aggressive personality, number of other drugs used per week and depression, number of other drugs used per week and anxiety and number of other drugs used per week and paranoia. On the other hand, the associations observed between paranoia and household income and aggressive personality and marital status among females were not observed for the total sample.

Overall, the strongest associations were observed between the mental health indicators, particularly between anxiety and depression and between anxiety and paranoia. The strength of these associations made it necessary to conduct further tests for multicollinearity between study variables of interest before conducting multivariable analyses. However, no evidence of multicollinearity was found as indicated by the variance inflation factors. The results of these tests for multicollinearity are available in Appendix D.

Table 6. Correlation matrix of continuous study variables of interest for total sample (N = 403)

	1	2	3	4	5	6	7	8	9
1. Age	1.000	0.017	-0.075	-0.134*	-0.087	-0.232**	-0.030	-0.031	-0.127*
2. Cocaine Use Frequency		1.000	0.170**	0.136*	0.071	0.097	0.071	0.135*	0.106*
3. Simultaneous Cocaine & Alcohol Use Frequency			1.000	0.109*	0.113*	0.131*	0.056	0.187**	0.076
4. Number of Other Drugs Used Per Week				1.000	0.066	0.211**	0.111*	0.124*	0.125*
5. Impulsivity/ Risk-Taking					1.000	0.346**	0.230**	0.342**	0.275**
6. Aggressive Personality						1.000	0.173**	0.241**	0.251**
7. Depression							1.000	0.508**	0.336**
8. Anxiety								1.000	0.483**
9. Paranoia									1.000

* $p < 0.05$, ** $p < 0.001$

Table 7. Correlation matrix of continuous study variables of interest for males (N = 195) and females (N = 207)[a]

	1	2	3	4	5	6	7	8	9
1. Age	**1.000**	-0.088	-0.089	-0.178*	-0.053	-0.209*****	-0.015	-0.020	-0.151*
2. Cocaine Use Frequency	*0.136*	**1.000**	0.254******	0.152*****	0.083	0.096	0.110	0.179*	0.203*****
3. Simultaneous Cocaine & Alcohol Use Frequency	*-0.065*	*0.095*	**1.000**	0.227*****	0.064	0.155*****	0.121	0.192*****	0.142
4. Number of Other Drugs Used Per Week	*-0.077*	*0.121*	*-0.017*	**1.000**	0.057	0.153*****	0.101	0.130	0.171*****
5. Impulsivity/ Risk-Taking	*-0.117*	*0.058*	*0.164**	*0.082*	**1.000**	0.319**	0.243******	0.319**	0.270******
6. Aggressive Personality	*-0.272***	*0.100*	*0.110*	*0.280***	*0.366***	**1.000**	0.157*	0.231*****	0.290**
7. Depression	*-0.018*	*0.028*	*0.003*	*0.122*	*0.214**	*0.211**	**1.000**	0.502**	0.297******
8. Anxiety	*-0.024*	*0.088*	*0.191**	*0.120*	*0.351***	*0.255***	*0.504***	**1.000**	0.550**
9. Paranoia	*-0.113*	*0.014*	*0.013*	*0.081*	*0.273***	*0.199**	*0.409***	*0.426***	**1.000**

[a] Results specific to women are presented in italics underneath the diagonal, while the results specific to men are presented above the diagonal.

***** $p < 0.05$, ** $p < 0.001$

Table 8. Associations between continuous and ordinal study variables of interest for total sample, males and females

	Total Sample (N = 403) Household Income	Males (N = 195) Household Income	Females (N = 207) Household Income
Age	0.083	0.111	0.033
Cocaine Use Frequency	-0.042	-0.018	-0.058
Simultaneous Cocaine & Alcohol Use Frequency	0.010	-0.005	-0.004
Number of Other Drugs Used Per Week	-0.093	-0.088	-0.095
Impulsivity/ Risk-Taking	-0.020	0.075	-0.074
Aggressive Personality	-0.103*	-0.081	-0.161*
Depression	-0.080	-0.046	-0.038
Anxiety	-0.075	-0.041	-0.048
Paranoia	-0.053	0.035	-0.180*

***** $p < 0.05$, ** $p < 0.001$

Table 9. Associations between continuous and categorical study variables of interest for total sample, males and females

	Total Sample (N = 403)				Males(N = 195)				Females (N = 207)			
	Marital Status				Marital Status				Marital Status			
	Group A[a] Mean (SD)	Group B[a] Mean (SD)	Group C[a] Mean (SD)	F-Value	Group A[a] Mean (SD)	Group B[a] Mean (SD)	Group C[a] Mean (SD)	F-Value	Group A[a] Mean (SD)	Group B[a] Mean (SD)	Group C[a] Mean (SD)	F-Value
Age	34.84 (9.05)	30.46 (8.14)	40.51 (9.08)	46.09**	36.66 (10.24)	30.66 (8.68)	41.05 (9.59)	22.64**	33.31 (7.67)	30.29 (7.69)	39.82 (8.44)	23.17**
Cocaine Use Frequency	17.45 (10.35)	19.11 (10.65)	20.00 (10.46)	1.45	16.22 (10.06)	19.65 (10.56)	18.94 (10.30)	1.66	18.53 (10.58)	18.64 (10.75)	21.28 (10.64)	1.09
Simultaneous Cocaine & Alcohol Use Frequency	2.29 (2.17)	2.77 (2.27)	2.32 (2.35)	2.01	2.30 (2.02)	2.80 (2.29)	2.48 (2.26)	0.82	2.28 (2.33)	2.74 (2.26)	2.11 (2.47)	1.39
Number of Other Drugs Used Per Week	2.06 (1.65)	2.23 (1.79)	1.91 (1.62)	1.21	2.10 (1.56)	2.22 (1.94)	1.89 (1.84)	0.56	2.04 (1.74)	2.24 (1.65)	1.93 (1.32)	0.67

[a] Group A: Married/Living together, Group B: Single/Never married, Group C: Widowed/Divorced/Separated

* $p < 0.05$, ** $p < 0.001$

Table 9 (Continued)

	Total Sample (N = 403)				Males(N = 195)				Females (N = 207)			
	Marital Status				Marital Status				Marital Status			
	Group A[a] Mean (SD)	Group B[a] Mean (SD)	Group C[a] Mean (SD)	F-Value	Group A[a] Mean (SD)	Group B[a] Mean (SD)	Group C[a] Mean (SD)	F-Value	Group A[a] Mean (SD)	Group B[a] Mean (SD)	Group C[a] Mean (SD)	F-Value
Impulsivity / Risk-Taking	18.64 (4.31)	19.04 (3.82)	19.12 (4.03)	0.43	17.59 (4.46)	18.94 (3.68)	19.52 (3.74)	3.15*	19.52 (4.02)	19.13 (3.96)	18.61 (4.37)	0.59
Aggressive Personality	30.09 (9.58)	31.59 (9.60)	28.99 (10.70)	2.48	29.66 (9.59)	31.68 (9.47)	31.29 (10.68)	0.65	30.46 (9.65)	31.51 (9.75)	26.12 (10.12)	4.81*
Depression	20.42 (4.06)	20.74 (4.09)	21.06 (3.94)	0.61	19.27 (3.88)	20.00 (4.05)	20.97 (4.08)	2.23	21.38 (3.99)	21.39 (4.02)	21.16 (3.79)	0.06
Anxiety	23.78 (5.02)	24.60 (5.23)	24.13 (4.97)	0.90	23.00 (5.13)	23.90 (5.29)	24.22 (5.22)	0.71	24.44 (4.88)	25.21 (5.12)	24.01 (4.69)	1.05
Paranoia	13.20 (4.93)	13.75 (4.70)	13.06 (5.245)	0.84	13.82 (4.83)	13.92 (4.94)	13.55 (5.44)	0.10	12.67 (4.99)	13.61 (4.50)	12.45 (4.98)	1.26

[a] Group A: Married/Living together, Group B: Single/Never married, Group C: Widowed/Divorced/Separated

* $p < 0.05$, ** $p < 0.001$

4.4 Analyses per study objectives

Objective 1: To conduct an assessment of the extent of violence in a sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients.

Objective 1.1: To provide an estimate of the proportion of cocaine and simultaneous cocaine and alcohol abuse treatment clients reporting violence during the past 12 months.

The first objective of the present study was to compute the proportion of treatment clients in the sample that reported violence during the past 12 months. The results from the analyses illustrated that 178 out of 403 (44.17%, 95% CI: 39.30% to 49.04%) treatment clients in the sample reported experiences of violence during the past 12 months.

Objective 1.2: To characterize objective 1.1 further by sex.

The proportion of treatment clients that reported violence during the past 12 months in the sample was further characterized by sex. The results of the cross tabulations by sex showed that 83 out of 195 (42.56%, 95% CI: 35.56% to 49.57%) males and 94 out of 207 (45.41%, 95% CI: 38.57% to 52.25%) females reported violence during the past 12 months in the sample. However, these differences failed to approach statistical significance as indicated by the results of the Pearson's chi-square analyses ($p = 0.566$).

Objective 2: To identify factors associated with violence in a sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Objective 2.1: To identify characteristics associated with violence among cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Characteristics associated with violence during the past 12 months were evaluated by conducting t-tests for continuous variables and Pearson's chi-square analyses for categorical variables. The results of these analyses for the total sample and males and females separately are presented in Table 10 and Table 11 respectively.

Overall, violence during the past 12 months was associated with the number of other drugs used per week ($p < .001$), impulsivity/risk-taking ($p = 0.019$), aggressive personality ($p < .001$), depression ($p = 0.010$), anxiety ($p = 0.004$) and paranoia ($p = 0.007$). Specifically, treatment clients who reported violence during the past 12 months on average used more other drugs per week (1 more other drug) and scored higher on each of the impulsivity/risk-taking (1 unit more), aggressive personality (7 units more), depression (1 unit more), anxiety (2 units more) and paranoia (1 unit more) scales as compared to their counterparts that reported no violence during the past 12 months.

Analyses conducted separately for males and females revealed similarities as well as differences in the characteristics associated with violence during the past 12 months. Number of other drugs used per week and aggressive personality were associated with violence during the past 12 months for both males ($p < .001$ and $p < .001$ respectively) and females ($p < .001$ and $p < .001$). Male and female treatment clients that reported violence during the past 12 months on average used more other drugs per week (1 more other drug for both males and females) and scored higher on the aggressive personality scale (8 and 7 units more respectively). However, each of simultaneous cocaine and alcohol use frequency ($p = 0.028$), impulsivity/risk-taking ($p = 0.014$), anxiety ($p = 0.012$) and paranoia ($p = 0.012$) were significantly associated with violence during the past 12 months only for male treatment clients unlike their female counterparts. Male treatment clients that reported violence during the past 12 months on average reported greater frequency of simultaneous cocaine and alcohol use (1 more day per week) and scored higher on the impulsivity/risk-taking (1 unit more), anxiety (2 units more) and paranoia (2 units more) scales as compared to their counterparts that reported no violence during the past 12 months.

Table 10. Characteristics of treatment clients associated with violence during the past 12 months by total sample

	Total Sample (N = 403)			
	No Violence (N = 225)	**Violence (N = 178)**	**Test Statistic[b]**	**P-Value**
	Mean (SD) or N (%)	**Mean (SD) or N (%)**		
Demographic Factors				
Age	34.26 (9.05)	33.81 (10.27)	-0.47	0.638
Sex[a]				
Females	113 (50.22)	94 (53.11)	0.3301	0.566
Males	112 (49.78)	83 (46.89)		
Marital Status[a]				
Married/Living Together	57 (25.33)	39 (22.16)	0.6775	0.713
Widowed/Divorced/Separated/Separated & Living Together	56 (24.89)	43 (24.43)		
Single/Never Married	112 (49.78)	94 (53.41)		
Household Income[a]				
=/> 50,000	73 (33.03)	56 (32.56)	0.4203	0.811
=/> 20,000 but < 50,000	58 (26.24)	41 (23.84)		
< 20,000	90 (40.72)	75 (43.60)		
Drug Consumption Measures				
Cocaine Use Frequency	18.69 (10.61)	19.29 (10.44)	0.57	0.572
Simultaneous Cocaine & Alcohol Use Frequency	2.40 (2.24)	2.73 (2.30)	1.44	0.150
Number of Other Drugs Used Per Week	1.72 (1.56)	2.62 (1.78)	5.35	**<.001**
Personality Traits				
Impulsivity/Risk-Taking	18.54 (3.96)	19.48 (4.04)	2.36	**0.019**
Aggressive Personality	27.40 (9.45)	34.54 (9.04)	7.67	**<.001**
Mental Health Indicators				
Depression	20.29 (4.08)	21.33 (3.91)	2.58	**0.010**
Anxiety	23.63 (5.11)	25.11 (5.04)	2.89	**0.004**
Paranoia	12.87 (4.85)	14.19 (4.91)	2.70	**0.007**

[a] Denotes categorical variables.
[b] T-statistics and chi-square statistics are presented for results of analyses involving continuous and categorical variables respectively.

Table 11. Characteristics of treatment clients associated with violence during the past 12 months by males and females

	Males (N = 195)				Females (N = 207)			
	No Violence (N = 112)	Violence (N = 83)	Test Statistic[b]	P-Value	No Violence (N = 113)	Violence (N = 94)	Test Statistic[b]	P-Value
	Mean (SD) or N (%)	Mean (SD) or N (%)			Mean (SD) or N (%)	Mean (SD) or N (%)		
Demographic Factors								
Age	34.37 (9.42)	35.79 (11.40)	0.95	0.342	34.16 (8.71)	32.07 (8.87)	-1.70	0.091
Marital Status[a]								
Married/Living Together	28 (25.00)	16 (19.28)	0.9351	0.627	29 (25.66)	23 (24.73)	0.5374	0.764
Widowed/Divorced/ Separated/Separated & Living Together	30 (26.79)	25 (30.12)			26 (23.01)	18 (19.35)		
Single/Never Married	54 (48.21)	42 (50.60)			58 (51.33)	52 (55.91)		
Household Income[a]								
=/> 50,000	47 (42.73)	35 (42.68)	0.0620	0.970	26 (23.42)	21 (23.33)	0.3253	0.850
=/> 20,000 but < 50,000	31 (28.18)	22 (26.83)			27 (24.32)	19 (21.11)		
< 20,000	32 (29.09)	25 (30.49)			58 (52.25)	50 (55.56)		
Drug Consumption Measures								
Cocaine Use Frequency	19.23 (10.70)	17.93 (10.02)	-0.86	0.390	18.15 (10.54)	20.54 (10.76)	1.60	0.112

[a] Denotes categorical variables.

[b] T-statistics and chi-square statistics are presented for results of analyses involving continuous and categorical variables respectively.

Table 11 (Continued)

	Males (N = 195)				Females (N = 207)			
	No Violence (N = 112)	**Violence (N = 83)**	**Test Statistic[b]**	**P-Value**	**No Violence (N = 113)**	**Violence (N = 94)**	**Test Statistic[b]**	**P-Value**
	Mean (SD) or N (%)	**Mean (SD) or N (%)**			**Mean (SD) or N (%)**	**Mean (SD) or N (%)**		
Drug Consumption Measures								
Simultaneous Cocaine & Alcohol Use Frequency	2.30 (2.09)	3.01 (2.36)	2.21	**0.028**	2.50 (2.39)	2.48 (2.24)	-0.06	0.949
Number of Other Drugs Used Per Week	1.68 (1.56)	2.66 (2.03)	3.63	**<.001**	1.76 (1.56)	2.57 (1.56)	3.74	**<.001**
Personality Traits								
Impulsivity/Risk-Taking	18.20 (3.89)	19.60 (3.85)	2.49	**0.014**	18.87 (4.02)	19.48 (4.12)	1.08	0.282
Aggressive Personality	27.73 (9.06)	35.69 (8.99)	6.09	**<.001**	27.08 (9.85)	33.72 (8.87)	5.05	**<.001**
Mental Health Indicators								
Depression	19.70 (4.04)	20.65 (4.02)	1.61	0.109	20.87 (4.04)	21.93 (3.76)	1.95	0.052
Anxiety	22.98 (5.16)	24.87 (5.15)	2.52	**0.012**	24.28 (5.01)	25.40 (4.90)	1.61	0.108
Paranoia	13.02 (5.12)	14.84 (4.76)	2.53	**0.012**	12.72 (4.59)	13.71 (4.94)	1.50	0.135

[a] Denotes categorical variables.
[b] T-statistics and chi-square statistics are presented for results of analyses involving continuous and categorical variables respectively.

Objective 2.2: To quantify unadjusted risks of violence associated with each of demographics, drug consumption measures, personality traits and mental health indicators in cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Modified Poisson regression analyses were utilized to quantify the unadjusted relative risks for violence during the past 12 months associated with each of demographics, drug consumption measures, personality traits and mental health indicators. The results of these analyses are presented in Table 12 for the total sample and Table 13 for males and females separately.

The results of the total sample indicated that the likelihood of experiencing violence during the past 12 months increased significantly with every unit increase in the number of other drugs used per week (16% increase per drug; $p < .001$), impulsivity/risk-taking (4% increase per unit; $p = 0.028$), aggressive personality (4% increase per unit; $p < .001$), depression (4% increase per unit; $p = 0.008$), anxiety (3% increase per unit; $p = 0.003$) and paranoia (3% increase per unit; $p = 0.007$). Similarly, the likelihood of violence during the past 12 months increased significantly among males particularly for every unit increase in frequency of simultaneous cocaine and alcohol use (8% increase per day; $p = 0.021$) number of other drugs used per week (16% increase per drug; $p < .001$), impulsivity/risk-taking (6% increase per unit; $p = 0.022$), aggressive personality (5% increase per unit; $p < .001$), anxiety (4% increase per unit; $p = 0.008$) and paranoia (4% increase per unit; $p = 0.010$). On the other hand, the likelihood of violence during the past 12 months increased significantly among females particularly for every unit increase in number of other drugs used per week (17% increase per drug; $p < .001$), aggressive personality (4% increase per unit; $p < .001$) and depression (4% increase per unit; $p = 0.048$).

Table 12. Unadjusted relative risks of violence during the past 12 months associated with demographics, drug consumption measures, personality traits and mental health indicators by total sample

	Total Sample (N = 403)		
	Estimated Regression Coefficient (Standard Error)	**Relative Risk (95% CI)**	**P-Value**
Demographic Factors			
Age	-0.003 (0.006)	0.997 (0.985 - 1.009)	0.645
Sex			
Females (Reference)	-	-	-
Males	-0.065 (0.113)	0.937 (0.751 - 1.169)	0.566
Marital Status			
Married/Living Together (Reference)	-	-	-
Widowed/Divorced/Separated/Separated & Living Together	-0.014 (0.132)	0.986 (0.762 - 1.277)	0.916
Single/Never Married	0.082 (0.113)	1.085 (0.869 - 1.355)	0.471
Household Income			
=/> 50,000 (Reference)	-	-	-
=/> 20,000 but < 50,000	-0.073 (0.136)	0.929 (0.712 - 1.214)	0.591
< 20,000	0.066 (0.115)	1.068 (0.853 - 1.338)	0.565
Drug Consumption Measures			
Cocaine Use Frequency	0.003 (0.005)	1.003 (0.993 - 1.014)	0.572
Simultaneous Cocaine & Alcohol Use Frequency	0.036 (0.024)	1.036 (0.988 - 1.086)	0.140
Number of Other Drugs Used Per Week	0.150 (0.026)	1.162 (1.105 - 1.221)	**<.001**
Personality Traits			
Impulsivity/Risk-Taking	0.035 (0.016)	1.035 (1.004 - 1.068)	**0.028**
Aggressive Personality	0.041 (0.005)	1.042 (1.031 - 1.053)	**<.001**
Mental Health Indicators			
Depression	0.036 (0.014)	1.037 (1.010 - 1.064)	**0.008**
Anxiety	0.031 (0.011)	1.032 (1.011 - 1.054)	**0.003**
Paranoia	0.030 (0.011)	1.031 (1.009 - 1.054)	**0.007**

Table 13. Unadjusted relative risks of violence during the past 12 months associated with demographics, drug consumption measures, personality traits and mental health indicators by males and females

	Males (N = 195)			Females (N = 207)		
	Estimated Regression Coefficient (Standard Error)	**Relative Risk (95% CI)**	**P-Value**	**Estimated Regression Coefficient (Standard Error)**	**Relative Risk (95% CI)**	**P-Value**
Demographic Factors						
Age	0.008 (0.008)	1.008 (0.992 - 1.024)	0.342	-0.015 (0.009)	0.985 (0.967 - 1.003)	0.100
Marital Status						
Married/Living Together (Reference)	-	-	-	-	-	-
Widowed/Divorced/ Separated/Separated & Living Together	0.093 (0.179)	1.097 (0.773 - 1.557)	0.604	-0.124 (0.200)	0.884 (0.597 - 1.308)	0.536
Single/Never Married	0.055 (0.166)	1.056 (0.762 - 1.464)	0.742	0.102 (0.155)	1.107 (0.816 - 1.501)	0.513
Household Income						
=/> 50,000 (Reference)	-	-	-	-	-	-
=/> 20,000 but < 50,000	-0.039 (0.190)	0.962 (0.663 - 1.395)	0.837	-0.104 (0.196)	0.902 (0.614 - 1.325)	0.598
< 20,000	0.038 (0.181)	1.039 (0.729 - 1.480)	0.833	0.074 (0.158)	1.076 (0.790 - 1.467)	0.641
Drug Consumption Measures						
Cocaine Use Frequency	-0.007 (0.008)	0.993 (0.978 - 1.009)	0.381	0.012 (0.008)	1.012 (0.997 - 1.028)	0.125
Simultaneous Cocaine & Alcohol Use Frequency	0.080 (0.035)	1.084 (1.012 - 1.160)	**0.022**	-0.002 (0.033)	0.998 (0.935 - 1.065)	0.948
Number of Other Drugs Used Per Week	0.146 (0.033)	1.157 (1.084 - 1.236)	**<.001**	0.155 (0.041)	1.168 (1.078 - 1.265)	**<.001**

Table 13 (Continued)

	Males (N = 195)			Females (N = 207)		
	Estimated Regression Coefficient (Standard Error)	**Relative Risk (95% CI)**	**P-Value**	**Estimated Regression Coefficient (Standard Error)**	**Relative Risk (95% CI)**	**P-Value**
Personality Traits						
Impulsivity/Risk-Taking	0.057 (0.025)	1.058 (1.008 - 1.111)	**0.022**	0.021 (0.020)	1.021 (0.981 - 1.063)	0.302
Aggressive Personality	0.048 (0.008)	1.049 (1.033 - 1.065)	**<.001**	0.037 (0.007)	1.038 (1.023 - 1.053)	**<.001**
Mental Health Indicators						
Depression	0.033 (0.019)	1.034 (0.995 - 1.073)	0.088	0.038 (0.019)	1.039 (1.000 - 1.079)	**0.048**
Anxiety	0.040 (0.015)	1.041 (1.010 - 1.072)	**0.008**	0.025 (0.015)	1.025 (0.995 - 1.056)	0.106
Paranoia	0.042 (0.016)	1.043 (1.010 - 1.076)	**0.010**	0.024 (0.016)	1.024 (0.993 - 1.056)	0.130

Objective 2.3: To quantify adjusted risks of violence associated with personality traits and mental health indicators while controlling for demographics and drug consumption measures in cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and for males and females.

Logistic regression with backward elimination procedures and modified Poisson regression analyses were used to quantify the adjusted relative risks of violence during the past 12 months associated with each of personality traits and mental health indicators while controlling for demographics and drug consumption measures for the total sample, and males and females separately.

First, logistic regression with backward elimination procedures were utilized to identify statistically significant personality traits and mental health indicators associated with violence during the past 12 months while controlling for demographics and drug consumption measures. The results from these analyses are included in Table 14 for the total sample and Table 15 for males and females separately. Satisfactory data fit was obtained in each of these three statistical models including total sample, males and females as indicated by the Hosmer–Lemeshow goodness of fit tests ($p = 0.264$, $p = 0.882$ and $p = 0.424$, respectively). The results for total sample demonstrated that violence during the past 12 months was associated with the number of other drugs used per week ($p < .001$) and aggressive personality ($p < .001$). Moreover, violence during the past 12 months among males was associated with age ($p = 0.009$), cocaine use frequency ($p = 0.050$), number of other drugs used per week ($p = 0.001$) and aggressive personality ($p < .001$). On the other hand, violence during the past 12 months was associated with number of other drugs used per week ($p = 0.030$) and aggressive personality ($p < .001$) among females.

The final resultant models from the logistic regression with backward elimination procedures were reanalyzed using modified Poisson regression. The results from these analyses are included in Table 16 for the total sample and Table 17 for males and females separately. These results were consistent with the findings from the logistic regression with backward elimination procedures in terms of direction of associations and statistical

significance. The results of the total sample indicated that there were significant increases in the likelihood of violence during the past 12 months for every unit increase in the number of other drugs used per week (12% increase per drug; $p < .001$) and aggressive personality (4% increase per unit; $p < .001$). Moreover, the likelihood of violence during the past 12 months increased significantly among males for one unit increase in each of age (2% increase per year; $p < .001$), number of other drugs used per week (14% increase per drug; $p < .001$) and aggressive personality (5% increase per unit; $p < .001$). On the other hand, the likelihood of violence during the past 12 months decreased significantly for males by 2% for every one day increase in cocaine use frequency ($p = 0.036$). Finally, the likelihood of violence during the past 12 months increased significantly among females for every one unit increase in number of other drugs used per week (10% increase per drug; $p = 0.042$) and aggressive personality (4% increase per unit; $p < .001$).

The protective association between cocaine use frequency and violence during the past 12 months observed among males was unexpected. Therefore, further analyses were conducted on the male sample to better understand this association. Specifically, the association between cocaine use frequency and violence during past 12 months was examined separately for different methods of administration (i.e., snorting, smoking and injecting cocaine). The results of these analyses are available in Appendix E. Overall, the pattern of findings was similar when comparing the two models. However, the model examining cocaine use frequency separately by methods of administration illustrated that the likelihood of violence during past 12 months decreased significantly by 5% for every one day increase in crack use frequency ($p = 0.002$). On the other hand, the effects of snorting and injecting cocaine frequency remained nonsignificant in models explaining violence during the past 12 months.

Table 14. Results from logistic regression with backward elimination procedures examining the associations between each of personality traits and mental health indicators and violence during the past 12 months while controlling for demographics and drug consumption measures by total sample

	Total Sample (N = 370)		
	Estimated Regression Coefficient (Standard Error)	**Odds Ratio (95% CI)**	**P-Value**
Demographic Factors			
Age	0.026 (0.015)	1.026 (0.997 - 1.056)	0.075
Sex			
Females (Reference)	-	-	-
Males	-0.391 (0.247)	0.677 (0.417 - 1.097)	0.113
Marital Status			
Married/Living Together (Reference)	-	-	-
Widowed/Divorced/Separated/Separated & Living Together	0.298 (0.351)	1.347 (0.677 - 2.680)	0.397
Single/Never Married	0.212 (0.309)	1.236 (0.675 - 2.263)	0.493
Household Income			
=/> 50,000 (Reference)	-	-	-
=/> 20,000 but < 50,000	-0.293 (0.313)	0.746 (0.404 - 1.379)	0.350
< 20,000	-0.403 (0.292)	0.668 (0.377 - 1.184)	0.167
Drug Consumption Measures			
Cocaine Use Frequency	-0.008 (0.012)	0.992 (0.970 - 1.015)	0.485
Simultaneous Cocaine & Alcohol Use Frequency	0.003 (0.053)	1.003 (0.905 - 1.111)	0.960
Number of Other Drugs Used Per Week	0.280 (0.074)	1.324 (1.145 - 1.530)	**<.001**
Personality Traits			
Impulsivity/Risk-Taking		Eliminated	
Aggressive Personality	0.085 (0.013)	1.089 (1.061 - 1.117)	**<.001**
Mental Health Indicators			
Depression		Eliminated	
Anxiety		Eliminated	
Paranoia		Eliminated	

Table 15. Results from logistic regression with backward elimination procedures examining the associations between each of personality traits and mental health indicators and violence during the past 12 months while controlling for demographics and drug consumption measures by males and females

	Males (N = 183)			Females (N = 187)		
	Estimated Regression Coefficient (Standard Error)	**Odds Ratio (95% CI)**	**P-Value**	**Estimated Regression Coefficient (Standard Error)**	**Odds Ratio (95% CI)**	**P-Value**
Demographic Factors						
Age	0.055 (0.021)	1.057 (1.014 - 1.102)	**0.009**	-0.007 (0.022)	0.993 (0.951 - 1.037)	0.743
Marital Status						
Married/Living Together (Reference)	-	-	-	-	-	-
Widowed/Divorced/ Separated/Separated & Living Together	0.161 (0.529)	1.175 (0.417 - 3.312)	0.761	0.397 (0.502)	1.487 (0.556 - 3.981)	0.430
Single/Never Married	0.480 (0.493)	1.617 (0.615 - 4.249)	0.330	0.084 (0.411)	1.087 (0.486 - 2.434)	0.839
Household Income						
=/> 50,000 (Reference)	-	-	-	-	-	-
=/> 20,000 but < 50,000	-0.263 (0.436)	0.769 (0.327 - 1.808)	0.547	-0.339 (0.482)	0.712 (0.277 - 1.834)	0.482
< 20,000	-0.147 (0.438)	0.863 (0.366 - 2.036)	0.737	-0.499 (0.415)	0.607 (0.269 - 1.370)	0.230
Drug Consumption Measures						
Cocaine Use Frequency	-0.036 (0.019)	0.964 (0.930 - 1.000)	0.050	0.014 (0.016)	1.014 (0.984 - 1.046)	0.356
Simultaneous Cocaine & Alcohol Use Frequency	0.102 (0.086)	1.107 (0.935 - 1.311)	0.239	-0.052 (0.070)	0.949 (0.828 - 1.088)	0.455

Table 15 (Continued)

	Males (N = 183)			Females (N = 187)		
	Estimated Regression Coefficient (Standard Error)	**Odds Ratio (95% CI)**	**P-Value**	**Estimated Regression Coefficient (Standard Error)**	**Odds Ratio (95% CI)**	**P-Value**
Drug Consumption Measures						
Number of Other Drugs Used Per Week	0.351 (0.110)	1.420 (1.145 - 1.761)	**0.001**	0.235 (0.108)	1.265 (1.023 - 1.564)	**0.030**
Personality Traits						
Impulsivity/Risk-Taking		Eliminated			Eliminated	
Aggressive Personality	0.109 (0.021)	1.116 (1.070 - 1.163)	**<.001**	0.069 (0.018)	1.072 (1.035 - 1.110)	**<.001**
Mental Health Indicators						
Depression		Eliminated			Eliminated	
Anxiety		Eliminated			Eliminated	
Paranoia		Eliminated			Eliminated	

Table 16. Adjusted relative risks of violence during past 12 months associated with personality traits and mental health indicators while controlling for demographics and drug consumption measures by total sample

	Total Sample (N = 370)		
	Estimated Regression Coefficient (Standard Error)	**Relative Risk (95% CI)**	**P-Value**
Demographic Factors			
Age	0.011 (0.006)	1.011 (0.998 - 1.023)	0.093
Sex			
Females (Reference)	-	-	-
Males	-0.191 (0.115)	0.826 (0.660 - 1.034)	0.095
Marital Status			
Married/Living Together (Reference)	-	-	-
Widowed/Divorced/Separated/Separated & Living Together	0.169 (0.159)	1.185 (0.868 - 1.618)	0.287
Single/Never Married	0.098 (0.141)	1.103 (0.837 - 1.455)	0.487
Household Income			
=/> 50,000 (Reference)	-	-	-
=/> 20,000 but < 50,000	-0.136 (0.145)	0.873 (0.657 - 1.158)	0.345
< 20,000	-0.206 (0.132)	0.814 (0.628 - 1.055)	0.120
Drug Consumption Measures			
Cocaine Use Frequency	-0.005 (0.005)	0.995 (0.985 - 1.005)	0.330
Simultaneous Cocaine & Alcohol Use Frequency	0.001 (0.022)	1.001 (0.959 - 1.045)	0.972
Number of Other Drugs Used Per Week	0.117 (0.029)	1.124 (1.063 - 1.189)	**<.001**
Personality Traits			
Aggressive Personality	0.042 (0.006)	1.043 (1.031 - 1.055)	**<.001**

Table 17. Adjusted relative risks of violence during past 12 months associated with personality traits and mental health indicators while controlling for demographics and drug consumption measures by males and females

	Males (N = 183)			Females (N = 187)		
	Estimated Regression Coefficient (Standard Error)	**Relative Risk (95% CI)**	**P-Value**	**Estimated Regression Coefficient (Standard Error)**	**Relative Risk (95% CI)**	**P-Value**
Demographic Factors						
Age	0.021 (0.009)	1.021 (1.004 - 1.039)	**0.018**	-0.005 (0.010)	0.995 (0.976 - 1.015)	0.642
Marital Status						
Married/Living Together (Reference)	-	-	-	-	-	-
Widowed/Divorced/ Separated/Separated & Living Together	0.144 (0.226)	1.155 (0.742 - 1.800)	0.523	0.208 (0.238)	1.231 (0.773 - 1.962)	0.382
Single/Never Married	0.240 (0.233)	1.271 (0.806 - 2.005)	0.302	0.032 (0.183)	1.032 (0.721 - 1.477)	0.863
Household Income						
=/> 50,000 (Reference)	-	-	-	-	-	-
=/> 20,000 but < 50,000	-0.113 (0.196)	0.893 (0.608 - 1.312)	0.564	-0.131 (0.219)	0.878 (0.572 - 1.347)	0.550
< 20,000	-0.151 (0.190)	0.860 (0.593 - 1.247)	0.425	-0.225 (0.179)	0.799 (0.562 - 1.135)	0.210
Drug Consumption Measures						
Cocaine Use Frequency	-0.016 (0.008)	0.984 (0.970 - 0.999)	**0.036**	0.006 (0.008)	1.006 (0.991 - 1.022)	0.444
Simultaneous Cocaine & Alcohol Use Frequency	0.024 (0.031)	1.025 (0.964 - 1.089)	0.438	-0.020 (0.032)	0.980 (0.921 - 1.042)	0.517

Table 17 (Continued)

	Males (N = 183)			Females (N = 187)		
	Estimated Regression Coefficient (Standard Error)	**Relative Risk (95% CI)**	**P-Value**	**Estimated Regression Coefficient (Standard Error)**	**Relative Risk (95% CI)**	**P-Value**
Drug Consumption Measures						
Number of Other Drugs Used Per Week	0.130 (0.038)	1.139 (1.056 - 1.227)	**<.001**	0.096 (0.047)	1.100 (1.003 - 1.206)	**0.042**
Personality Traits						
Aggressive Personality	0.051 (0.009)	1.052 (1.035 - 1.070)	**<.001**	0.034 (0.008)	1.035 (1.018 - 1.052)	**<.001**

Objective 2.4: To test for multiplicative interactions of sex by demographics, drug consumption measures, personality traits and mental health indicators in models explaining violence among cocaine and simultaneous cocaine and alcohol abuse treatment clients.

Logistic regression with backward elimination procedures were executed to identify multiplicative interaction effects between sex and each of the demographics, drug consumption measures, personality traits and mental health indicators in models explaining violence during the past 12 months. The results of this analysis are available in Table 18. Satisfactory data fit was achieved within this statistical model as indicated by the Hosmer–Lemeshow goodness of fit test ($p = 0.305$). Overall, there were no statistically significant multiplicative interactions between sex and these variables, as all of the interaction terms were eliminated in subsequent steps of the statistical procedure after the main effects of demographics, drug consumption measures, personality traits and mental health indicators were forced in the model.

Table 18. Results from logistic regression with backward elimination procedures assessing multiplicative sex interactions between each of demographics, drug consumption measures, personality traits and mental health indicators and violence during the past 12 months

	Total Sample (N = 370)		
	Estimated Regression Coefficient (Standard Error)	**Odds Ratio (95% CI)**	**P-Value**
Demographic Factors			
Age	0.026 (0.015)	1.026 (0.997 - 1.056)	0.076
Sex			
Females (Reference)			
Males	-0.386 (0.255)	0.680 (0.412 - 1.120)	0.129
Marital Status			
Married/Living Together (Reference)			
Widowed/Divorced/Separated/Separated & Living Together	0.290 (0.353)	1.336 (0.669 - 2.670)	0.412
Single/Never Married	0.203 (0.310)	1.225 (0.667 - 2.250)	0.514
Household Income			
=/> 50,000 (Reference)			
=/> 20,000 but < 50,000	-0.314 (0.316)	0.730 (0.393 - 1.357)	0.320
< 20,000	-0.417 (0.292)	0.659 (0.372 - 1.169)	0.154
Drug Consumption Measures			
Cocaine Use Frequency	-0.009 (0.012)	0.991 (0.969 - 1.014)	0.449
Simultaneous Cocaine & Alcohol Use Frequency	0.0005 (0.053)	1.000 (0.901 - 1.110)	0.993
Number of Other Drugs Used Per Week	0.273 (0.075)	1.314 (1.136 - 1.521)	**<.001**
Personality Traits			
Impulsivity/Risk-taking	-0.019 (0.034)	0.981 (0.918 - 1.048)	0.570
Aggressive Personality	0.085 (0.014)	1.089 (1.059 - 1.119)	**<.001**
Mental Health Indicators			
Depression	0.014 (0.035)	1.014 (0.946 - 1.086)	0.697
Anxiety	0.006 (0.031)	1.006 (0.947 - 1.070)	0.838
Paranoia	0.015 (0.028)	1.015 (0.960 - 1.072)	0.605

Table 18 (Continued)

	Total Sample (N = 370)		
	Estimated Regression Coefficient (Standard Error)	**Odds Ratio (95% CI)**	**P-Value**
Sex Interaction Terms			
Age x Sex	Eliminated		
Marital Status x Sex	Eliminated		
Household Income x Sex	Eliminated		
Cocaine Use Frequency x Sex	Eliminated		
Simultaneous Cocaine & Alcohol Use Frequency x Sex	Eliminated		
Number of Other Drugs Used Per Week x Sex	Eliminated		
Impulsivity/Risk-taking x Sex	Eliminated		
Aggressive Personality x Sex	Eliminated		
Depression x Sex	Eliminated		
Anxiety x Sex	Eliminated		
Paranoia x Sex	Eliminated		

4.5 Sensitivity analysis

Multiple imputation procedures were conducted for the multivariable models as part of a sensitivity analysis despite the low rates of missingness in the present sample. The results of this sensitivity analysis are available in Appendix F. These procedures failed to demonstrate any notable differences from the findings obtained without multiple imputation procedures. Hence, results were presented from the complete case analysis.

Chapter 5

5 Discussion

The present study assessed violence in a sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients using data obtained from the Patterns and Consequences of Cocaine and Alcohol Use for Substance Abuse Treatment Clients Study. The purpose of the study was to test proposed hypotheses, address several methodological limitations of previous studies, contribute towards narrowing the knowledge gap in the literature, improve treatment and ultimately prevent future violence within this population.

There were two primary objectives of this present study. The first of these aimed to conduct an assessment of the extent of violence within this sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients. Specifically, the proportion of treatment clients reporting violence during the past 12 months was estimated, which was characterized further by sex. This objective was accomplished by calculating the proportion of this outcome within this sample. Furthermore, cross-tabulations with sex were conducted to obtain the sex-specific estimates, which were compared with each other using a Pearson's chi-square test.

The second objective of the present study was to identify factors associated with violence during the past 12 months within this sample of cocaine and simultaneous cocaine and alcohol abuse treatment clients for the total sample and males and females separately. This objective was attained by first calculating descriptive statistics and comparing these estimates using t-tests and chi-square tests to identify characteristics associated with violence during the past 12 months for the total sample and for males and females separately. Next, unadjusted and adjusted risks of violence during the past 12 months were estimated for the total sample and males and females separately using logistic regression with backward elimination procedures and modified Poisson regression. Part of the second objective was to assess whether correlates of violence were different for males and females. Hence, multiplicative interactions of sex by all study variables of

interest were tested using logistic regression with backward elimination procedures and modified Poisson regression.

5.1 Consideration of findings

5.1.1 Extent of violence

The proportion of cocaine and simultaneous cocaine and alcohol abuse treatment clients that reported violence during the past 12 months in the present sample was estimated to be 44.2%. Overall, this estimate is similar to the results of previous research, as studies have generally characterized this proportion to range between 32% and 50% (Chermack & Blow, 2002; Chermack, Booth, et al., 2006; Chermack et al., 2010; Macdonald et al., 2008). Moreover, this estimate is comparable to studies that have only examined substance use disorder treatment clients with problems pertaining to cocaine use (Lee et al., 1997; Paim Kessler et al., 2012). For example, 38% of treatment clients entering treatment for cocaine dependence reported partner violence in the study conducted by Lee et al. (1997).

There was no significant difference between men and women in the proportion of treatment clients that reported violence during the past 12 months (43% and 45%, respectively). This finding is not entirely surprising, as the substance use disorder treatment population constitutes a group of high-risk individuals. Sex differences in violence that are observed in the general population may not be generalizable to this population specifically. Some evidence suggests that men and women in substance use disorder treatment closely resemble each other with respect to substance use problems and consequences (Imtiaz et al., manuscript in preparation). However, it is important to note that whether sex differences are found in the extent of violence may also depend on the type of violence assessed. For example, one study documented that men reported significantly higher rates of violence perpetration and victimization than women for most relationship types with the exception of partner violence (Chermack et al., 2001). Unfortunately, the present research did not distinguish between these specific typologies of violence. Therefore, sex differences that may exist in the extent of violence were not detected due to insufficient information regarding the type of violence.

5.1.2 Factors associated with violence

The next primary objective of the present study was to assess factors that were associated with violence during the past 12 months. In particular, contributions of personality traits and mental health indicators towards explaining this outcome in both bivariate and multivariable models were examined.

5.1.2.1 Personality traits

The results indicated a strong role of personality traits in explaining violence within the substance use disorder treatment population. The bivariate analyses involving the total sample illustrated that both impulsivity/risk-taking and aggressive personality were associated with violence. This pattern of findings is consistent with the results of previous research that have examined these correlates (Barrett et al., 2011; Easton et al., 2008; Macdonald et al., 2008; Roozen et al., 2011). For example, treatment clients who reported violence scored significantly higher mean scores than their non-violent counterparts on the impulsivity/risk-taking and aggressive personality scales in a study conducted by Macdonald et al. (2008).

However, it was important to assess whether these correlates of violence remained significant in multivariable models after adjusting for other correlates including demographics, drug consumption measures and mental health indicators. Aggressive personality maintained statistical significance in such models. These findings are also consistent with the study performed by Macdonald et al. (2008), as both impulsivity/risk-taking and aggressive personality were associated with violence in their bivariate analyses, but only aggressive personality maintained statistical significance after adjustment in multivariable models. It was not possible to compare the magnitude of the findings between the two studies, as the study conducted by Macdonald et al. (2008) did not report the odds ratios. However, the magnitude of the findings from the present study pertaining to aggressive personality compared favorably with that reported by Barrett et al. (2011) in their assessment of participants with concomitant substance use disorders and posttraumatic stress disorder (OR: 1.09, 95% CI: 1.06-1.12 vs. OR: 1.16, 95% CI: 1.04-1.30, respectively).

The observed association between aggressive personality and violence may be attributed to a treatment client's provocative and escalatory behaviours in interpersonal conflicts that stem from an underlying aggressive personality (Wells et al., 2011b). However, the lack of association between impulsivity/risk-taking and violence in multivariable models warrants comment even though our findings are consistent with prior literature. This lack of an association may be due to the medium statistically significant intercorrelation between impulsivity/risk-taking and aggressive personality ($r = 0.346$, $p < 0.001$). Therefore, the relationship of impulsivity/risk-taking with violence may be partly explained by its association with aggressive personality.

5.1.2.2 Mental health indicators

The results illustrated a limited role of mental health indicators in explaining violence within the substance use disorder treatment population. Depression, anxiety and paranoia were found to be associated with violence in the bivariate analyses. The relationships between depression and paranoia with violence are consistent with prior research (Chermack et al., 2008; Lee et al., 1997; Murray et al., 2008; Perron et al., 2008). For example, two studies conducted by Chermack et al. (2008) and Murray et al. (2008) demonstrated statistically significant correlations between depression symptomatology and violence perpetration and victimization in samples of substance use disorder treatment clients. Similarly, elevated levels of paranoid ideation were observed in cocaine-dependent batterers as compared to cocaine-dependent non-batterers in a study conducted by Lee et al. (1997). However, this was not entirely the case for the bivariate findings pertaining to the role of anxiety in explaining violence. For example, diagnosis of generalized anxiety disorder was found to be associated with violence victimization in a study conducted by Perron et al. (2008), which is consistent with the present study's results. On the other hand, two studies conducted by Lee et al. (1997) and Barrett et al. (2011) reported null findings with respect to an association between anxiety and violence. This lack of an association may be better explained by the type of violence examined by Lee et al. (1997). In their research, only partner violence was assessed as supposed to the more general form of violence assessed in the present study. Differences in the nature of the samples may also explain the conflicting findings with the present study. Barrett et al.

(2011) used a strict inclusion criterion in their research that included participants with concomitant posttraumatic stress disorder and substance use disorders. Therefore, detection of an association between anxiety and violence would have been difficult, given the minimal variability in the measures of state and trait anxiety due to the nature of the sample.

Surprisingly, none of the mental health indicators included in the present study maintained statistical significance after adjustment for demographics, drug consumption measures and personality traits in the multivariable models. This finding is not consistent with previous research. For example, Chermack et al. (2008) and Murray et al. (2008) documented significant associations between depression symptomatology and occurrence of violence perpetration and victimization even after adjustment for a range of other variables. However, these studies did not account for the contribution of personality traits in their multivariable models. Furthermore, it was not possible to compare the results pertaining to the role of anxiety and paranoia towards explaining violence in multivariable analyses, as to our knowledge no other study has previously examined these correlates in multivariable models within this population.

Overall, the role of mental health indicators in explaining violence within the substance use disorder treatment population cannot be completely ruled out given the inconsistencies in the literature. Thus, further research is needed examining associations with specific types of violence. Treatment clients with symptoms of mental health problems may be at an increased risk of violence due to characteristics associated with such problems including anger, abnormal emotional regulation, distorted interpretations and exaggerated reactions (Esbec & Echeburua, 2010; Neumann et al., 2010; Painuly et al., 2005). However, it is also possible that mental health problems may emerge as a consequence of exposure to violence (Devries et al., 2013). It was impossible to determine the direction of these associations in the present study given its cross-sectional design. Most importantly, the associations between mental health indicators and violence diminished in the presence of number of other drugs used per week and aggressive personality. It is possible that number of other drugs used per week and aggressive personality partly accounted for the effects of these mental health indicators in

multivariable models, given their significant intercorrelations with each other. For example, the intercorrelations between depression, anxiety, and paranoia and aggressive personality were $r = 0.173$ ($p < 0.001$), $r = 0.241$ ($p < 0.001$) and $r = 0.251$ ($p < 0.001$), respectively.

5.1.2.3 Demographics and drug consumption measures

The findings pertaining to demographic factors and drug consumption measures deserve comment even though they were not the focus of the present study. The results of the analyses revealed that only number of other drugs used per week was significantly associated with violence in both bivariate and multivariable analyses among all other demographics (age, sex, marital status and household income) and drug consumption measures (cocaine use frequency and simultaneous cocaine and alcohol use frequency). Notably, number of other drugs used per week demonstrated its statistical influence, as the magnitude of the relative risk for this particular correlate surpassed that of any other variable in the study in both bivariate and multivariable analyses.

It was not possible to compare the finding pertaining to number of other drugs used per week with other studies in the literature, as to our knowledge previous research has mainly assessed the contribution of individual substances in explaining violence rather than developing a composite measure that captures the extent of other substance use. However, this particular finding is not entirely surprising as previous literature has demonstrated associations between a number of substances and violence including marijuana, sedative hypnotics, methamphetamines, opioids and hallucinogens (Boles & Miotto, 2003; Murray et al., 2008). Furthermore, the lack of statistically significant associations observed for the remaining demographics and drug consumption measures in bivariate and multivariable analyses is not entirely consistent with prior findings from the literature. Several reasons may be proffered to explain these lack of associations. First, many studies on violence within the substance use disorder treatment population have utilized convenience samples given the inherent difficulties associated with the use of random sampling procedures for this population. Therefore, findings from these samples may not necessarily be generalizable to the population. Additionally, most studies have utilized heterogeneous samples of substance use disorder treatment clients rather than

focusing specifically on treatment clients with problems pertaining to cocaine use. This is particularly relevant in the case of drug consumption measures as both groups (violent vs. non-violent treatment clients) in the present study reported similar cocaine consumption patterns. Therefore, the homogeneity of the present sample with respect to the type of substance abuse problem may be responsible for mitigating differences in demographics and drug consumption patterns.

Evidence from the present study suggests an important role of the extent of other substance use in the likelihood of experiencing violence among this population. However, this relationship may be a reflection of the overall severity of substance use problems experienced by treatment clients as attributable to their substance use. The tripartite conceptual framework developed by Goldstein may be particularly relevant in explaining these findings (Goldstein, 1985). For example, alcohol, cocaine and crack were most frequently implicated in incidents of violence in a study that sought to characterize such incidents by Goldstein's tripartite conceptual framework among substance use disorder treatment clients (Erickson et al., 2009). This study mainly documented the psychopharmacological model in explaining incidents of violence among the sample (Erickson et al., 2009). However, there was evidence for the other two models of the tripartite conceptual framework as well (Erickson et al., 2009). Incidents of violence categorized as economically compulsive were predominated by conflicts between partners as they struggled with the shortage of drugs (Erickson et al., 2009). On the other hand, incidents of violence categorized as systemic were predominated by events when treatment clients visited risky locations to purchase drugs (Erickson et al., 2009). As such, treatment clients with greater severity of substance use problems may experience violence more often through one or more of the models postulated by Goldstein et al. (1985).

5.1.3 Sex differences in correlates of violence

Part of the second primary objective of the present study was to assess sex differences in the correlates of violence across all domains of risk including demographics, drug consumption measures, personality traits and mental health indicators.

5.1.3.1 Demographics

There was no evidence of multiplicative interaction by sex between demographics (age, marital status and household income) and violence in the present study. These findings are consistent with the results obtained by Chermack et al. (2001) in their assessment of substance use disorder treatment clients, as they found no evidence of statistically significant multiplicative interactions by sex between age, marital status and income and violence perpetration and victimization.

Moreover, there were no differences in the pattern of findings between males and females in the associations between demographics and violence based on the sex-stratified bivariate and multivariable analyses with the exception of one surprising finding. Specifically, age was positively associated with an increased likelihood of violence for males, but only after adjustment for other correlates in multivariable models that included drug consumption measures, personality traits and mental health indicators. The direction of this association contradicts the literature on this topic within this population, which has mainly shown a negative association between age and violence (Chermack & Blow, 2002; Chermack et al., 2008; Murray et al., 2008). To our knowledge, only one study conducted by Schneider et al. (2009) also reported positive associations between age and violence for both males and females. Furthermore, comparison of the sex-stratified results pertaining to marital status and household income was not possible, as previous studies have not examined the relationships between these demographics and violence through sex-stratification.

Long-standing substance use problems among male treatment clients may account for the unexpected positive association between age and violence. This may be a consequence of increased opportunities for such occurrences or chronic impairments in health, which would be reflected in age. However, this was probably not the case in the present study as null findings were obtained in the bivariate analyses. Overall, these findings do not provide support for differences between males and females with respect to the associations between demographics and violence.

5.1.3.2 Drug consumption measures

No evidence of multiplicative interaction by sex between drug consumption measures (cocaine use frequency, simultaneous cocaine and alcohol use frequency and number of other drugs used per week) and violence was found in the present study. The nonsignificant multiplicative interaction by sex between acute cocaine usage and violence found by Chermack et al. (2010) is consistent with the findings of the present study. However, it was not possible to compare the results pertaining to multiplicative interaction by sex between simultaneous cocaine and alcohol use frequency and number of other drugs used per week and violence given that this has not been previously addressed within this population.

There were some differences in the patterns of findings between males and females in the associations between drug consumption measures and violence based on the sex-stratified analyses. Number of other drugs used per week was significantly associated with violence for males and females in both bivariate and multivariable analyses. Furthermore, simultaneous cocaine and alcohol use frequency was found to be uniquely associated with increased likelihood of violence among males in the bivariate analysis, despite the lack of evidence for multiplicative interaction by sex. This finding was not completely unexpected as it is consistent with the results of another study that documented a multiplicative interaction between cocaine and alcohol use frequency in the prediction of violence (Chermack & Blow, 2002). However, simultaneous cocaine and alcohol use frequency was nonsignificant for both males and females after adjustment for other correlates in multivariable models including demographics, personality traits and mental health indicators.

Interestingly, a negative association between cocaine use frequency and violence was observed only for males in the multivariable analyses. The direction of this association contradicts much of the literature, as only null or positive associations have been documented previously within this population. This relationship may be explained by the statistically significant intercorrelation observed between cocaine use frequency and simultaneous cocaine and alcohol use frequency ($r = 0.254$, $p < 0.05$) for males. This may particularly be the case given that the association between simultaneous cocaine and

alcohol use frequency and violence became nonsignificant in multivariable analyses. Additional analyses were also performed to further assess this unexpected negative association found in the multivariable model for males. Specifically, associations between cocaine use and violence were examined by methods of administration. A negative association between crack smoking frequency and violence was found unlike the other methods of administration. Therefore, another possible explanation for this protective association may lie in the physiological effects produced by crack smoking. Crack smoking typically produces effects that are more instantaneous and intense as compared to powder cocaine (Morton, 1999). Moreover, discontinuation of crack smoking produces craving for the substance, which is more likely to be present in the case of this method of administration as compared to others (Da Silveira, Doering-Silveira, Niel, & Jorge, 2006). Male treatment clients may engage in high-risk activities that increase their likelihood of violence to obtain crack to alleviate their craving. Therefore, reductions in frequency of crack smoking may bring around elevated levels of craving, which may subsequently increase likelihood of involvement in violent activities. Therefore, the elevated levels of craving may be responsible for the protective association observed between crack smoking frequency and violence.

Comparison of the sex-stratified results pertaining to these drug consumption measures with other studies was not possible, as this has not been addressed previously within this population. Overall, further research is needed to determine whether males and females differ in terms of the associations between drug consumption measures and violence, given that no evidence of multiplicative interaction by sex was found, but sex-specific analyses yielded different effects.

5.1.3.3 Personality traits

The examination of multiplicative interactions by sex between personality traits (impulsivity/risk-taking and aggressive personality) and violence yielded null results. Once again, comparison of these findings with the literature was not possible, as previous studies have not examined these multiplicative interactions by sex between personality traits and violence among substance use disorder treatment clients previously.

The results of the sex-stratified analyses illustrated some differences in the patterns of findings between males and females in the associations between personality traits and violence. Impulsivity/risk-taking was only associated with violence for males, while aggressive personality was associated with violence for both males and females in the bivariate analyses. However, the finding pertaining to impulsivity/risk-taking observed for males became nonsignificant in multivariable models that adjusted for other correlates including demographics, drug consumption measures and mental health indicators. Attenuation of this relationship may be partly explained by the statistically significant intercorrelation between impulsivity/risk-taking and aggressive personality ($r = 0.319$, $p < 0.001$) observed for males. On the other hand, aggressive personality was associated with violence for both males and females in the multivariable analyses. Comparison of these sex-stratified results pertaining to impulsivity/risk-taking and aggressive personality with previous literature was not possible, as other studies have not examined the relationships between these personality traits and violence through sex-stratification. Overall, these findings suggest further research is needed to ascertain whether the associations between personality traits and violence differ across males and females, given the lack of statistically significant multiplicative interactions by sex, but differences in the pattern of findings in the sex-stratified analyses.

5.1.3.4 Mental health indicators

The examination of multiplicative interactions by sex between mental health indicators (depression, anxiety and paranoia) and violence yielded null results. Comparison of these findings from the present study was not possible, as previous studies have not examined multiplicative interactions by sex these between mental indicators and violence.

There were differences in the patterns of findings between males and females in the associations between mental health indicators and violence based on the sex-stratified analyses. The bivariate analyses illustrated that anxiety and paranoia increased the likelihood of violence uniquely for males, while only depression increased the likelihood of violence for females. The bivariate association between depression symptomatology and violence observed for females should be interpreted cautiously, as it was only marginally significant ($p = 0.048$). None of the mental health indicators maintained

statistical significance after adjustment for demographics, drug consumption measures and personality traits in multivariable models for both males and females. Interestingly, results from the bivariate and multivariable analyses of the present study appear to contradict findings obtained by Schnedier et al. (2009) in their sex-stratified assessment of violence victimization among a sample of substance use disorder treatment clients. In their research, both anxiety and depression were associated with violence victimization in bivariate and multivariable analyses for both males and females (Schneider et al., 2009). However, it is important to note that these authors used measures of mental health indicators that have not been validated (Schneider et al., 2009). Additionally, they assessed measures of violence victimization specifically (Schneider et al., 2009), whereas the present study measured any personal involvement in violence without distinguishing between perpetration and victimization. Therefore, it is possible that these mental health symptoms are more strongly linked to victimization than perpetration, and hence a measure of any personal involvement in violence that includes both victimization and perpetration masks this association.

Evidence regarding differences in mental health problems among males and females in substance use disorder treatment is mixed. For example, some studies have found no differences in depressive symptomology among males and females in substance use disorder treatment (Kosten, Gawin, Kosten, & Rounsaville, 1993), while other studies have suggested that females are more likely than males to report depressive symptomology (McCance-Katz, Carroll, & Rounsaville, 1999). Males as compared with females in substance use disorder treatment may experience greater difficulty in coping with anxiety and paranoia. This may account for the uniquely increased likelihood of violence among males with elevated symptomatology of anxiety and paranoia. Additionally, a recent systematic review and meta-analysis of depression, suicide and partner violence suggested that depressive symptomatology may impact an individual's partner selection (Devries et al., 2013). Specifically, individuals with depressive symptomatology may be accepting of behaviours that predispose their partners to use violence in their relationships (Devries et al., 2013). This may be the case for females in substance use disorder treatment particularly, as the results of the meta-analysis indicated that depressive symptomatology was associated with incident partner violence for

females (OR: 1.93, 95% CI: 1.51-2.48) but not for males (Devries et al., 2013). Importantly, the respective bivariate sex-stratified relationships between the mental health indicators and violence diminished for both males and females after adjustment for demographics, drug consumption measures and personality traits in multivariable models. This may be explained by the intercorrelations between depression, anxiety and paranoia and aggressive personality for males ($r = 0.157$, $p < 0.05$; $r = 0.231$, $p < 0.05$; and $r = 0.290$, $p < 0.001$, respectively) and females ($r = 0.211$, $p < 0.05$; $r = 0.255$, $p < 0.001$; and $r = 0.199$, $p < 0.05$, respectively). Overall, these inconsistent findings suggest that further research is needed to determine whether males and females differ with respect to the associations between mental health indicators and violence.

5.1.3.5 Conclusion

Overall, findings from the present study lend support to Hoaken et al.'s (2003) postulation that individuals who abuse psychostimulants are likely to exemplify violent behaviour due to underlying antisocial personality disorder or psychopathy, impulse control impairments and aggressive tendencies. There is also evidence from the present study to support that there may be multi-causal explanations for violence beyond the psychopharmacological effects of substances as has been suggested elsewhere in the literature (Hoaken & Stewart, 2003; Macdonald et al., 2003; Macdonald et al., 2008).

Furthermore, the assessment of multiplicative interactions by sex suggest lack of evidence for differences between males and females in terms of the correlates that explain violence within this population. This reinforces the theme that sex differences in substance use disorder treatment clients may be less apparent than in the general population given that they are a high-risk or vulnerable population (Imtiaz et al., manuscript in preparation). However, future research on sex differences in correlates of violence is needed, given some conflicting findings in the pattern of results from the sex-specific analyses.

5.2 Clinical implications

Substance use disorder treatment programs represent an ideal window of opportunity for targeted prevention and treatment initiatives aimed towards curbing violence within this population (Chermack et al., 2009; Schumacher, Fals-Stewart, & Leonard, 2003). However, evidence indicates that not only is comprehensive assessment of violence missing from substance use disorder treatment programs, but referral to other treatment initiatives is also limited (Schumacher et al., 2003). For example, one study found that only 17% of 658 treatment clients who reported partner violence during the year prior to initiating treatment were referred to domestic violence treatment initiatives in a sample of alcohol use disorder treatment clients (Schumacher et al., 2003). Similarly, another review documented that less than 2% of treatment clients belonging to multiple substance abuse treatment programs were concurrently enrolled in a legally mandated domestic violence intervention program as well (Klostermann, 2006). These findings in consolidation with the results of the present study pertaining to the extent of violence suggest routine and systematic assessment of violence within this population. Moreover, the important role of aggressive personality in explaining violence suggests that assessment for this personality trait in substance abuse treatment programs may be useful for identifying treatment clients with an increased likelihood of violence, which has been suggested previously in the literature (Schumm, O'Farrell, Murphy, Murphy, & Muchowski, 2011). Identification of treatment clients at an increased risk for violence could be used to guide appropriate assignment to violence prevention and intervention initiatives.

Furthermore, prevention initiatives have been developed to address partner violence in substance use disorder treatment programs. For example, behavioral couples therapy is a clinically proven intervention for preventing this specific form of violence among this population (Chermack et al., 2009; Klostermann, 2006). Prevention initiatives aimed towards reducing other forms of violence within substance use disorder treatment clients may also be needed (Chermack et al., 2009). However, it is important to identify factors associated with violence within this population to better understand the treatment needs of these clients as pointed out by Chermack et al. (2009). The results of the present study

pertaining to the correlates of violence might be considered in the design, testing and implementation of future violence prevention initiatives (Chermack et al., 2009). For example, prevention initiatives may benefit by incorporating components that address attitudes about the normality and acceptability of violence given our findings pertaining to aggressive personality.

5.3 Study strengths

There were several strengths of the present study that deserve mention. This study makes an important contribution to the previous literature on this topic within this population by addressing several methodological limitations and knowledge gaps. For example, the sample was restricted to substance abuse treatment client with problems pertaining to cocaine, which is in contrast to much of the previous literature. This allows for the control of extraneous variables relating to other substance use problems. Moreover, validated scales were utilized to measure the primary explanatory variables of interest, unlike some previous research (e.g. Schneider, et al., 2009). It is critical to use validated research instruments to ensure adequate measurement, and thus, develop accurate estimates of associations among study variables. Furthermore, in comparison to most studies in the existing literature (Chermack & Blow, 2002; Chermack, et al., 2010; Chermack, et al., 2008), the role of personality traits in addition to a range of mental health indicators was examined. This assessment is essential given that several studies in the literature have hypothesized multi-causal explanations of violence within the substance use disorder treatment population. Finally, individual contributions of all explanatory variables were examined by constructing multivariable models. Some studies in the existent literature have only assessed the contribution of these explanatory variables to violence without the adjustment for other correlates (Lee, et al., 1997; Roozen, et al., 2011). This is particularly important as it facilitates examination of the importance of all correlates in relation to each other.

In addition, a moderate sample size with an equal number of men and women was utilized, which is attributable to the quota sampling strategy used. This characteristic is

distinctive of the present study as several pervious assessments of violence, including those examining sex differences, among substance use disorder treatment clients have often utilized small or predominantly male samples (Chermack, et al., 2010; Chermack, et al., 2008; Chermack, et al., 2009; Lee, et al., 1997; Murray, et al., 2008). For example, the study conducted by Chermack et al. (2010) that assessed multiplicative interactions by sex comprised of 178 treatment clients among whom 77% were males. Thus, the study was likely underpowered to detect multiplicative interaction effects.

Finally, data were collected from five treatment agencies in Ontario and British Columbia. Some studies in the literature have utilized samples from single treatment agencies or treatment agencies belonging to particular jurisdictions (Chermack, et al., 2009; Lee, et al., 1997; Murray, et al., 2008). This limits the generalizability of their findings as undetected biases may be present as a consequence of geographical location. The multi jurisdiction and treatment agency design of the present study enhances the representativeness of the sample, which will assist in generalizing the findings from the present study.

5.4 Study limitations

There were also several limitations of the present study despite the strengths noted previously. A key limitation relates to the measurement of the outcome variable. The measurement of violence reflected personal involvement in such an incident, but did not distinguish between the relationship type, i.e. partner or non-partner. Some research indicates that correlates of violence are different depending on the relationship type examined (Chermack, et al., 2000; Chermack, et al., 2010; Chermack, et al., 2001). This distinction between relationship type may be especially important when attempting to assess sex differences in correlates of violence, as some evidence indicates that women in substance use disorder treatment are especially likely to be involved in partner violence (Chermack et al., 2001). Therefore, sex differences in correlates of violence may have been masked due to the inability to distinguish between relationship types.

Likewise, another key aspect of violence pertains to the individual's role, i.e. perpetrator or victim. Sex differences in correlates of violence may have been minimized due to an inability to distinguish between perpetrators and victims of violence. For example, some evidence suggests that females may develop mental health problems as a consequence of violence victimization, while males may be involved in violence perpetration due to underlying personality traits that predispose them towards violence (Graham et al., 2012; Wells et al., 2011b). The Patterns and Consequences of Cocaine and Alcohol Use for Substance Abuse Treatment Clients Study collected data on the role of the participant in the most recent incident of violence. Frequency analysis of these particular data categorized 7.5% (N = 30) of treatment clients as perpetrators, 14.7% (N = 59) as victims and 21.6% (N = 87) as both. However, it was not possible to assess correlates of violence by role within the present study due to the inadequate sample size. Importantly, researchers have noted that the distinction between victims and perpetrators is not always clear because violence often develops as part of an escalating process involving a series of actions and reactions. It is thus, some evidence suggests that victims and perpetrators of violence share many attributes (Murray et al., 2008).

Similarly, the measurement of violence did not assess severity. Evidence suggests that sex differences may be pronounced when measurements of violence that take severity into account are used. For example, some studies have implicated the male sex for its association with violence including injuries (Chermack, et al., 2010; Chermack, et al., 2009; Murray, et al., 2008). It is thought that violence involving males is generally greater in severity, which is more likely to result in injuries. Therefore, an inability to account for severity of violence might have contributed towards the lack of sex differences in the correlates of violence observed in the present study.

Additionally, no information pertaining to motivational or contextual factors associated with violence was collected in the present study. As pointed out by Chermack et al. (2002), assessment of such factors would facilitate examination of the complex interplay between various domains of risk and violence. In addition, important sex differences may also be elucidated in the examination of such correlates (Chermack, et al., 2000). For example, violence perpetrated by females may be defensive in nature as compared to

males (Chase, O'Farrell, Murphy, Fals-Stewart, & Murphy, 2003). Therefore, future research should explore these factors to obtain a thorough understanding of violence within this population.

Furthermore, there were limitations with the sampling strategy employed in the present study even though it is used most commonly in research on substance abuse treatment population. Specifically, the study did not utilize a random probability sampling procedure. Therefore, not every individual within the sampling frame had an equal probability of being included in the study. Hence, this limits the generalizability of the findings given the obvious dangers to the representativeness of the sample. It is possible that findings may only be characteristic of the sample rather than the target population. On a similar note, considerable heterogeneity existed among the treatment agencies that participated in the present study with respect to criteria for entrance into the treatment programs, treatment goals and treatment methodology (see Appendix A for further details on the treatment agencies). Thus, treatment clients may have varied in characteristics across treatment agencies. These differences between treatment agencies may have influenced the present findings.

Moreover, a cross-sectional study design was used in the present study to address the research objectives. This particular study design limits the ability to make causal inferences due to the lack of temporality. For example, it is very possible that mental health problems followed rather than preceded incidents of violence, as has been discussed when examining the link between partner violence and depression (Devries et al., 2013). Thus, caution should be taken when interpreting associations among the study variables. Longitudinal research is needed to better understand the etiology of violence in the substance use disorder treatment population.

What's more, the self-report nature of the data collected is prone to recall and social desirability biases. As suggested by Murray et al. (2008), it would be ideal to corroborate self-reported measures of violence with other data sources such as criminal records to address some of these biases. However, this was not possible in the present study. Notably, previous research indicates that, compared with general population samples,

data obtained from samples of treatment clients is less likely to be prone to threats to internal validity. For example, substance use is less likely to be underreported by treatment clients as compared to the general population, as they recognize their problems pertaining to substance use (Macdonald, 1987).

Another limitation is that a number of measures shown to be important in relation to violence were excluded from the present study. For example, only the physical aggression subscale from the Aggression Questionnaire was used in the present study. Some research indicates unique associations between other subscales of the Aggression Questionnaire and violence within this population (Barrett, et al., 2011). An inability to assess these other subscales hinders a comprehensive understanding of the contribution of trait aggression to violence. Furthermore, in terms of mental health indicators, reliance was based on measures of psychiatric symptomatology rather than clinical diagnoses. As Chermack et al. (2009) argue, information obtained from measures of psychiatric symptomatology may be compromised as it is subject to influence through the client's previous interaction with treatment providers. Moreover, the present study examined only three mental health disorders. Research has shown that other mental health disorders may be important in relation to violence, including posttraumatic stress disorder and antisocial personality disorder (Barrett et al., 2011; Hoaken & Stewart, 2003).

Finally, statistical analyses were conducted to test the presence of interactions on a multiplicative scale only, given that the theory hypothesized differences in the social experiences of violence between men and women rather than a biological mechanism. There is evidence to suggest that absence of interactions on a multiplicative scale may imply presence of interaction on an additive scale (Rothman, Greenland, & Lash, 2008). However, these analyses were beyond the scope of the present study.

5.5 Recommendations for future research

There is need for further research on this topic despite the breadth of studies focusing on violence within the substance use disorder treatment population. Future research may benefit by giving due consideration to several recommendations outlined below.

First, comprehensive assessments pertaining to violence should be included in future studies, such that information is collected on the role in incidents (victim or perpetrator), relationship between participants (partner or non-partner) and severity (violence with injury or violence without injury). These comprehensive assessments would not only facilitate examination of differences in correlates across violence typologies, but also elucidate potential sex differences as has been suggested by studies elsewhere in the literature (Chermack, et al., 2009).

Second, probability sampling procedures should be utilized by future studies. These sampling procedures would avoid many of the threats to generalizability encountered in the use of convenience samples. These procedures would ultimately enhance the representativeness of the samples and increase confidence in making inferences to the population.

Third, longitudinal methodologies should be incorporated in future studies to assess temporality and make causal inferences about the relationships between personality traits and mental health indicators and violence. Moreover, advanced statistical methodologies, such as structural equation modeling, would assist in teasing apart the meditational role of certain correlates in explaining violence.

Fourth, diagnostic information rather than measures of psychiatric symptomatology should be included in future studies, as it would improve the accuracy of the information collected regarding mental health correlates of violence. This could be accomplished through data linkages with administrative databases such as Drug and Alcohol Treatment Information System (DATIS) and the Institute for Clinical Evaluative Sciences (ICES).

Fifth, contribution of motivational and contextual factors as they relate to violence should be assessed by future studies. This is particularly important given the multi-causal

explanations for violence emphasized in the literature (Hoaken & Stewart, 2003; Macdonald, et al., 2008).

Overall, these recommendations may improve the understanding of violence in substance use disorder treatment population, and ultimately contribute towards curbing violence within this population.

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Appendices

Appendix A. Details on treatment agencies

Newport Centre

The Newport Centre is a 35 bedroom facility for alcohol and substance use located in Port Colborne, Ontario (Niagara Health System, 2013). This facility provides both community and residential (18 days) treatment programs that address addictions through stabilization, education, skill development, health promotion and aftercare planning (Niagara Community Information Database, 2013; Niagara Health System, 2013).

Bellwood health services

Bellwood Health Services is a 58 bedroom facility located in Toronto, Ontario, which offers residential treatment (21 days) for alcohol addiction through its Bellwood Hospital Division (Bellwood Health Services, 2013). This provincial ministry funded program comprises assessment, orientation, stabilization, alcohol addiction education, group therapy, medical care and support, relapse prevention, stress management, nutritional education and counseling, physical education and fitness and 12 step support groups (Bellwood Health Services, 2013).

The Jean Tweed Centre

The Jean Tweed Centre is a 18 bedroom facility located within Toronto, Ontario that provides residential treatment (21 days) for substance use and problem gambling issues exclusively to women (The Jean Tweed Centre, 2010). The treatment philosophy emphasizes a women centered framework, which acknowledges experiences and contextualizes substance use problems within the social and cultural experiences (The Jean Tweed Centre, 2010).

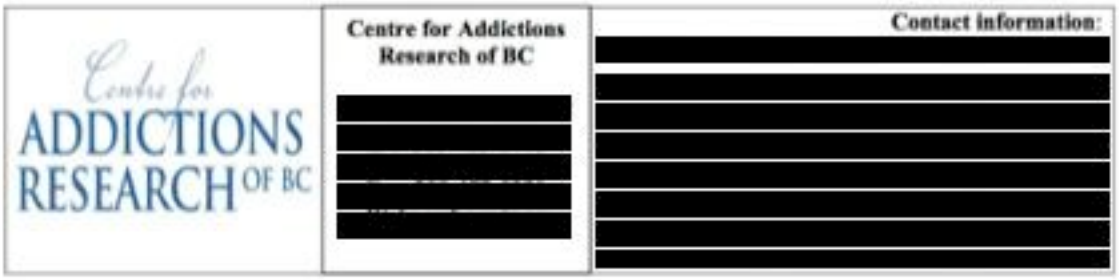
Aurora Treatment Centre

The Heartwood Centre for Women, formerly known as the Aurora Treatment Centre, is a residential treatment facility (90 days) for women with alcohol and substance use problems located in Vancouver, British Columbia (Heartwood Centre for Women, 2012). The program comprises of three phases: 1) S.T.A.R. (stabilization, assessment and retreat), 2) treatment, and 3) returning home (Heartwood Centre for Women, 2012).

Peardonville House Treatment Centre

Peardonville House Treatment Centre is a women only facility located in Abbotsford, British Columbia that propagates a client centered harm reduction philosophy (Peardonville House Treatment Centre, 2011). The centre provides a intensive residential treatment program (70 days) that involves several group components including recreational activities, life skills, 12 step meetings, community guest speakers, arts and crafts, self esteem building, communication skills, problem solving strategies, health relationships education, achieving lifestyle balance, eliminating codependency, dealing with feelings, goal setting, “Nobody’s Perfect” parenting skills, recreation/physical activity and relaxation training (Peardonville House Treatment Centre, 2011).

Appendix B. Consent form



Participant Consent Form

Patterns and consequences of alcohol with cocaine use for substance abuse treatment clients

Introduction
You are being invited to participate in a research study entitled "Patterns and consequences of alcohol with cocaine use for substance abuse treatment clients" that is being conducted by principal investigator Scott Macdonald, and co-investigators Amy Salmon, Tim Stockwell, Eric Roth, Samantha Wells, Russ Callaghan, and Guilherme Borges.

Scott Macdonald (PhD) is an Associate Director of Research at the Centre for Addictions Research of BC and a faculty member in the School of Health Information Science at the University of Victoria. You may contact him at the number above (collect) if you have further questions.

This research is being funded by the Centre for Addictions Research of BC and the Canadian Institutes of Health Research.

Purpose of the Study
The purpose of this research project is to describe the patterns and functions of alcohol use among cocaine clients in treatment and identify differential impact of combined use versus use of cocaine or alcohol alone. Research of this type is important because understanding the use and effects of these substances together is critical for developing effective health interventions.

Procedures
You are eligible to participate in this study if you are 19 years of age and over, and you meet the eligibility questions on use of cocaine or alcohol. The decision to participate or decline will not affect access to treatment, quality of treatment, or status within the treatment program. If you agree to voluntarily participate in this research, you will be asked to complete a self-administered questionnaire, with questions regarding your use of cocaine or alcohol, your explanations for and patterns of cocaine and alcohol use, as well as your health and well-being.

The questionnaire will be take about 45 minutes to complete, and will be conducted in a confidential manner at the treatment agency to minimize the possibility that treatment staff becomes aware of your participation. Recruitment, consent and data collection will be carried out by persons who have no connection with the treatment program that you are currently attending. Your name or other identifying information will not be included on these records or shared with the staff at the treatment agency.

Risks and Benefits
The anticipated risks to you are minimal. However, it is possible that you could feel fatigued or stressed or may experience some psychological discomfort as a consequence of participation, with some questions related to drug and alcohol addiction potentially serving as triggers for relapse. You will be provided with supports available while in treatment, such as counseling, should such triggers arise.

The potential benefits of your participation in this research include better understanding of the patterns and explanations for use of cocaine and alcohol. This knowledge may also have implications for areas of public policy, health service delivery, and treatment.

Compensation
As a way to compensate you for any inconvenience related to your participation, you will be given a $30 gift certificate to a local grocery store. It is important for you to know that it is unethical to provide undue compensation or inducements to research participants and, if you agree to be a participant in this study, this form of compensation must not be coercive. If you would not otherwise choose to participate if the compensation was not offered, then you should decline.

Your participation in this research is completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study your data will not be used and you will not receive the compensation.

Anonymity
In order to protect your anonymity, you will not be required to provide your name or any other identifying information. A paper record of the questionnaire will be stored at a secure location at the University of Victoria. The information will be entered into a database. The database will be available as a secure computer file to the principal investigator, co-investigators as well as the research analyst.

It is anticipated that the results of this study will be shared with others in the form of conference presentations and publications, such as journal articles. No identifying information will be included in any publication or forms of dissemination that arise from the research.
You may choose to skip a question or to withdraw your participation at any time.

Limits to Confidentiality
The research assistant conducting the study will maintain all communication with you in strictest confidence. It is possible however that the staff at the treatment centre may become aware of your participation as the interview will take place at the treatment agency. The treatment you receive at the agency will be the same regardless of whether or not you choose to participate in the study.

Contact Information
In addition to being able to contact the researcher, Scott Macdonald, at the above phone number, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Associate Vice-President of Research at the University of Victoria [redacted]

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions be answered by the researchers.

_____	_____	_____
Name of Participant	*Signature*	*Date*

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix C. Screening form

Screening Form

In this study, we are interested in learning about your experiences with the use of alcohol alone, cocaine alone or cocaine and alcohol used on the same occasion.

1. What is your primary substance use problem for which you are seeking treatment?

   ☐ Cocaine
   ☐ Alcohol

2. In a normal ***month*** before your decision to enter treatment, have you used cocaine and alcohol on the same occasion? ("on the same occasion" means that cocaine and alcohol were either taken together or within three hours of each other).

   ☐ Yes (*proceed to question 3*)
   ☐ No (*proceed to question 4*)

3. In a normal ***month*** before your decision to enter treatment, have you used cocaine and alcohol simultaneously on more than 50% of your cocaine using occasions?

   ☐ No (*proceed to question 4*)
   ☐ Yes (*proceed to question 4*)

4. Do you have a secondary substance use problem?

   ☐ No
   ☐ Yes Please indicate the substance (i.e., heroin, marijuana, prescription medication, etc):_____ (*proceed to question 5)*

5. How frequently did you feel the following about your secondary substance?

	Never/Almost Never	**Sometimes**	**Often**	**Always**
Did you think your use of your secondary substance was out of control?	0	1	2	3
Did the prospect of missing use of your secondary substance make you anxious or worried?	0	1	2	3
Did you worry about your use of your secondary substance?	0	1	2	3
Did you wish you could stop?	0	1	2	3
	Not Difficult	**Quite Difficult**	**Very Difficult**	**Impossible**
How difficult would you find it to stop or go without your secondary substance?	0	1	2	3

Appendix D. Results of tests for multicollinearity

Multicollinearity was assessed in the present study by the calculation of variance inflation factors. According to statistical diagnostic principles there is evidence for multicollinearity if the variance inflation factors are equal or greater than 10. The table below presents the variance inflation factors for all study variables of interest by total sample, males and females.

Variable	Total Variance Inflation Factor	Males Variance Inflation Factor	Females Variance Inflation Factor
Demographic Factors			
Age	1.150	1.171	1.167
Sex	1.159	-	-
Marital Status	1.122	1.182	1.099
Household Income	1.143	1.091	1.124
Drug Consumption Measures			
Cocaine Use Frequency	1.071	1.133	1.074
Simultaneous Cocaine & Alcohol Use Frequency	1.081	1.150	1.081
Number of Other Drugs Used Per Week	1.110	1.143	1.130
Personality Traits			
Impulsivity/ Risk-Taking	1.282	1.261	1.369
Aggressive Personality	1.292	1.237	1.401
Mental Health Indicators			
Depression	1.418	1.353	1.477
Anxiety	1.703	1.835	1.608
Paranoia	1.413	1.596	1.398

Appendix E. Results of male sample, a posteriori multivariable analyses including cocaine use frequency by method of administration

Further analyses were conducted on the male sample to assess the relationship between violence during the past 12 months and cocaine use frequency. Statistical models examining violence during the past 12 months were constructed that included frequencies of the three different methods of cocaine administration i.e. snorting, smoking and injecting. These analyses were necessary to better understand the unexpected protective association observed between violence during past 12 months and cocaine use frequency in the multivariable models focusing on males. The results of the backward elimination analysis and modified Poisson regression analysis are presented in the tables below. The data fit the models adequately as illustrated by the Hosmer-Lemeshow goodness of fit test ($p = 0.103$).

	Males (N = 183)		
	Estimated Regression Coefficient (Standard Error)	**Odds Ratio (95% CI)**	**P-Value**
Demographic Factors			
Age	0.059 (0.023)	1.061 (1.014 - 1.109)	**0.0095**
Marital Status			
Married/Living Together (Reference)	-	-	-
Widowed/Divorced/Separated/Separated & Living Together	0.131 (0.547)	1.140 (0.390 - 3.333)	0.8108
Single/Never Married	0.386 (0.505)	1.471 (0.547 - 3.955)	0.4447
Household Income			
=/> 50,000 (Reference)	-	-	-
=/> 20,000 but < 50,000	-0.303 (0.446)	0.739 (0.308 - 1.771)	0.4975
< 20,000	0.006 (0.453)	1.006 (0.414 - 2.446)	0.9894
Drug Consumption Measures			
Cocaine Snorting Frequency	-0.035 (0.023)	0.966 (0.923 - 1.011)	0.1350
Crack Smoking Frequency	-0.054 (0.018)	0.947 (0.915 - 0.981)	**0.0023**
Cocaine Injecting Frequency	0.026 (0.026)	1.027 (0.976 - 1.080)	0.3079
Simultaneous Cocaine & Alcohol Use Frequency	0.142 (0.095)	1.152 (0.957 - 1.387)	0.1345
Number of Other Drugs Used Per Week	0.355 (0.114)	1.426 (1.140 - 1.785)	**0.0019**
Personality Traits			
Impulsivity/Risk-taking		Eliminated	
Aggressive Personality	0.113 (0.022)	1.120 (1.072 - 1.169)	**<.0001**
Mental Health Indicators			
Depression		Eliminated	
Anxiety		Eliminated	
Paranoia		Eliminated	

	Males (N = 183)		
	Estimated Regression Coefficient (Standard Error)	**Relative Risk (95% CI)**	**P-Value**
Demographic Factors			
Age	0.022 (0.009)	1.022 (1.005 - 1.041)	**0.0134**
Marital Status			
Married/Living Together (Reference)	-	-	-
Widowed/Divorced/Separated/Separated & Living Together	0.164 (0.224)	1.178 (0.759 - 1.828)	0.4643
Single/Never Married	0.238 (0.240)	1.268 (0.793 - 2.029)	0.3215
Household Income			
=/> 50,000 (Reference)	-	-	-
=/> 20,000 but < 50,000	-0.144 (0.198)	0.866 (0.587 - 1.276)	0.4669
< 20,000	-0.105 (0.201)	0.901 (0.608 - 1.335)	0.6027
Drug Consumption Measures			
Cocaine Snorting Frequency	-0.014 (0.009)	0.986 (0.968 - 1.004)	0.1303
Crack Smoking Frequency	-0.024 (0.007)	0.977 (0.963 - 0.991)	**0.0011**
Cocaine Injecting Frequency	0.010 (0.009)	1.010 (0.992 - 1.027)	0.2784
Simultaneous Cocaine & Alcohol Use Frequency	0.038 (0.035)	1.039 (0.971 - 1.112)	0.2713
Number of Other Drugs Used Per Week	0.126 (0.042)	1.134 (1.044 - 1.233)	**0.0030**
Personality Traits			
Aggressive Personality	0.051 (0.009)	1.052 (1.035 - 1.070)	**<.0001**

Appendix F. Results of sensitivity analysis

Multiple imputations were conducted for the multivariable models to gauge the impact of the missing data on our observed results from the complete case analysis. All study variables of interest were treated as continuous in order to simplify the analyses as initial results from the procedure indicated failure of the data to reach monotoneness. This analytic decision was methodologically sound as the present study only employed three categorical variables. The results of these analyses are presented in the table as follows.

	No Imputations (N = 370)			Multiple Imputations (N = 403)		
	Estimated Regression Coefficient (Standard Error)	**Odds Ratio (95% CI)**	**P-Value**	**Estimated Regression Coefficient (Standard Error)**	**Odds Ratio (95% CI)**	**P-Value**
Demographic Factors						
Age	0.023 (0.015)	1.026 (0.997 - 1.056)	0.0758	0.025 (0.013)	1.025 (0.999 - 1.052)	0.0548
Sex				0.306 (0.242)	1.358 (0.846 - 2.182)	0.2054
Female (Reference)	-	-	-	-	-	-
Male	-0.386 (0.255)	0.680 (0.412 - 1.120)	0.1293	-	-	-
Marital Status				0.114 (0.146)	1.121 (0.842 - 1.493)	0.4346
Married/Living Together (Reference)	-	-	-	-	-	-
Widowed/Divorced/ Separated/Separated & Living Together	0.290 (0.353)	1.336 (0.669 - 2.670)	0.4122	-	-	-
Single/Never Married	0.203 (0.310)	1.225 (0.667 - 2.250)	0.5137	-	-	-
Household Income				0.146 (0.140)	1.157 (0.879 - 1.522)	0.2988
=/> 50,000 (Reference)	-	-	-	-	-	-
=/> 20,000 but < 50,000	-0.314 (0.316)	0.730 (0.393 - 1.357)	0.3202	-	-	-
< 20,000	-0.417 (0.292)	0.659 (0.372 - 1.169)	0.1541	-	-	-

Continued

	No Imputations (N = 370)			Multiple Imputations (N = 403)		
	Estimated Regression Coefficient (Standard Error)	**Odds Ratio (95% CI)**	**P-Value**	**Estimated Regression Coefficient (Standard Error)**	**Odds Ratio (95% CI)**	**P-Value**
Drug Consumption Measures						
Cocaine Use Frequency	-0.009 (0.012)	0.991 (0.969 - 1.014)	0.4488	-0.010 (0.011)	0.990 (0.969 - 1.012)	0.3642
Simultaneous Cocaine & Alcohol Use Frequency	0.0005 (0.053)	1.000 (0.901 - 1.110)	0.9926	0.022 (0.052)	1.023 (0.924 - 1.132)	0.6659
Number of Other Drugs Used Per Week	0.273 (0.075)	1.314 (1.136 - 1.521)	**0.0002**	0.282 (0.071)	1.326 (1.154 -1.524)	**<.0001**
Personality Traits						
Impulsivity/Risk-taking	-0.019 (0.034)	0.981 (0.918 - 1.048)	0.5704	-0.017 (0.032)	0.983 (0.924 - 1.046)	0.5968
Aggressive Personality	0.085 (0.014)	1.089 (1.059 - 1.119)	**<.0001**	0.080 (0.014)	1.083 (1.055 -1.112)	**<.0001**
Mental Health Indicators						
Depression	0.014 (0.035)	1.014 (0.946 - 1.086)	0.6971	0.023 (0.033)	1.023 (0.959 - 1.092)	0.4860
Anxiety	0.006 (0.031)	1.006 (0.947 - 1.070)	0.8380	0.003 (0.030)	1.003 (0.947 -1.063)	0.9137
Paranoia	0.015 (0.028)	1.015 (0.960 - 1.072)	0.6051	0.017 (0.027)	1.017 (0.965 - 1.073)	0.5212

Curriculum Vitae

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Honours and Awards:	Merit Scholarship University of Waterloo Entrance Scholarship 2006 Schulich Graduate Scholarship Western University Tuition Scholarship 2011-2013 Global Opportunities Exchange Program Western University Travel Scholarship 2012 Province of Ontario Graduate Scholarship 2012-2013
Related Work Experience	Research Ethics Board Assistant/Research Assistant St. Joseph's Health Centre 2008-2008 Volunteer Research Assistant Baycrest Hospital 2010-2011 Volunteer Research Assistant Centre for Addiction and Mental Health 2010-2011 Summer Student Centre for Addiction and Mental Health 2011-2011

Publications:

Lev-Ran, S., **Imtiaz, S.,** Taylor, B. J., Shield, K. D., Rehm, J., & Le Foll, B. (2012). Gender differences in health-related quality of life among cannabis users: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Drug and Alcohol Dependence, 123,* 190-200.

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Lev-Ran, S., **Imtiaz, S.,** Rehm, J., & Le Foll, B. (2013). Exploring the association between lifetime prevalence of mental illness and transition from substance use to substance use disorders: Results from the National Epidemiologic Survey of Alcohol and Related Conditions (NESARC). *The American Journal on Addictions, 22,* 93-98.