The Intersection between Crime and Drug Dependence: Establishing the Clinical Utility of the Severity of Dependence Scale (SDS) with a Sample of Federally Incarcerated, Male Offenders

A Thesis

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We accept this thesis as conforming to the required standards

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Abstract

Between 70% to 80% of Correctional Service Canada's (CSC) general offender population and over 90% of its Aboriginal offender population has an identified substance abuse problem requiring intervention. Ensuring that these offenders receive the most effective treatment is a major challenge that is best addressed through the application of assessments that are shown to be reliable, accurate, and useful for client-treatment matching and correctional planning. ***Aim.*** The main objective of the study was to establish the Severity of Dependence Scale (SDS) (Gossop et al. 1995) as a suitable measure for client-treatment matching, and as a predictor of recidivism and relapse to substance use. ***Setting.*** The SDS and the Drug Abuse Screening Test (DAST) (Skinner, 1982) were administered to a sample of 3350 adult, male inmates from CSC between 2002 and 2007. A total of 1667 inmates were eventually released from custody and available for 24 months of follow-up. ***Measurements.*** Cronbach's coefficient alpha provided a measure of internal consistency (reliability), and canonical correlation analysis quantified the dimensional relationship between the two instruments. With DAST as the reference standard, Receiver Operating Characteristics (ROC) analyses established the optimal cut-off score for a classification of psychological drug dependence on the SDS. A number of multivariable logistic regression models uncovered the dimensions of the classification, while a series of Cox proportional hazards models examined SDS's ability to predict the rates of revocation and relapse to substance abuse over a maximum of 24 months of follow-up into the community. ***Findings.*** Large Cronbach's coefficient alpha values confirmed the internal consistency of both the DAST and SDS. The canonical correlation analysis revealed

linear combinations of DAST and SDS items that were highly correlated along a single dimension that closely approximated the dependence syndrome as defined by the Diagnostic and Statistical Manual of Mental Disorders-IV. The results from the logistic regression and Receiver Operating Characteristics (ROC) analyses underscored the strong relationship between DAST's classification of drug dependence and the SDS. The cut-off value of ≥ 6 for a classification of psychological drug dependence produced the best trade-off between sensitivity and specificity. The individual logistic regression models and the significant unconditional associations between indicators within a number of life domains and psychological drug dependence uncovered a host of deficits that are important for client-treatment matching and correctional planning. The SDS was also predictive of post-release outcomes. After adjusting for the effects of other predictors within a series of Cox proportional hazards models, offenders who were classified as psychologically drug dependent had higher hazards of revocation and relapse to substance abuse. However, exposure to the high intensity program and community-based maintenance reduced the hazard of revocation and relapse to substance. ***Conclusions.*** The SDS was a reliable measure of psychological drug dependence, and useful for differentiating offenders for treatment and for predicting post-release outcomes. The findings underscore the importance of accurately matching offender criminogenic need to appropriate levels of service delivery, and reinforce the importance of community aftercare in mitigating the risk of recidivism and relapse to substance abuse.

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List of Abbreviations

ADS	Alcohol Dependence Scale
AOSAP	Aboriginal Offender Substance Abuse Program
CASA	Computerized Assessment of Substance Abuse
CLAI	Computerized Lifestyle Assessment Instrument
CMP	Community Maintenance Program
COP	Correctional Operations and Programs
CSC	Correctional Service Canada
DAST	Drug Abuse Screening Test
DSM	Diagnostic Statistical Manual
EXCOM	Executive Committee
HISAP	High Intensity Substance Abuse Program
NHQ	National Headquarters
NSAP-H	National Substance Abuse Program – High Intensity
NSAP-M	National Substance Abuse Program – Moderate Intensity
OIA	Offender Intake Assessment
OMS	Offender Management System
OSAPP	Offender Substance Abuse Pre-release Program
RHQ	Regional Headquarters
SDS	Severity of Dependence Scale
SIR-R1	Statistical Information on Recidivism Scale - Revised
WHO	World Health Organization

Chapter One: Introduction

Setting the Context

In terms of social and monetary costs, the harms associated with substance abuse are a major burden for Canada. In 2002, an estimated $39.8 billion was spent on social costs that were directly and indirectly attributable to substance abuse (Rehm, et al., 2006; Single, Rehm, Robson & Truong, 2000). Loss in productivity due to premature death and disability generated the highest costs ($24.3 billion), followed by health care costs ($8.8 billion). To put a human face on the problem, of the 223,603 deaths in 2003, approximately 8100 and 1700 were attributable to alcohol and drugs, respectively. An estimated 4.1 million acute care hospital days were associated with substance abuse, of which 1.6 million were related to alcohol, and 352,121 were related to drugs (Rehm, et al., 2006).

The third highest cost associated with substance abuse in 2002 was related to criminal justice activities. An estimated $5.4 billion was spent on police services, the courts and Canada's prison systems (Rehm, et al., 2006). In calculating the estimates, the costs associated with offences, such as possession, cultivation and trafficking were considered 100% attributable to drugs, while other types of offences, such as committing a robbery to finance the high price of drugs or committing offences while intoxicated, were deemed partially attributable to drug and/or alcohol use.

Between 70% and 80% of Correctional Service Canada's (CSC) general offender population and over 90% of its Aboriginal offender population has an identified substance abuse problem requiring intervention. Ensuring that these offenders receive

the most effective treatment for their substance abuse problems is a major challenge for CSC. To address this challenge, CSC includes standardized assessments in its service delivery process to ensure efficiency, accurate treatment matching, consistency and a common language among service providers and clients. Information from well-informed assessment is also valuable for research. Accordingly, an important component of service delivery is the integration of ongoing research that is designed to translate information into useful knowledge for policy development, enhancement and implementation at the national, operational and clinical levels (Lomas, 2000).

To address the extent of substance abuse problems among its offender population CSC maintains an ongoing program of addictions research through the Addictions Research Centre (ARC). ARC is a national, publicly funded research centre in the province of Prince Edward Island that is mandated to enhance corrections policy, programming and management practices on substance abuse through the creation and dissemination of knowledge and expertise (ARC, 2006). To this end, the following goals have been established for the Centre: 1) to build co-operative & complementary relationships with partners within and outside of CSC; 2) to promote research in addictions & corrections; 3) to provide training & development to operational and research staff and 4) to meet the applied research needs of CSC in the area of substance abuse (ARC, 2006). ARC's approach to maintaining "ongoing links and more comprehensive communication" between internal and external partners to the organization is consistent with best-practices in knowledge exchange (Lomas, 2000, p. 142).

This thesis research is the latest addition to ARC's applied program of research in the area of assessment and measurement of substance abuse problems in CSC's male offender population. It builds on prior research by Kunic and Grant (2005), which examined the clinical utility of a computer-based interview schedule called the Computerized Assessment of Substance Abuse (CASA). In this examination of the information collected by CASA, the authors found that offenders who were more psychologically dependent on drugs as measured by the Severity of Dependence Scale (SDS) (Gossop et. al, 1995), also experienced more drug-related behavioural instability based on the results from the Drug Abuse Screening Test (DAST) (Skinner, 1982). That is, offenders who produced DAST severity levels of substantial and severe scored well above the cut-off on the SDS for a classification of psychological dependence on drugs. This cut-off score has been previously reported in other literature (De Las Cuevas, Sanz, De La Fuente, Padilla, & Berenguer, 2000; Topp & Mattick, 1997); however, the establishment of an optimal diagnostic cut-off with a correctional population is necessary so that the SDS can be formally considered for clinical decision-making.

Purpose

The research will explore the dimensional characteristics of the sub-population of Canadian federal offenders who abuse drugs to formally integrate the SDS, as a measure of psychological drug dependence, into the clinical decision-making process. It is anticipated that the inclusion of SDS in the process will result in better case differentiation by uncovering important individual differences and dimensions of substance abuse that are associated with a classification of psychological drug

dependence. The overall goal of the study is to uncover empirical evidence in support of SDS's appropriateness as an instrument for the identification of needs that are linked to criminal offending. Although the SDS has been shown to be an accurate measure of psychological drug dependence for a number of different populations, its clinical utility has yet to be assessed within a correctional context. Accordingly, the study will aim to assess the reliability of the SDS, establish an appropriate classification threshold for psychological dependence on drugs, examine the covariates of psychological drug dependence across a number of life domains or dimensions of an offender's life, and establish the SDS's ability to predict revocation and relapse to substance abuse.

It is hypothesized that offenders, who have a higher level of need identified across a number of life domains known to be associated with re-offending, will have a higher probability of psychological drug dependence. It is also hypothesized that offenders who use drugs because of negative affective states, or as a result of having to cope with physical distress, or to manage withdrawal symptoms will have a higher probability of psychological drug dependence than those individuals who use drugs because of positive life circumstances (e.g., good times with others). With respect to post-release outcomes, it is predicted that the group of offenders who exceed the classification threshold for psychological drug dependence will be revoked at a higher rate than the group of offenders who do not exceed the threshold. Where applicable, additional comparisons will be made to assess the effect of substance abuse treatment intensity on the rates of revocations for the psychologically drug dependent offenders. It is also predicted that completion of more intensive substance abuse treatment by the group of psychologically drug dependent offenders will better mitigate the risk/rate of

return to custody than participation in less intensive treatment. Lastly, community-based urinalysis results will be examined to establish SDS's ability to predict post-release substance use. It is hypothesized that the offenders who exceed the threshold on the SDS for a classification of psychological drug dependence will test positive for drugs at a higher rate than offenders who do not exceed the threshold.

Chapter Two: Literature Review

Substance Abuse Prevalence

Federal Offender Population

Within the federal correctional population (CSC) in 2005 there were 5588 (26%) drug offenders, of whom 2360 (11%) were serving sentences for drug trafficking, 493 (2%) for importation, 286 (1%) for cultivation and 3826 (18%) for possession of illicit drugs (Motiuk & Vuong, 2006). Roughly 70% to 80% of offenders who are admitted to federal custody have an identified substance abuse problem requiring some level of intervention (Grant, Kunic, MacPherson, McKeown & Hansen, 2003; Weekes, Moser & Langevin, 1999). Of these, 15% require institutionally-based substance abuse treatment at the moderate intensity and 21% at the high intensity level (Kunic & Grant, 2005).

The proportion of offenders under CSC's jurisdiction who identify substance abuse as a contributing factor in their current offences has remained stable over the last 15 years. Of the total number of offenders who were under CSC's jurisdiction during the 1990s, between 50% to 60% of them used alcohol, drugs or a combination of the two on the day of their current offence(s) (Brochu et al., 2001; Robinson, Porporino & Millson, 1991). Results from a recent study with CSC's offender population support these earlier findings (Kunic & Grant, 2005). Specifically, of the offenders admitted to federal custody in the Atlantic and Ontario regions, 12% reported they used both alcohol and drugs, 18% consumed alcohol and 21% used drugs on the day of their current offence(s). Kunic and Grant (2005) also found that violent offences were more closely related with

alcohol impairment than drug impairment, whereas property offences were more closely linked to drug impairment.

Of the offenders who reported drug use during the 12 month period prior to arrest, over half (52%) of the offenders identified cannabinoids as their most frequently used drug, followed by crack cocaine (14%), opioids (13%) and cocaine (12%). All "other" combined drug categories accounted for less than 10% of offenders who used drugs[1]. Out of all of the groups, offenders in the cocaine, crack cocaine and the opioids groups were more likely to be assessed as having a substantial to severe drug problem (Kunic & Grant, 2005). In the case of cocaine and opioids, the elevated risk of acquiring and transmitting infectious diseases through the sharing of equipment, including syringes, cookers, cotton swabs and rinse water, present additional health risks above those physical risks associated with prolonged use or overdosing, such as marked tolerance, withdrawal symptoms, dysphoria (i.e., rapid decline in the pleasurable effects the drug) leading to reinstatement, increased morbidity and mortality (Health Canada, 2001; McNeece & DiNitto, 1998).

Aboriginal Offender Population

Aboriginal offenders differ from non-Aboriginal offenders in a number of ways so it is necessary to compare the characteristics of this unique population to the general population. The conditions that contribute to crime, in combination with limited rehabilitative services and interventions aimed at prevention, and a judicial system that

[1] Benzodiazepines (2%), heroin (2%), amphetamines (1%), MDA (methylenedioxyamphetamine) (1%) and the unspecified group (2%) contribute the majority of observations to this combined group. The inhalants, steroids, LSD and the methadone drug categories each contribute less than 1%.

has had difficulty considering the Aboriginal worldview (e.g., avoidance of confrontation and adversarial positions) have invariably led to disproportionate levels of Aboriginal incarceration (Canadian Criminal Justice Association, 2000; Frideres & Gadacz, 2001; LaPrairie, 1992; Mussell, 2005; Ross, 1992). This has led to over-representation within Canada's federal penitentiaries. In 2000, approximately 18% of CSC's offender population identified as Aboriginal – roughly six times the size of the Canadian Aboriginal population (Moore, 2003). As with provincial admissions to correctional facilities, over-representation of Aboriginal offenders is markedly higher within federal institutions located in the Prairie Region with roughly 44% of the admissions to CSC's prairie institutions reporting Aboriginal ancestry (Boe, 2000). Although a 1999 Supreme Court of Canada decision in *R. v. Gladue* ruled that restorative approaches to sentencing should be considered so that the justice system can address the serious problem of over-representation of Aboriginal people in Canada's prisons, over-representation continues and is expected to increase (Public Safety and Emergency Preparedness, 2007; *R. v. Gladue*, 1999).

Aboriginal offenders also share a disproportionate burden of problems in all life areas and have more extensive criminal histories compared to the general population of non-Aboriginal offenders. They are more likely to experience deficits within the life domains of family, education, employment, community functioning, social interaction, personal and emotional orientation and attitude when compared to the general population of offenders (Moore & Trevethan, 2002; Rugge, 2006; Statistics Canada, 2001). Aboriginal offenders are also considered higher risk for re-offending compared to the general population of offenders (Brown & Motiuk, 2005). In 2000, 74% of the

population of Aboriginal offenders in federal custody were considered high risk, compared to 57% of the non-Aboriginal offender population (Moore & Trevethan, 2002)

Substance abuse remains a major problem for Aboriginal offenders. Almost all (94%) of the population of federal Aboriginal offenders have an identified substance abuse problem compared to 70% to 80% of non-aboriginal offenders (Grant et. al, 2003; Moore, 2003). Moore and Trevethan (2002) found that approximately, 94%, 92% and 91% of the First Nations, Inuit and Métis offenders, respectively, were identified as requiring some or a considerable level of intervention in the area of substance abuse.

As with the general population, the link between substance-abuse and crime exists for the Aboriginal population of offenders. Recently, in a detailed examination of the static and dynamic offender characteristics that are association with recidivism, Brown and Motiuk (2005) found that drug abuse was a relatively stronger predictor of readmission than alcohol use for Aboriginal offenders. Other studies suggest that alcohol and drug abuse are better predictors of recidivism with Aboriginal offenders than with non-Aboriginal offenders (Bonta, LaPrairie & Wallace-Capretta, 1997).

Substance Use and Criminality

The link between substance use and crime is well established. Among CSC's offender population, those with an alcohol-dependency problem are more likely to commit a violent crime than offenders with an identified drug-dependency problem (Pernanen, Cousineau, Brochu & Sun, 2002; Zamble & Quinsey, 1997). Conversely, drug dependent offenders are more likely to commit crimes of a property nature (e.g., robberies, break and enters, thefts, fraud). It has been argued that where alcohol use is

associated with criminal behaviour, the intoxicating effects of alcohol often result in cognitive disruption and exacerbated physical aggression, which consequently leads to violent behaviour. In contrast, where drug use is linked to criminal behaviour, the offences are often property or theft related and motivated by financial gain to finance the high price of illicit drugs (Brochu, et. al, 2001; Kunic & Grant, 2005).

There is general agreement in the literature that substance use is a reliable predictor of recidivism among adults and adolescent offenders (Andrews & Bonta, 1998; Benda, Corwyn, & Toombs, 2001; Bonta et al., 1997; Bonta, Law & Hanson, 1998; Cartier, Farabee & Prendergast, 2006; Dowden & Brown, 2002; Gendreau, Goggin & Little, 1996; Gjeruldsen, Myrvang & Opjordsmoen, 2004; Kinlock, O'Grady & Hanlon, 2003; Stoolmiller & Blechman, 2005). For example, Dowden and Brown (2002), in their meta-analytic review of 45 studies examining the role of substance abuse factors in predicting recidivism, found that the strongest predictors of general recidivism were extant alcohol/drug abuse problems and drug abuse problems, with effect sizes of .22 and .19, respectively. Similarly, Gjeruldsen et al. (2004) found that a cohort of drug addicted adult individuals were far more likely to recidivate over a 25-year follow-up than a non-addicted cohort of adults. Other research has found that the major predictors of general and non-violent recidivism in mentally-disordered, adult offenders, such as substance abuse, are comparable to those found in non-disordered, adult offenders (Bonta et al., 1998). And among adolescents, one of the strongest predictors of entry into an adult correctional system is alcohol and/or drug use (Benda et al., 2001).

Moreover, research examining the link between severity of substance abuse problems and crime has demonstrated that success following post-release from Canadian federal custody varies as a function of substance abuse severity, with offenders with more severe substance abuse problems returning to custody at higher rates than offenders with a low level problem (Lightfoot, 1999). Zamble and Quinsey (1997), in their seminal work examining the determinants of criminal recidivism in a sample of men returned to prison, found that men who recidivated used alcohol/drugs more regularly and in greater amounts than did the comparison group of non-recidivists. The level of substance use was "unquestionably" a major factor in differentiating the two groups (Zamble & Quinsey, 1997, p. 78).

Treatment programs, however, often mitigate the risk of recidivism and relapse to substance abuse by effectively targeting behaviours and cognitions that are related to criminal offending (i.e., addressing criminogenic need) (Andrews, 2001; Andrews & Bonta, 1998; CSC, 1999). Interventions that effectively address criminogenic need: 1) "promote learning" and enhance "interpersonal influence"; 2) select appropriate intermediate targets that, when changed through appropriate content, impact on criminal behaviour; 3) are structured or manualized; 4) match services to the client's style of learning; and 5) are delivered cost effectively and ethically (Andrews & Bonta, 2006). What is more, improvements in post-release outcomes often occur, especially for higher risk offenders who actively participate in the full course of treatment (Wormith & Olver, 2002).

It is generally accepted that active engagement and participation of the offender in the full course of treatment can be mediated through multi-modal interventions that consider the specific responsivity and strengths of the participant, such as "personality, ability, motivation, strengths, age, gender, ethnicity/race, language, and various barriers to successful participation in service" (Andrews, 2001, p. 11). In the case of Aboriginal offenders, programs and interventions that are grounded in Aboriginal traditions, spirituality and culture - that strive to heal the individual in holistic terms - can facilitate rehabilitation efforts and enhance engagement, participation and retention of the participant in treatment, thereby increasing the effectiveness and efficiency of treatment (Health Canada, 1998; Royal Commission on Aboriginal Peoples, 1996). Therefore, it is important to accurately and reliably match offenders who have higher needs to more intensive and responsive interventions so that the risk of recidivism is diminished. Accurate matching is best facilitated through the careful and timely administration of standardized and systematic assessment.

Standardized Assessment in a Correctional Context

Offender assessment has long been considered an important activity in the day-to-day management of offenders (Bonta, 2000). Over the last 20 years, it has evolved from a clinically-based, subjective process to one that involves a rigorous, evidence-based approach, designed to systematically identify factors which contribute to criminal behaviour (Andrews & Bonta, 1998). Once identified, these criminogenic needs can be addressed through relevant correctional programming.

First generation assessment approaches emphasized a reliance on professional judgment, which was guided by informal, non-observable criteria. The decisions that were borne out of these assessment approaches were subjective and intuitive in nature, driven by feelings about a particular case rather than by empirically validated assessment methods. Second generation approaches relied on results from actuarial assessments that specifically targeted an offender's historical or static factors (i.e., criminal history). While an improvement over clinical judgment, these assessments failed to include other known covariates of criminal behaviour that are dynamic or changeable in nature (e.g., antisocial peer group, substance abuse, community functioning, pro-criminal attitudes, etc.) (Andrews & Bonta, 1998).

With the introduction of third generation approaches, criminal justice systems began to recognize the utility of incorporating comprehensive, multi-dimensional, standardized assessments into their program delivery and decision making processes. These third generation assessments specifically examine the static (historical) and dynamic (need) factors associated with criminal behaviour for the purposes of matching an offender's static and dynamic needs to appropriate levels of programming. This systematic identification of criminogenic need is consistent with the principles of effective correctional treatment, which argue that offenders who present with higher needs that are associated with criminal behaviour should be matched to more intensive and extensive services so that the probability of recidivism is diminished. Low needs offenders, on the other hand, require minimal to no treatment (Andrews & Bonta, 1998).

Theoretical Underpinnings – Criminal Behaviour

The principles of effective correctional treatment have their underpinnings in general personality and social psychological theory of criminal behaviour (Andrews & Bonta, 2006). The theory holds that criminal behaviour is learned like any other behaviour, wherein behaviour (the response) is related to the environment in which it occurs (the stimuli). The probability of a criminal act increases with increases in the density of stimuli that reward criminal behaviour and decreases with increases in the density of stimuli that represent the costs of criminal behaviour. Andrews and Bonta (2006) further suggest that the general model of criminal behaviour is best described as encompassing the theories of social learning, cognitive behaviourism and social cognition, whereby "attitudes, associates, behavioural history, or personality" (the "big four" indicators of criminal behaviour) are [potentially] influenced by other indicators within the major life domains of family, education, employment, community functioning, leisure activities and substance abuse (p. 13). The predictive validity of these indicators is supported by a wealth of empirical evidence stemming from research on criminal conduct (Andrews & Bonta, 2006). Generally, the more deficits in a given life area, the greater the likelihood of recidivism and the greater the need for intervention and treatment.

In the case of substance abuse, prevalence studies have consistently uncovered significant correlations between substance abuse and crime; however, describing the relationship in causal terms has been a major challenge for researchers (Lightfoot, 2001). Does substance abuse simply follow from a criminal lifestyle or does substance abuse cause criminal behaviour? It has been suggested that both pathways help explain

the association between substance abuse and criminality (Andrews & Bonta, 1998; Gjeruldsen et al., 2004; Lightfoot, 2001). The first suggests that attitudes, values, beliefs, rationalizations and cognitions that are supportive of a criminal lifestyle, as seen in individuals with a conduct disorder for example, lead to patterns of substance abuse. The second pathway proposes that individuals first develop a substance abuse problem and then engage in criminal activity to support the problem. These individuals are often characterized as "primary substance abusers"; whereas, the former are viewed as "primary criminals" or conduct disordered (Lightfoot, 2001, p. 100). This distinction has important implications for the assessment and treatment of substance abuse problems because individuals with antisocial personality traits will require more intensive and extensive treatment to mitigate their elevated risks of recidivism compared to those individuals who more closely fit the profile of a substance abuser (Lightfoot, 2001). Accurately matching these offenders to appropriate treatment is a principal goal of assessment.

Standardized Assessment of Substance Abuse Problems

The emergence of best practices literature concerning the treatment of alcohol and illicit drug users has further strengthened the argument for standardized assessment (Cross & Sibley-Bowers, 2001; McMurran, 2001; Miller & Rollnick, 1991). There is now general agreement in the field of addictions that a standardized assessment approach builds efficiency in the system, since only information that is required for programming decisions is gathered for each client. Standardized assessment approaches also ensure consistency or a common language among decision makers and stakeholders

across the service delivery continuum. Clients and clinicians alike consider formal, empirically-based tools credible for program planning purposes. The sharing of assessment results also provides useful feedback to the client and enhances treatment-seeking behaviour by building motivation and a commitment to change in the client. Lastly, from a policy perspective, a database of standardized assessment results provides a means of informing promising or best practices policy because this information can be readily transformed into knowledge about the population's characteristics, such as trends, profiles and outcomes.

Emerging assessment models

Recent developments in the assessment and diagnosis of substance abuse disorders have focussed on the possibility of incorporating categorical and dimensional approaches to diagnosing substance abuse disorders. Helzer, van den Brink and Guth (2006) have argued that the individual differences among those with a given substance abuse disorder (i.e., satisfying a specific diagnostic category) warrant new statistical models that provide both categorical and dimensional representations within the same model. For instance, multivariable models, such as logistic regression, in which the categorical diagnosis serves as the response variable, can serve to further explain the dimensions of the diagnosis by uncovering important individual differences (i.e., covariates and correlates) that are associated with the diagnosis. In this approach, the dimensional component is directly linked to the categorical definition allowing for further case differentiation within a diagnostic category (Helzer, van den Brink & Guth, 2006). Such an approach can also be extended to multivariable models in which the

response variable is continuous and representative of the degree to which a latent construct is manifest given a set of predictors (Muthén, 2006).

Furthermore, advancements in structured interview schedules, which are designed to collect descriptive clinical information for decision-making purposes, have created new opportunities for further sub-typing within diagnostic categories. Babor & Caetano (2006) have suggested that the principles governing the organization of individuals into groups according to their relation to a set of criteria (i.e., classification theory) can be best operationalized through a simple structure that: a) has practical clinical utility; b) allows for client-treatment matching; c) takes full advantage of available data; d) permits for an examination of underlying causes; e) facilitates the prediction of future behaviour; f) demonstrates validity and reliability; and g) allows for the identification of reliable sub-types within diagnostic categories. They suggest that further sub-typing or case differentiation may lead to more complex decision-making and more refined client-treatment matching.

Theoretical Underpinnings – Addictive Behaviour

Much like the causes of criminal behaviour, the causes of addictive behaviours can best be explained by a unifying theory that reflects the multidimensional nature of addiction. It has been argued that no one discipline can fully explain the process of addiction to drugs because the behaviours that are associated with it are developed and maintained by multiple sources within the environment and through the interaction of biological, sociological, and psychological processes (Compton, Thomas, Conway & Colliver, 2005; Donovan, 1988; McNeece & DiNitto, 1998; Shaffer et al., 2004).

Donovan (1988) has suggested that a biopsychosocial model may have the most to offer in terms of explaining the addiction process because it recognizes addiction as a multifactorial condition that is caused by predisposing, precipitating and reinforcing factors. With this formulation, the addiction process is viewed as an interaction between the host (i.e., aspects of personality, moods states, attitudes, expectations, behaviours and biology), the agent (i.e., the physiological effects of a given drug) and the environmental determinants (i.e., formal and informal rules, rewards and punishments, interpersonal relationships and physical environment) (Donovan, 1988).

More recently, Shaffer et al., (2004) have proposed an addiction syndrome that includes "multiple and interacting biopsychosocial antecedents, manifestations, and consequents - within and among behavioural and substance-related patterns of excess" (p. 367). Predisposing antecedents, such as psychosocial elements (e.g., coping with negative affective mood states, associating with drug-using individuals), increase the risk of developing an addiction, while other protective factors, such as pro-social supports, reduce the risk. Access to the object of addiction in the presence of predisposing antecedents increases the likelihood of the individual interacting with the object. Repeated interactions, in turn, expose the individual to potent and rapid short-term neurobiological consequences (e.g., activating the dopamine reward system), which invariably lead to short-term pleasurable effects. However, repeated exposure may also lead to manifestations of the syndrome that reinforce and maintain continued use (e.g., minimizing negative affective mood states, managing physical withdrawal), which invariably lead to negative biopsychosocial consequences (e.g., increased tolerance, psychopathology, comorbidity, criminality and social drift) (Shaffer et al., 2004).

McNeece and DiNitto (1998) similarly argue that no single model or theory can fully explain the phenomenon of dependence or addiction. For some, there are individual genetic predispositions or physiological dysfunctions that are necessary precursors for drug abuse, while for other individuals, interpersonal orientation and personal development problems may serve to precipitate and maintain drug use and abuse. McNeece and DiNitto (1998) propose that the model of addiction is similar in scope to a public health model because conceptualizations of addiction, like conceptualizations of public health issues, are best informed by an understanding of the complex interaction between the individual, the host and the environment. This has led to epidemiologic methods that have linked the process of drug use and addiction to putative causes, "such as exposure to drugs, opportunities for drug use, social-environmental risk factors, and individual characteristics, including genetic and biological factors" (Compton, et al., 2005, p. 1494). Within this framework, the causal path to addiction may involve interactions between distal antecedents (e.g., early exposure to drugs, tumult within the family home, and peer group associations) that influence more proximal antecedents (e.g., social pressure, mood states, expectations, physiological discomfort). These, in turn, may predispose the individual to use drugs (McNeece and DiNitto, 1998). The pattern of drug use, once entrenched, leads to aversive consequences (e.g., psychosocial dysfunction, antisocial behaviour, health problems) and reinforcing consequences (e.g., mood enhancement, relief of physiological withdrawal symptoms) that serve to reinforce and maintain the pattern of drug use.

Implementation of Computer-based Assessment

Advancements in computer technology, such as audio enhancement (i.e., having the computer deliver the questions orally using a human voice), have created additional opportunities for innovations in standardized assessment, thereby capitalizing on the efficiencies and dynamic capabilities of the computer (Turner et al., 1998). Computerized assessments are event driven and rely on an automated, computer-controlled flow of questions to deliver complex questionnaires within a simplified process. Respondents choose an answer on the computer screen (the event), which in turn automates a complex (hidden) branching procedure that is responsible for sequencing subsequent relevant questions. Respondents only see or hear the relevant questions; all other questions are obscured from view. This is a marked improvement over pencil-and-paper questionnaires, which rely on conditional statements, additional instructions and branching statements that are often onerous, even for the literate respondent.

Furthermore, research in this area has suggested that efficient, computerized assessment models have the added benefit of increasing the candidness of self-reported responses given by the subject because of a number of unique properties (Del Boca & Noll, 2000; Feigelson & Dwight, 2000; Williams, Freeman, Bowen & Saunders, 1998). First, assessment items are answered with little or no assistance from the administrator, which greatly reduces the potential for interviewer influence. Second, as the respondent progresses through the assessment, questions and related response choices appear only as needed. In this way, responses are obscured from view and from the scrutiny of others during the assessment. Third, computer scoring and analysis algorithms create an

impartial, non-judgmental evaluative process, which may in turn boost the candidness of self-report information, especially when the information is of a sensitive nature (Turner et al., 1998). Lastly, computerized testing situations create an impersonal situation, free of social cues, where individuals can respond more candidly (Feigelson & Dwight, 2000).

In 2002, CSC implemented a new computer-based interview schedule, called the Computerized Assessment of Substance Abuse (CASA) to facilitate efficient, accurate and timely matching of offenders to treatment. The 288-item, bilingual, audio-enhanced CASA assesses substance abuse in seven domains: 1) alcohol and 2) drug abuse severity, 3) patterns of use, 4) link to criminal behaviour, 5) parental substance abuse, 6) previous program participation; and 7) treatment readiness.

Assessing Drug Abuse and Psychological Drug Dependence with CASA

To ensure that offenders who have an identified drug problem are matched to appropriate levels of treatment, CSC administers the Drug Abuse Screening Test (DAST) (Skinner, 1982). The Severity of Dependence Scale (SDS) (Gossop et al., 1995) is also administered to offenders who report drug use. The SDS was introduced in 2002 to establish its utility as a measure of psychological drug dependence in an offender population. Both are considered valid instruments for screening drug problems in men and women and both are included in the CASA.[2]

[2] The 288-item, bilingual, audio-enhanced CASA was implemented in 2002 as a demonstration project at two regional intake units; Springhill and Millhaven Institutions. Inmates self-administer the assessment; the results are then used to match offenders to appropriate intensities of treatment. Since, then the CASA has been fully operational in four of five regions of Canada.

The 20-item DAST focuses on the negative consequences of drug use and classifies the level of drug problem into the categories of "none", "low", "moderate", "substantial" and "severe". Individuals with a substantial or severe problem are considered dependent on drugs, while low to moderate categories indicate the presence of a substance abuse problem (Gavin, Ross & Skinner, 1989). The five-item SDS assesses the degree of psychological dependence on drugs, with higher scores reflecting a greater likelihood of psychological dependence (Gossop et al., 1995). Both the DAST and the SDS reference the 12-month period prior to arrest to examine drug problems in Canada's federal offender population. Additional information relating the instruments' psychometric properties is presented in Chapter Three: Methodology (see Indicators section).

Correctional Service Canada has used the DAST to match offenders to appropriate treatment intensities since the early 1990s. The DAST includes questions regarding the frequency and type of use (e.g., abusing more than one type of drug); withdrawal and dependence symptoms (e.g., experiencing blackouts, withdrawal symptoms); feelings of guilt over drug use; legal difficulties (e.g., engaged in illegal activities to obtain drugs); disruptions to family (e.g., neglected family) to work (e.g., lost a job because of drug abuse), and social life (e.g., lost friends due to drug use); physical health problems (e.g., medical problems as a consequence of drug use); and prior program participation. Scores of 10 or greater suggest substantial to severe problems with drug abuse, resulting in referrals to a high intensity substance abuse program. The cut-off score of 10 is based on previous research by Gavin et al. (1989) in which they assessed the trade-off between sensitivity and specificity for various cut-off

values on the DAST for a classification of drug dependence in a sample of 501 men and women seeking treatment at the Addiction Research Foundation. Using the American Psychiatric Association's Diagnostic Statistic Manual (DSM-III)[3] (American Psychiatric Association, 1987) as the criterion measure, they found that a number of "equally good" cut-off points, ranging from five to 10, resulted in 85% accuracy (correctly classified cases) across the range of cut-off scores for drug dependence (Gavin et al., 1989, p. 305). It is important to clarify at this juncture that the DSM criterion measure is comprised of two major diagnostic categories - an *abuse* diagnosis and a *dependence* diagnosis. Abuse involves a pattern of pathological use that causes impairment in social or occupational functioning that is present for at least a 12 month period. A diagnosis of dependence requires that the individual also exhibit symptoms of physical dependence, such as withdrawal and increased tolerance.

The SDS was included in the CASA so that additional information related to the psychological dimensions of addictions, such as an individual's preoccupation with and anxiety about drug taking and impaired control could be more closely examined in an offender population. The inclusion of SDS also made sense from a clinical perspective because additional information about the psychological dimensions of dependence could serve to further elucidate potential treatment targets, such as addressing the compulsive

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[3] Strongly influenced by Edwards' and Gross' (1976) conceptualization of the dependence syndrome, the American Psychiatric Association first operationalized the definition for drug dependence in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM –III) (American Psychiatric Association, 1987) (Saunders, 2006). With the introduction of the fourth edition further refinements to the definition occurred. The diagnostic criteria for dependence in the fourth edition (DSM-IV-R) proved to be at least as robust as the criteria in the third edition (Saunders, 2006). The classification system within DSM is one of the most widely used methods to identify substance abuse disorders (Lightfoot, 1999).

nature of drug-related behaviours. Additionally, providing a measure of psychological dependence potentially aligns CSC's referral process with current findings from the field of addictions research. A number of studies have examined the relationship between the dependence syndrome, first identified by Edwards and Gross (1976) in their research with alcohol abusers and the consequences of drug use (Skinner & Goldberg, 1986; Feingold & Rounsaville, 1995). Since then, a greater emphasis has been placed on the psychological components (e.g., compulsiveness) of dependence within this syndrome. The compulsive use of drugs is seen as a central feature of drug dependence as defined by the DSM (Gossop et al., 1995; Swift, Copeland & Hall, 1998). Information relating the instruments' psychometric properties is presented in Chapter Three: Methodology (see Indicators).

Previous research has confirmed a strong relationship between the DAST and the SDS. Kunic & Grant (2005) found that offenders with ratings of substantial and severe on the DAST were clearly more psychologically dependent on drugs as indicated by the divergence between their elevated scores on the SDS and the successively lower scores for the offenders with moderate and low ratings on the DAST. The elevated scores on the SDS for offenders who have a substantial to severe problem on the DAST is suggestive of a unique set of offender characteristics that can potentially serve to further differentiate cases for program referrals. From a service delivery perspective, the elevated SDS scores for the combined substantial and severe groups on the DAST suggests that they are more appropriate for referral to an intensive program that effectively targets the psychological, physiological and behavioural dimensions of dependence so that the risks of relapse and recidivism are reduced or eliminated.

Other research literature clearly demonstrates that individuals who are dependent on drugs are more likely to use drugs because of negative circumstances (Sklar, Annis & Turner, 1997) leading to patterns of drug use that are intractable to change (Shearer, 2007). These individuals also experience instability across a number of life areas suggesting the need for more intensive treatment services, including relapse prevention, to address the myriad determinants of relapse (Andrews & Bonta, 1998; Wanberg & Milkman, 1998; Witkiewitz & Marlatt, 2004; Zamble & Quinsey, 1997).

As stated previously, the cut-off score on the SDS has been previously reported in other research using clinical samples (De Las Cuevas et al., 1997; Swift, Copeland & Hall, 1998; Topp & Mattick, 1998). Although offenders within CSC custody, who produced DAST severity levels of substantial and severe, scored well above the cut-off on the SDS for a classification of psychological dependence, the establishment of an optimal classification cut-off with CSC's population is necessary so that the SDS can be formally considered for clinical decision-making purposes with a correctional population.

Chapter Three: Methodology

Purpose

As stated previously in Chapter One, the purpose of this thesis study was to formally integrate the SDS into the clinical decision-making process. It was anticipated that further case differentiation, as defined by SDS, would augment client-treatment matching and provide additional information concerning the link between psychological drug dependence, psychosocial offender characteristics and post-release outcomes. It is important to note that CSC does not incorporate an assessment of psychological drug dependence in its decision-making. Formally assessing for psychological drug dependence with SDS may provide additional insight into the dimensions of drug dependence that may be important for correctional planning.

The research employed two study designs to evaluate the SDS as a screening instrument for psychological drug dependence in a sample of federally incarcerated male offenders. For the first part of the study, a cross-sectional sample of male offenders was used to: a) assess the reliability of the SDS and DAST; b) examine the relationships between DAST and SDS through multivariate analyses; c) establish a quantitatively-derived classification threshold for psychological dependence on drugs as measured by the SDS; d) examine the covariates of psychological drug dependence across a number of life domains or dimensions of an offender's life; and e) develop offender profiles based on the covariates that are associated with the classification.

A second design involved a retrospective, closed, single cohort of offenders (from the above sample of men) who were released into the community. This sub-

sample was examined to establish SDS's ability to predict post-release outcomes; i.e., predict a return to custody (revocation) for a technical violation of the conditions of a release (e.g., a positive result on a urinalysis test) or a return to custody because of a re-offence.

In more specific terms, psychological dependence on drugs was defined as the SDS cut-off score which best separated the combined group of offenders with ratings of substantial or severe on the DAST from those offenders with ratings of none, low or moderate.[4] Thus, two groups were created from the sample: The group who did not exceed the classification threshold and the psychologically drug dependent group who exceeded the threshold. It was hypothesized that offenders who had a higher level of need identified across a number of life domains known to be associated with re-offending, had a higher probability of psychological drug dependence.[5] It was also hypothesized that offenders who used drugs because of negative affective states, or as a result of having to cope with physical distress, or to manage withdrawal symptoms would have a higher probability of psychological drug dependence than those individuals who used drugs because of positive life circumstances (e.g., good times with others).

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[4] Previous research has established DAST's clinical utility through its validation against the criteria for substance abuse disorders in the *DSM-III* (Gavin et al., 1989). Individuals with a substantial or severe problem are considered dependent on drugs.

[5] Appendix A provides a complete list of indicators that comprise each domain of an offender's life.

Next, offenders who met the classification threshold for psychological drug dependence were compared to the other group to examine differences in rates of revocation over a 24 month follow-up period. It was hypothesized that the group of offenders who exceeded the classification threshold for psychological drug dependence, as measured by the SDS, were revoked at a higher rate (with or without a new offence) than the group of offenders who did not exceed the classification threshold. Comparisons were made after adjusting for the effects of the other covariates that were associated with the classification and the outcome, such as exposure to substance abuse treatment, risk of recidivism, and level of need identified across a number of life domains.

Accurate client-treatment matching can lead to better treatment outcomes, such as reductions in rates of recidivism (Andrews & Bonta, 2006). Therefore, additional comparisons were made to assess the effect of treatment intensity (i.e., treatment dose) on the rates of revocation for the psychologically drug dependent offenders. It was hypothesized that the psychologically drug dependent offenders who participated in the current high intensity substance abuse program should be revoked at lower rates than the psychologically drug dependent offenders who participated in the current moderate intensity program. Both groups of offenders were compared to the group of offenders who were classified as psychologically drug dependent but never participated in a substance abuse treatment program prior to release from custody. It was believed that participation in the current high intensity program rather than the moderate intensity program exposed the offender to a higher dosage of treatment that was more effective in

addressing substance abuse criminogenic need.[6]

Study Design

Cross-sectional Sample

A total of 3350 male offenders from the Atlantic, Ontario, Quebec and Pacific Regions of CSC, who completed the Computerized Assessment of Substance Abuse (CASA) between May 2002 and July 2007, comprised the sample. Of the total number of offenders, 281 (8.4%) were of Aboriginal ancestry. Aboriginal offenders were younger in age ($M = 31.8$, $SD = 9.1$) than non-Aboriginal offenders ($M = 34.3$, $SD = 10.8$) at the time of assessment. It is important to note that the sample of Aboriginal offenders was under-representative of the total population of Aboriginal offenders in federal custody because offenders from the Prairies Region – a region with 41% Aboriginal representation - could not be included in the study.[7] This region is still in the process of phasing-in CASA.

The non-random sample represented approximately 19% of all admissions to federal custody at these four regions over the five year period. The remaining offenders

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[6] Program intensity refers to the scope, sequencing and duration of treatment, and is related to the seriousness and persistence of an offender's risk and need (CSC, 2003b). Therefore, referrals to high, moderate and low intensity substance abuse programs are based on the severity of substance abuse problems as measured by the Alcohol Dependence Scale (ADS) (Skinner & Horn, 1984), the Problems Related to Drinking Scale (PRD), and the Drug Abuse Screening Test (DAST) (Skinner, 1982). Offenders with a substantial to severe problem require treatment in a high intensity program; however, some are referred to moderate intensity because the demand for high intensity exceeds capacity. Offenders with a moderate or low level problem require treatment in respective intensity levels. For a complete description of the referral process, the reader is referred to Kunic & Grant (2005).

[7] Approximately 18% of the population in federal custody is Aboriginal (Trevethan, Moore, Rastin, 2002).

were assessed with the existing Computerized Lifestyle Assessment Instrument (CLAI)[8] because the rates of admission at the regional intake units exceeded the capacity of CASA during the phase-in of the project. Therefore, assignment to the CASA depended on the availability of the CASA work-stations. There was no systematic pre-selection for the CASA that was based on offender-specific factors. Nonetheless, analyses were performed (described hereinafter) to ensure that there were no case-specific factors or any other potentially confounding criteria related to the completion of the CASA that would have biased the results.

Release Cohort Sample

Of the 3350 male offenders from the cross-sectional sample, a total of 2037 offenders were released to the community. However, the release cohort was restricted to offenders from the Atlantic and Ontario Regions (n = 1677, M_{age} = 33.5, SD = 10.3) because of bias in the yearly distribution of CASA completions and releases to the community from the Pacific and Quebec Regions. Prior to 2005, there were no CASA completions within the Pacific and Quebec Regions because CASA was not yet available in these two regions. Therefore, very few offenders who completed the CASA within these two regions were available for follow-up into the community. Of those who were available for follow-up (25% of the total sample of offenders from the Pacific and Quebec Regions), the majority were released in 2007. As a result, the period between release and the end of the study period was relatively short. The shorter period

[8] In 1998, CSC commenced development of a replacement software for CLAI after operational staff and an international panel of expert consultants cited a number of difficulties with the CLAI software and content. The CASA was phased-in as a replacement for CLAI between 2002 and 2007.

of follow-up precluded a thorough examination of post-release outcomes. In contrast, approximately 70% of the offenders who completed the CASA in the Ontario and Atlantic Regions between 2002 and 2007 were released to the community and available for the analyses of community-based outcomes.

The majority of non-Aboriginal offenders from the Atlantic and Ontario regions were released on day parole (57%) followed by statutory release (40%) and full parole (3%). In contrast, of the 119 (7%) Aboriginal offenders who comprised the release cohort, the majority were released on statutory release (62%), followed by day parole (36%) and full parole (2 %). They also had a shorter sentence length than non-Aboriginal offenders - 1065 days (SD = 455) versus 1117 days (SD = 495).

Data Sources

The CASA and the Offender Intake Assessment (OIA) administrative databases served as the two main data sources. These data were made available through the Addictions Research Centre, CSC, in accordance with CSC's Research Guidelines and after full review and approval of the research proposal by UPEI's Research Ethics Board.

The 288-item, self-administered CASA explores the nature and seriousness of an offender's substance abuse problems. It specifically assesses: patterns of alcohol use (total of 36 items); consequences of alcohol use (25 items); severity of alcohol problems (25 items); problems related to drinking (15 items); and alcohol's link to past and current offending (20 items). The CASA also assesses: patterns of drug use (39 items); the severity of drug problems (20 items); the degree of psychological dependence on drugs

(5 items); drug use and its relationship to past and current offending (19 items); injection drug use (6 items); and poly-substance use patterns (8 items). Nine items investigate in-custody substance abuse patterns and nine items explore family-related patterns of substance use. Information concerning progress in prior substance abuse programming, including methadone maintenance, is collected by means of 20 items. The CASA concludes with 20 items that delve into the area of treatment readiness along the following six dimensions: problem recognition, level of comfort with problem, feelings of personal responsibility, commitment to treatment, willingness to change and external support for change. Twelve additional post-assessment items provide respondents with an opportunity to rate their experience completing the CASA.

The CASA is a supplementary assessment to the Offender Intake Assessment (OIA) (described later in section) (CSC, 2003a). The OIA involves the analysis and identification of critical static (i.e., criminal risk factors) and dynamic factors (i.e., needs identified within seven life domains) that affect the safe and timely reintegration of each offender into the community. Both the CASA and the OIA are used for correctional planning activities, such as matching offenders to appropriate treatment and services, and for other administrative purposes.

The OIA and release information was extracted from the Offender Management System (OMS). CSC uses OMS to maintain all offender records and to manage offenders from sentence commencement to sentence end. The system captures a wealth of information that includes, but is not limited to the following: demographic information, other offender characteristics, sentence and conviction information, all

admission and release records, assessments for decision making purposes, urinalysis results, misconduct information, reports on offender performance, and related records. Both the CASA and the OIA databases were merged and stripped of all personal identifiers to render the data anonymous prior to release for this research.

Indicators

OIA Dynamic Factor Analysis

The OIA dynamic factor analysis is conducted by the institutional parole officer within the first 90 days after an offender's admission to federal custody. Through interview(s) with the offender and in-depth analyses of information from collateral sources, such as police agencies, family members, professionals from other jurisdictions, the institutional parole officer confirms the presence of specific indicators within the following seven life domains or criminogenic need areas: education/employment, marital/family relationships, associates/social interaction, substance abuse, community functioning, personal/emotional orientation, and attitude.

The total number of identified need indicators is as follows: education/employment (35 indicators), marital/family (31 indicators), associates/social interaction (11 indicators), substance abuse (29 indicators), community functioning (21 indicators), personal/emotional orientation (46 indicators) and attitude (24 indicators). The indicators are structured as questions with a dichotomous response format ("yes" =

presence of a problem; "no" = absence of a problem; missing value = "unknown").[9] This allows for the efficient identification of specific problems within each domain area. This information is electronically stored in an offender record within OMS. Appendix B includes the complete list of indicators across the seven domains.

For each domain, OMS automatically scores the number of responses within each domain and the parole officer ranks the domains in order of priority (i.e., the higher the score, the higher the priority) (CSC, 2003a). For example, the domain of education/employment consists of 35 indicators of instability within the areas of education and employment (see Appendix B). A "yes" response to any one of the 35 indicators warrants a score of one for a maximum score of 35 for this domain. The higher the number of yes responses, the more instability within the domain and the higher the priority ranking for the domain.

Parole officers use the results from this exercise and other case specific information to establish an overall need rating for each domain. A total of four possible ratings on need can be assigned for the domains of education/employment, marital/family, associates/social interaction, community functioning and attitude: "asset", "no need for improvement", "some need for improvement" or "considerable need for improvement". Only three of the four need ratings can be assigned for the domains of substance abuse and personal/emotional orientation: "no need for improvement", "some need for improvement" or "considerable need for improvement".

[9] Missing values (unknowns) were recoded to "2" and analyzed along with the other responses to see if they were significantly associated with any of the outcomes. Note that the unknowns comprised a very small proportion of the total responses (< 2%) for most of the indicators. The distributions/proportions of unknown responses for a specific indicator were reported if the responses were significantly associated with an outcome.

Considerable research has been conducted on the OIA since its phase-in during the early 1990s. Motiuk and Brown (1993) examined the ability of the OIA to predict post-release suspensions (i.e., returns to custody on a suspension) in a sample of 604 federally sentenced adult offenders (573 males; 31 females). They found that each of the seven dynamic factors was significantly related to having a suspension warrant issued during the first six months after release from custody. The strongest indicators in terms of predictive validity were: unstable job history, criminal friends and acquaintances, associates with drinkers/drug abusers, relations with others are exploitative, poor financial management, unable to set goals, low empathy, impulsiveness, difficulty controlling temper, copes poorly with stress/frustration, and unable to work towards life goals (Motiuk and Brown, 1993).

Motiuk (1997) presented additional evidence in support of the OIA's validity by demonstrating that the number of positively endorsed indicators within a given domain (i.e., the number of indicators scored as 'yes') was strongly associated with the domain rating. For instance, the number of indicators scored as 'yes' within the substance abuse domain was correlated .78 with the substance abuse domain rating. For all other domains, correlations ranged from a low of .54 for community functioning to .78 for substance abuse. This analysis, therefore, demonstrated that the OIA was being used in the manner in which it was originally intended. Parole officers were using the individual indicator endorsements to guide their overall rating on a given domain.

In 1998, Motiuk examined the OIA's ability to predict returns to custody for a sample of 3,380 male offenders who were at risk for an average of 250 days. Chi-square

and correlational analyses confirmed OIA's predictive validity. Pearson r's correlation coefficients ranged from .09 for the attitudinal domain to .17 for the associates and education/employment domains. The correlation coefficients for the remaining domains (personal/emotional domain, community functioning, substance abuse, marital/family) ranged from .11 to .15.

Recently, Brown and Motiuk (2005) in their meta-analytic, psychometric and consultative review of the OIA indicators, found OIA valid in terms of its ability to predict re-offending. Offenders who were rated with more serious problems across all seven domains were more likely to be returned to custody during a three year follow-up in the community.

Region

The regional reception centres at: Millhaven Insitution, Ontario Region; Springhill Institution, Altantic Region; Centre régional de réception (Ste-Anne-des-Plaines), Quebec Region; and the Regional Reception Assessment Centre, Pacific Region, were coded and included in the analyses to control for possible region effects on outcomes.

Measure of Alcohol Abuse

The Alcohol Dependence Scale (ADS) (Skinner & Horn, 1984) consists of 25 items that are designed to tap into the alcohol dependence syndrome (Edwards & Gross, 1976). The ADS provides a measure of the extent to which the use of alcohol has progressed from psychological involvement to impaired control. Sample items include:

"Did you have the shakes when sobering up (hands tremble, shake inside)?" and "As a result of drinking, did you see things that weren't really there?" Empirically derived severity levels of none (0), low (1-13), moderate (14-21), substantial (22-30) and severe (31-47) are used to differentiate cases for program referral purposes. The case classification system is supported by previous research with the scale (Skinner & Horn, 1984). The ADS references the "12 month period prior to arrest" in establishing a severity level.

The ADS boasts excellent internal consistency and external validity (Skinner & Horn, 1984). Cronbach's alpha values range from 0.85 to 0.94, which indicate excellent reliability (Boland, Henderson & Baker, 1998). External validity is supported by the scale's strong association with other measures of alcohol-related instability (Skinner & Horn, 1984; Boland et al., 1998). The scale is considered unidimensional. Previous research has supported its clinical utility within a correctional context (Hodgins & Lightfoot, 1988, 1989).

Measures of Drug Abuse

The results from the Drug Abuse Screening Test (DAST) (Skinner, 1982) and the Severity of Dependence Scale (SDS) (Gossop et al., 1995) were extracted from the Computerized Assessment of Substance Abuse (CASA) database. The DAST is used to assess the severity of problems associated with drug use. Quantitative severity levels of none (0), low (1-5), moderate (6-10), substantial (11-15) and severe (16-20) are based on normative data for the scale (Robinson et al., 1991). These severity levels are used to differentiate cases for program-referral purposes. The DAST includes items concerning

the frequency of use, symptoms of dependence, extent of drug-related interference, feelings of guilt and prior treatment (Boland et al., 1998). Sample items include: *"Could you get through the week without using drugs?"* and *"Did you neglect family because of your drug use?"* The DAST references the *"12 month period prior to arrest"* to establish the severity of drug abuse. A dichotomous response format is used with each "yes" endorsement warranting a score of one.

Previous psychometric work has established the reliability and validity of the DAST (Yudko, Lozhkina & Fouts, 2007). Cronbach's coefficient alpha values range from 0.74 to 0.95, which indicates excellent reliability (i.e., internal consistency of the items) (Boland et al., 1998; Yudko et al., 2007). Previous research has also supported its clinical utility within a correctional context and with clinical populations (Hodgins & Lightfoot, 1988, 1989; Skinner & Goldberg, 1986). The DAST is considered unidimensional by its author and by others who have examined the instrument's factor structure (Skinner, 1982; Yudko et al., 2007). The DAST is considered valid in terms of its item composition (i.e., face validity); its high correlation with other measures of drug use (i.e., criterion validity) and its relationship to other constructs that are related to drug abuse (i.e., construct validity) (Yudko et al., 2007).

The Severity of Dependence Scale (SDS) (Gossop et al., 1995) provides a measure of the psychological dimensions of addiction, such as an individual's preoccupation and anxiety about drug taking and impaired control. The CASA respondent first identifies the drug used most often during the 12-month period prior to arrest for the current offences. The CASA then automatically inserts the name of the

drug into each of the five SDS items. Sample items include: *"Did the prospect of missing a fix (or dose) or not chasing make you anxious or worried?"* and *"Did you worry about your use of (named drug)?"* Responses are indicated using a four-point scale ranging from *"never or almost never"* to *"always or almost always"* for the first four items. The fifth item, *"How difficult did you find it to stop or go without (named drug)?"* is also scored on a four-point scale; however, response choices range from *"not difficult"* to *"impossible"*. Total scores on the SDS range from 0 to15. A cut-off score of at least five has been used to indicate the presence of dependence (Swift, et al., 1998).

The psychometric properties of the SDS have been previously examined with clinical and non-clinical samples of heroin, cocaine and amphetamine users (Gossop et al., 1995). Cronbach's alpha values of between 0.80 and 0.90 suggest excellent reliability (i.e., internal consistency) across drug types. Principal component analysis uncovered a single factor suggesting unidimensionality across drug types. The validity of the scale is supported by its positive correlation with a number of indicators of drug abuse (e.g., dose, duration of use, frequency of use) (Gossop et al., 1995). The complete list of DAST and SDS items are located in Appendix A.

Triggers of drug use

CASA respondents are asked to indicate what types of triggers precipitated their drug use during the 12 month period prior to arrest. A total of 13 triggers comprise the response choices. They include:

1. Feeling good
2. Feeling bad
3. Pressure from friends and/or family
4. Good times with others
5. Conflict with others
6. To get rid of pain
7. To get rid of cravings
8. To test self-control
9. To relax
10. To get courage
11. Because of stress
12. Because of boredom
13. To cure withdrawal symptoms

The 13 triggers were collapsed into the following eight categories to reduce the potential for duplication of information between triggers:

1. Because of positive circumstances, comprised of *feeling good*, *good times with others*, or *to relax.*
2. Because of negative affective states (*feeling bad* or *because of stress*)
3. Because of external influence (pressure *from friends and/or family* or *conflict with others*)
4. To manage physical pain (*to get rid of pain*)
5. To manage withdrawal symptoms (*to get rid of cravings* or *to cure withdrawal symptoms*)
6. To test self-control
7. Because of boredom
8. To get courage

Risk of Recidivism

The Revised Statistical Information on Recidivism Scale (SIR-R1) (Nuffield, 1982, as cited in Nafekh & Motiuk, 2002) is an actuarially derived tool for predicting re-

offending in federally sentenced, non-aboriginal men. It is completed within OMS and during the first 90 days after an offender's admission to federal custody to help establish an offender's likelihood for re-offending.

The SIR-R1 statistically quantifies 15 demographic and criminal history indicators using the weighted Burgess method (Hakeem, 1948). This method applies positive and negative scores to individual items to reflect differences between endorsed items and population success rates. Items (predictor variables) are assigned a weight depending on their deviation from the base rate of success (Bonta, Harman, Hann & Cormier, 1996). Simple summation of the items yields scores ranging from -30 (poor risk) to +27 (very good risk) (Nafekh & Motiuk, 2002).

Offenders are classified into one of the following five risk categories: "very good" risk (four out of five offenders predicted to succeed on release); "good" risk (two out of three offenders in this category predicted to succeed); "fair" risk (one out of two offenders predicted to succeed); "fair/poor" risk (two out of five offenders predicted to succeed); and "poor" risk (one out of three offenders predicted to succeed). These categories provide an estimate of an offender's risk for re-offending during the first three years after release from federal custody.

The internal reliability and predictive validity of the SIR-R1 has been previously established with CSC's offender population (Bonta et al., 1996). It is considered a stable predictor of general recidivism. Scores predict a variety of outcomes and the risk categories which comprise the scale demonstrate systematic associations with re-offence outcomes.

Recall, that Aboriginal offenders are not administered the SIR-R1. For this subpopulation, which represented 8.4% of the study sample, the SIR-R1 rating was coded as "unknown" and included in the modelling procedures to assess the probability of recidivism for this group as a whole.

Substance Abuse Program Exposure

Once an offender completes an institutionally-based substance abuse program, the Offender Management System (OMS) is updated to reflect "successful completion" (CSC, 2003b). If the offender should fail to complete a substance abuse program, OMS is updated to reflect same (e.g., "suspended", "withdrawn"). Offenders who either failed to complete a substance abuse program or were referred to a substance abuse program, but never participated, were considered "non-exposed" to a substance abuse program for the purposes of this research.

Both Aboriginal and non-Aboriginal Offenders have the option of participating in the National Substance Abuse Program (NSAP) at the high intensity (NSAP-H) or moderate intensity (NSAP-M) levels prior to conditional or statutory release.[10] Both NSAP intensity levels are based on social cognitive theory, relapse prevention therapy and cognitive behavioural therapy and are designed to reduce the risk of relapse to substance abuse and re-offending (CSC, 2004). NSAP-M and NSAP-H are delivered over 26 and 89, 2-hour group sessions, respectively. They vary in intensity and are designed to match with the severity of an offender's substance abuse problems.

[10] Prior to 2004, Choices (low intensity which was delivered in the community as a community-based relapse prevention and maintenance program), the Offender Pre-Release Program (OSAPP) (moderate intensity), and the High Intensity Program (HISAP) were the only substance abuse programs delivered to offenders. Offenders who completed these programs were also considered program exposed.

NSAP-M is designed to address the needs of offenders with a moderate problem, while the NSAP-H is reserved for offenders with a severe problem. The program content for both intensities spans four phases (J. Eno, personal communication, July 3, 2008). Phase I focusses on preparing the participant to change their substance abusing behaviour. In Phase II participants identify and learn how to more effectively manage their personal risk factors. During Phase III, participants learn basic cognitive and behavioural strategies to manage their risk. In Phase IV participants develop relapse prevention and life planning skills. Both intensity levels incorporate pre-release maintenance and "booster" sessions to reinforce and maintain treatment gains. Once successful participants of NSAP are released to the community, they can participate in a community-based maintenance (aftercare) program that is of varying length.

The Aboriginal Offender Substance Abuse Program (AOSAP) is also a national program that is offered as a high intensity program for male, Aboriginal offenders prior to conditional or statutory release from federal custody. It is also designed to reduce relapse to substance abuse and the risk of re-offending. AOSAP is holistic in its approach. It responds to the cultural and spiritual needs of Aboriginal men (First Nations, Inuit and Métis) who seek an alternative to 'main-stream' substance abuse treatment programs. AOSAP recognizes diversity within Aboriginal cultures and encourages the use of ceremonial activities appropriate to the participants in the program. The program is delivered over 65 group sessions of 2.25 hours in length. At least four additional, individual sessions are provided to augment the program's teachings (CSC, 2007a).

Release Type

Type of release is an indicator of the level of risk the National Parole Board (NPB) perceives the offender to present to the community. Offenders may be granted a conditional release – either day parole or full parole - before they have served two-thirds of their sentence, or a statutory release when they have served two-thirds of their sentence.

Day parole may be granted to an offender by the NPB or a provincial parole board, which requires the offender to return to a penitentiary, a Community-Based Residential Facility (CBRF), which includes an authorized private home placement, or a provincial correctional facility each night, unless otherwise authorized. Full parole may be granted to an offender by the NPB or a provincial parole board which allows the offender to serve a portion of the sentence in the community while under supervision.

Statutory release is normally a non-discretionary form of legislated release that CSC and NPB are obligated to follow unless there is sufficient evidence to support the detention of the offender. The offender remains subject to supervision until the expiration of his or her sentence. Statutory release is mandated in law, and only under exceptional circumstances can offenders be kept in custody beyond two-thirds of their sentence. Statutory release is only available for offenders serving determinate sentences, while all releases for those serving indeterminate sentences (mostly offenders serving life sentences) are conditional.

Revocation (Return to Custody)

Revocations occur if the offender has failed to meet the conditions of his or her conditional release (i.e., release from custody on day or full parole) or statutory release (i.e., release from custody after serving two-thirds of the sentence) or if a new offence has been committed while on conditional release or statutory release. Failure to meet the conditions results in a technical violation when the supervising parole officer and the National Parole Board believe that the offender's behaviour can no longer be managed in a way that ensures the safety of the public and the offender, such as a positive urinalysis test and unlawfully leaving the jurisdiction. Revocation with a new offence occurs when the offender is charged and convicted of committing a new offence while on conditional or statutory release.

Community-based Urinalysis:

The collection and laboratory testing of urine to detect substances of abuse is a well-established technology that has been used in a variety of settings to monitor and deter drug use (MacPherson, 2004). As part of the supervision process, CSC relies on urinalysis testing to monitor released offenders and assist them in discontinuing their substance abuse (CSC, 2007b).[11] For the purposes of this research all post-release urinalysis results were analyzed to look for evidence of substance use and the type of drug(s) found for those offenders who were tested. Tests that were administered after release from custody, but before re-admission to custody or before the end of the study

[11] The collection of urine is supervised to reduce the possibility of an offender's attempt to alter or falsify the urine sample. If the sample cannot be collected without prior notification, the offender may be informed no longer than 24 hours in advance of the sample. Otherwise, the dates and times of sample collection are irregular (CSC, 2007b).

period or warrant expiry- whichever was the case - were analyzed to estimate relapse to substance abuse.

Other Indicators:

A number of other indicators were extracted from OMS and CASA databases to generate descriptive statistics, such as demographic characteristics, average sentence length, and drug(s) of choice. Other descriptive statistics were generated where applicable. Above noted indicators were also used for descriptive purposes.

Procedures[12]

Assessing the reliability of the SDS and DAST

Cronbach's coefficient alpha was used to asses the degree to which DAST items and SDS items converged to measure evidence of problematic drug use and the concept of psychological drug dependence, respectively. In general terms, Cronbach's coefficient alpha reflects the degree to which an instrument is internally consistent (Nunnally & Bernstein, 1994). It varies as a function of the number of items and their average inter-item correlation. The higher the average correlation, the lower the error and the higher the commonality between items; and the more items, the greater the likelihood that errors will cancel out (Ho Yu, 2001). Possible coefficient alpha values can range between zero and one, with values closer to zero reflecting an instrument that is too short and/or comprised of items that have very little in common (Nunnally &

[12] All data management, data transformations, and statistical analyses were performed with the SAS/STAT © Version 9.1 software.

Bernstein, 1994). It is generally accepted that an alpha value of greater than .70 is considered acceptable in terms of confirming the internal consistency of items for a given instrument (Nunnally & Bernstein, 1994).

Examining the dimensional relationship between DAST and SDS items

A multivariate method called canonical correlation analysis was performed between the 20 DAST and five SDS items to describe the dimensional relationship between the two instruments. The canonical correlation procedure combines sets of variables into linear combinations, known as canonical variates, for each instrument to produce, a predicted value that has the highest correlation with the predicted value on the other instrument (Tabachnik & Fidell, 2001). These pairs of canonical variates can be thought of as superordinate or latent constructs. The degree to which the variates are correlated is interpreted in much the same way as an ordinary Pearson product-moment correlation (r). That is, the higher the numerical r-value for the canonical correlation, the stronger the correlation and the more variance that is explained. Squaring the r provides an estimate of the amount of overlapping variance that is extracted by the two variates in the canonical pair. The interpretability of canonical variate pairs depends on the strength of their correlation, and the amount of overlapping variance and total variance they explain.

The canonical variate pairs were used to provide additional insight into how combinations of items co-varied across instruments. For instance, along how many dimensions were the items on the DAST related to the items on the SDS? Did these dimensions and the items which comprised them provide additional information that

could be used for clinical decision-making?

Although the normality, homoscedasticity and linearity assumptions do not need to be satisfied to conduct canonical correlation analyses, the interpretation of the results can often be enhanced if they are (Tabachnik & Fidell, 2001). Therefore, all three assumptions were tested to assess whether or not there were any serious violations to the assumptions. Scatter plots of the canonical variate scores for canonical variate pairs were first examined to determine whether there were any serious departures from linearity or homoscedasticity. Then, the kurtosis and skewness of the distribution of canonical variate scores for each significant pair were examined to assess normality or the shape of the distribution. The possibility of using statistical transformations of the variate scores were explored to correct for instances when assumptions were violated.

Establishing a Cut-off Score on the SDS for a Classification of Psychological Drug Dependence

Receiver Operating Characteristics (ROC) (Hosmer & Lemeshow, 2000) was used to establish a classification threshold for psychological drug dependence as measured by the SDS. ROC is a diagnostic tool designed to assess the ability of a model to discriminate between events and non-events.

For the purposes of these analyses, DAST severity levels were divided into two groups – the combined substantial and severe category (Y=1; DAST total score $\geq$ 10) and the combined moderate, low and none categories (Y=0). The comparison was fitted into the model to predict the odds and estimated probabilities of membership in Y=1 based on the SDS scores. A number of summary statistics were also computed to

indicate the estimated overall accuracy: the number of correctly predicted events (i.e., positive predictive values); the number of correctly predicted non-events (i.e., negative predictive value), the number of false positives (i.e., 1-specificity) and false negatives (i.e., 1-sensitivity); and the specificity and sensitivity for each SDS cut-off score.

A Receiver Operating Characteristics Curve (ROC) curve was also produced to graphically depict the relationship between sensitivity and the proportion of false positives (1-specificity). In general terms, a ROC curve provides a visual representation of a test's effectiveness (Dohoo, Martin & Stryhn, 2003). If the rate of true positive cases (sensitivity) increases at a greater rate than the rate for false positives (1-specificity), the area under the curve (AUC) will be larger. A perfect test would have an AUC value of one and no false positives. In contrast, a diagonal line extending at a 45 degree angle from the (0,0) coordinate on the plot surface represents a test that does no better than chance in terms of its predictive accuracy. In other words, the AUC underneath the diagonal line is .50 signifying equal true positive and false positive rates across the full range of cut-off scores. Thus, the larger the AUC and the greater the deviance from the diagonal, the better the predictive accuracy of a test.

Examining the Covariates of Psychological Dependence on Drugs

Introduction

The hypothesized covariates of psychological dependence included ratings on the domains of: education/employment, marital/family relationships, associates/social interaction, community functioning, substance abuse, personal/emotional orientation, and attitude. Because the identification of specific need indicators served as the basis

for the domain ratings, and since the domains represented unique dimensions of an offender's life, attempts were made to identify indicators that were associated with psychological drug dependence within each domain. See Appendix B for a complete list of indicators that comprise each of the seven domains. Age, race (Aboriginal vs. Non-Aboriginal) and the SIR-R1 risk rating variables were also examined to assess their association with psychological drug dependence and to control for possible confounding.

Multivariable logistic regression procedures, described later in this section, were used to examine the covariates of psychological drug dependence (the outcome). A total of eight binary logistic regression models were created, of which seven assessed the association between the outcome and a) the domain need ratings and respective indicators within each domain, b) offender age at assessment, c) race (e.g., Aboriginal vs. non-Aboriginal) and d) the SIR-R1 risk rating. The domain ratings and indicators, and the variables that were identified as significant covariates of the outcome for each individual domain were then included in the eighth model to identify the covariates that were most strongly associated with the outcome across all domains. The SDS cut-off score - identified through the aforementioned ROC procedure - served to define the dichotomous outcome: the individuals identified with psychological drug dependence (Y=1) and the remaining group of offenders who did not exceed the threshold for the classification (Y=0).

Recall that during intake, the institutional parole officer confirms the presence of indicators within a specific domain through interview(s) with the offender and in-depth analyses of information from collateral sources, such as police agencies, family

members, other professionals, and through specialized assessments like the CASA. This is important from a number of perspectives. First, this kind of process provides a means of triangulating information so that the most accurate and complete assessment of offender needs informs the correctional planning process. Second, the synthesis of information from a variety of sources, including specialized assessments, facilitates evidence-informed and consistent decision-making within and between jurisdictions. Third, from a research perspective, multiple sources of information provide a means by which researchers can examine the concurrent validity of a newly introduced instrument by comparing it to an established criterion. In this case, assessing the association between psychological drug dependence as assessed by the SDS and the 29 indicators within the substance abuse domain of the OIA provided additional information relating to the degree of concurrence between the two sources of information. Significant, covariate-adjusted associations between the SDS-derived classification of psychological drug dependence and the indicators within the substance abuse domain would provide additional information confirming the SDS's concurrent validity and clinical utility.

A brief description of the logistic regression procedure

Like any other regression approach, multivariable logistic regression analysis characterizes the relationship between an outcome variable and one or more covariates or explanatory variables (Allison, 1999). In linear regression, the response variable is continuous (e.g., raw scores on an assessment); whereas, in logistic regression, the response variable is dichotomous (i.e., categorical with two categories). If a logistic regression model is a good one, variables will be highly predictive of the outcome. The modelling procedure uses coefficients, derived from maximum likelihood (*ML*)

estimation,[13] to quantify the effect of significant predictor variables on the outcome. Exponentiating the coefficient produces an odds ratio.

In statistical terms, an odds ratio indicates how much more likely, with respect to odds, a certain event will occur in one group relative to the occurrence of that event in another group. For example, an odds ratio equal to 1.0 will result in no change in the likelihood of the event occurring with a change in the covariate or predictor. The main goal of any type of regression analysis is to statistically determine whether the model with at least one covariate or variable is significantly better than a model with just an intercept. A number of statistics, discussed hereinafter, describe how well the model fits the data.

Covariate selection and model building steps

The first step in the selection of covariates involved screening each indicator within each domain to establish the strength of the indicator's unconditional association with psychological drug dependence (the outcome). Only those domain indicators and variables that were unconditionally associated with the outcome at a liberal *p-value* ($p<0.20$) were retained for further analyses.[14] For the continuous age variable, one additional step was required. A quadratic term (age squared) was added to assess the linearity assumption between age and the outcome. If the quadratic term was significant then the linearity assumption was violated. The quadratic term was included in the

[13] *ML* estimation chooses, as estimates, those parameter values that maximize the probability of observing what has actually been observed (Dohoo et al., 2003). Maximization involves an iterative numerical approach that involves successive approximations of the estimate until maximum likelihood for the parameter estimate is obtained (Allison, 1999).

[14] A liberal *p*-value of 0.20 was chosen for the initial screening to reduce the likelihood of excluding indicators that could potentially interact with other indicators in the final model.

model along with the original age variable to account for the curvilinear association between age and psychological drug dependence.[15] The domain indicators and variables that were unconditionally associated with the outcome were then fit into a multivariable logistic model to assess their association with the outcome after adjusting for the effects of other indicators in the model.

Domain indicators were identified as significant covariates of the outcome through backward, forward and manual selection modelling procedures[16]. If the procedures produced different results (i.e., identified different covariates), the model that was created through manual selection was chosen as the valid model because the author could factor in other considerations in the selection process (e.g., the possibility of one variable masking the effects of another variable). All possible two-way interactions between covariates within each domain were also assessed.

Rather than relying on the results of the *Wald-test* statistic, a likelihood ratio test (*LRT*) was performed to determine if a covariate's contribution to the model was significant in terms of its ability to explain variation in the outcome.[17] An indicator was retained as a significant covariate of psychological drug dependence at the standard significance level ($p < .05$) or if the indicator affected another covariate's effect on the

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[15] To assess violations to the linearity assumption, age was first centered and then squared to reduce collinearity between the two age parameters (Dohoo et al., 2003).

[16] Backward selection includes all indicators in the logistic regression equation, then removes the least informative indicator in terms of its association with the outcome (based on the *Wald-test* statistic under a specified criterion). This is repeated until all of the non-significant indicators are removed. Forward selection starts by adding the covariate with the largest partial *Wald-test* statistic. The process is repeated until no other covariates meet the entry criteria (Dohoo et al., 2003).

[17] *LRT* is considered the preferred method because the *Wald-test* is considered less reliable, especially for covariates that have *p*-values close to the rejection region (Dohoo et al., 2003).

outcome through a confounding or interacting effect.

Each logistic regression model was then assessed to determine how well it fitted the data. The Hosmer-Lemeshow goodness-of-fit test was used to assess whether or not the observed values were significantly different from the model's predicted values (Hosmer & Lemeshow, 2000). The Hosmer-Lemeshow test statistic groups the predicted probabilities into deciles. A Pearson chi-square test is then calculated based on the observed and expected number of observations in each decile (Hosmer & Lemeshow, 2000). A non-significant Pearson chi-square statistic is suggestive of adequate model fit because the observed and expected values are relatively equivalent. However, one limitation with the Hosmer-Lemeshow test is worth noting. The goodness of fit statistic has low power if too few groups are used to calculate the statistic. Therefore, the test was only applied if: a) the number of groups exceeded 5 and b) the number of observations within each group were of relatively equal size (Allison, 1999; Hosmer & Lemeshow, 2000).

Plots were generated of changes in the Pearson chi-square statistic versus the predicted values in order to assess each model's sensitivity to influential observations.[18] Visual inspection of the plots allowed for the identification of those covariate patterns that were poorly fit by the model (i.e., observations that produced the largest Pearson chi-square value for a given predicted probability). Although there is no cut-off value for the statistic, Hosmer and Lemeshow (2000) suggest that values of greater than four

[18] Changes in the value for the Pearson chi-square statistic reflect the extent to which observations contribute to the disagreement between the data and predicted values of the fitted model. Larger values for the statistic correspond to larger residuals, and identify observations with covariate patterns that do not adequately fit the data.

for the statistic indicate potential outliers. Sensitivity analyses were conducted by deleting influential observations (values > 4), and then re-fitting each model and comparing it to the model with all of the observations. Only observations that influenced the results substantially away from the null (i.e., amplifying the strength of association between a covariate and the outcome) were considered cause for concern and reported.

As a final step, the predictive power of each of the eight models was compared to the other models using the generalized (pseudo) R^2 statistic. This statistic is based on the likelihood ratio test (*LRT*) of the null hypothesis that all coefficients for the covariates are equal to zero (Allison, 1999). That is,

$$R^2 = 1 - \exp(LRT / n) \text{ (where } n \text{ is the sample size).}$$

The larger the value for the generalized R^2 statistic, the more predictive the set of covariates are of the outcome. The generalized R^2 is only valid and useful in evaluating multiple models which predict the same outcome, on the same dataset and with the same sample (Dohoo et al., 2003). In other words, a pseudo R-squared statistic without context has little meaning. R^2 ranges between zero and one.

Examining the Triggers of Drug Use and their Association with Psychological Drug Dependence

The triggers or antecedents of drug use, which were categorized into eight groups, were also examined using the above procedures. Each of the categories was examined individually through simple logistic regression. Only the categories that had a significant unconditional association ($p<0.20$) were retained for inclusion in the full

model. The same model-building steps and model diagnostics, described in the preceding section, were performed on this model.

Psychological Drug Dependence as a Predictor of Post-release Revocation

Three Cox proportional hazards models (Allison, 1995) were used to examine post-release failure rates for a maximum of 24 months for the offenders who were classified by the SDS as psychologically drug dependent and the other group of offenders who did not exceed the threshold on the SDS for the classification. Failure was defined as the first revocation (with or without a new offence) after the first release from custody. Only offenders who were released on conditional release (i.e., day parole or full parole) or statutory release were considered suitable for follow-up because they comprised the group of offenders for whom CSC routinely collects community-based performance measures, such as reasons for a technical violation and/or a return to custody.

The hypothetical causal path diagram is presented in Figure 1. Need ratings on six of the seven OIA domains were believed to be related to the outcome (i.e. revocation), and to psychological drug dependence. Note that the severity ratings on the Alcohol Dependence Scale (ADS) were used in place of the ratings on the substance abuse domain because ratings on the latter are based on the results from the DAST and ADS. By including ADS in place of the substance abuse domain ratings, the author avoided duplication of information while at the same time controlling for the potential confounding effects of alcohol abuse on the relationship between psychological drug dependence and the outcome. Need ratings on the domains and severity ratings on the

ADS were also believed to be related to substance abuse program exposure and to the SIR-R1 risk rating. Similarly, region of origin[19], offender age, and whether the offender was Aboriginal or not were believed to be related to the outcome, successful program completion, psychological drug dependence, the six domains, ADS, and the SIR-R1 risk rating. Although the hypothetical causal path diagram does not depict possible interactions, all possible two-way interactions were assessed.

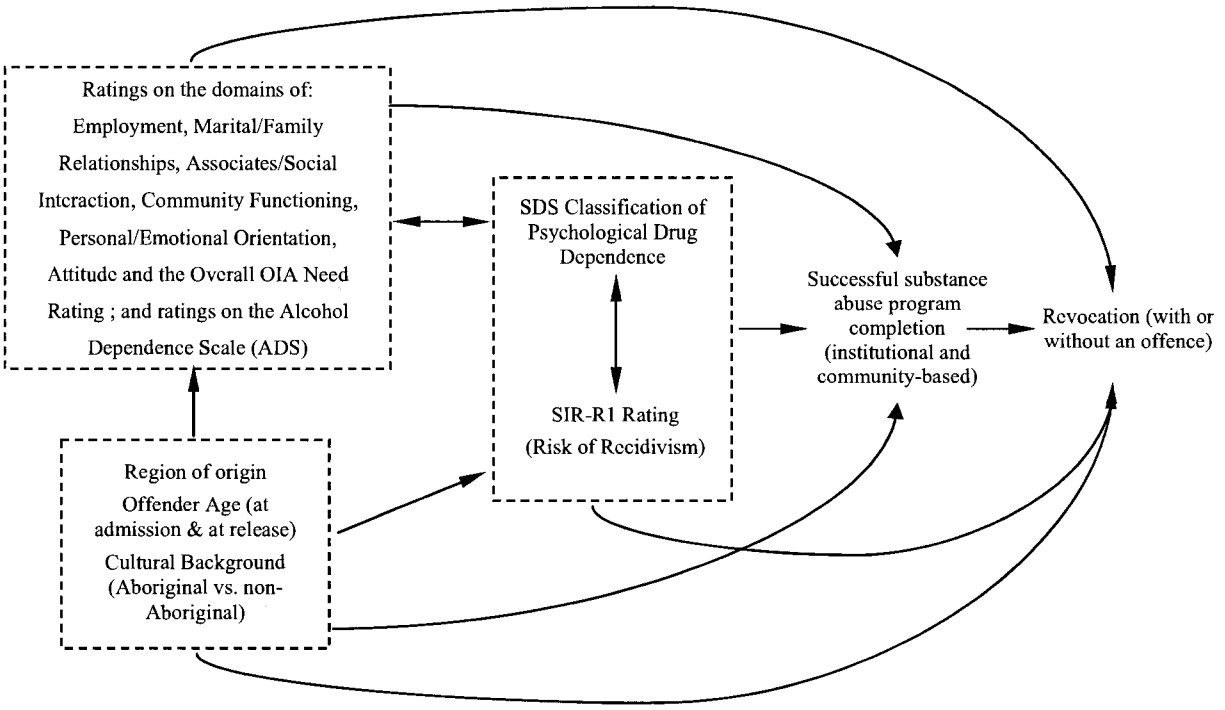
Furthermore, exposures to substance abuse programs (prior and during release) were considered intermediate covariates between SDS's classification of psychological drug dependence and the outcome (see Figure 1). In other words, the total effect of SDS could not be estimated because part of its effect was subsumed within the effects of the substance abuse program covariates. Therefore, intermediate covariates were removed from the second model so that the total effect of SDS (and other covariates) on the hazard for failure could be estimated (Dohoo et al., 2003). Due to differences in the length of follow-up for substance abuse program categories, year of release was included in the initial model to assess for its potential (confounding) effect on other estimates.

It was also predicted that psychologically drug dependent offenders who completed the current NSAP-H intervention would be returned to custody at a lower rate than the psychologically drug dependent offenders who participated in the NSAP-M intervention. Therefore, the third Cox proportional model tested the hypothesis using a sub-sample of offenders who were either exposed to the current NSAP-H or NSAP-M interventions or non-exposed to a substance abuse program. As with the previous Cox

[19] Region of origin was included in the model to account for potential regional effects on the baseline hazard.

proportional hazards model, this model adjusted for the effects of other covariates believed to be associated with the outcome (see Figure 1).

Figure 1. Hypothetical causal path diagram examining the effects of psychological drug dependence on post-release survival



Note. The dashed boxes which outline groups of covariates are used to simplify the diagram. The arrows between the dashed boxes indicate that a link may exist between covariates. The bi-directional arrow between domains and psychological drug dependence and SIR-R1 risk rating indicate that substance abuse may follow from a criminal lifestyle or that substance abuse may lead to a criminal lifestyle.

The "hazard ratio", which the Cox Proportional Hazards model produces, provides a measure of the likelihood of revocation (i.e., the hazard of revocation) for the offenders classified as psychologically drug dependent relative to the hazard of revocation for the other offenders who are not classified as psychologically drug dependent. The hazard ratio essentially provides a measure of the effect of psychological drug dependence, after adjusting for the effects of other covariates on the

hazard for failure, such as risk and need ratings, and program exposure. For example, if the hazard ratio is 2.0, then the rate of failure for the group of psychologically drug dependent offenders is twice the rate than that of the "reference" group of non-psychologically drug depended offenders, after adjusting for the effects of other covariates on the outcome. In other words, an individual in one group is twice as likely as an individual in the reference group to be revoked at any point during the 24-month period, given that the individual was not revoked prior to that point. A hazard ratio of 1.0 indicates no difference in hazards between groups. It is important to note that the method of estimation (estimating relative hazards) is based on the times at, and the order in which, the events occur between groups (Allison, 1995; Dohoo et al., 2003).

Covariate Selection and Model Building Steps

SAS's TPHREG and PHREG procedures (SAS, 2004) were employed to model the hazard of post-release failure using Cox proportional hazards modelling. A multivariable approach was chosen over *a priori* subject matching (e.g., propensity score matching, exact matching) as a method for controlling confounding and reducing bias because the former produces similar results and also allows for the examination of the effects of other covariates on the outcome. Also, study participants are less likely to be lost because of an inability to find controls who have the same distribution of matching factors as the study participants (Cepeda, Boston & Strom, 2003; Dohoo et al., 2003; Shah, Laupacis, Hux & Austin, 2005).

As with the aforementioned logistic procedures, backward, forward and manual selection methods were used to determine each covariate's contribution to the model and

effect on the outcome. If the selection methods produced different results, the model that the manual selection method produced was chosen as the valid one for the same reasons as previously stated.

The *Wald* chi square test statistic was used to determine if a covariate's contribution to the model was significant in terms of its ability to explain variation in the hazard of revocation. An indicator was retained as a significant covariate of the outcome at the standard significance level ($p < .05$) or if the indicator affected another covariate's effect on the outcome through a confounding or interacting effect. Also, covariates of borderline significance ($p < .10$) were considered for inclusion in the final model; however, inclusion depended on the relative stability of the covariate's parameter estimates and the covariate's subject matter relevance. Rationales for inclusion were provided where necessary.

One additional step was required to assess the linearity assumption for the continuous age-at-release variable. The variable was first replaced with several dummy variables (age categories) and then fit into the final model to generate parameter estimates for each age category. Parameter estimates were next plotted against the age categories. If the smoothed line connecting the parameter estimates was fairly linear, the linearity assumption was confirmed (Hosmer, 1999). However, if the smoothed line deviated from a linear trend, then its form was used to decide how to model age. If a curved line was observed, a number of power terms (polynomials) were added to age to allow the regression line to follow a curve (Dohoo et al., 2003). Alternatively, if parameter estimates were relatively the same for some of the age categories, these were

combined into a single age category and the covariate modelled as a categorical variable.

Generating Adjusted Survival Curves

The median covariate method of generating adjusted survival curves was used to create predicted probabilities of remaining in the community (survival) for the two SDS categories (psychologically drug dependent vs. the other group) over a 24 month period. The method applies the median value of each covariate to the proportional hazards regression equation to estimate covariate-adjusted survivor curves/functions (Hosmer, Lemeshow, & May, 2008; L. Rothman, SAS Canada, personal communication, January 21, 2008).[20] With this method each covariate is held constant at a median value across the two SDS categories as the procedure produces monthly predicted probabilities of survival for the full 24 month period. Adjusted survival curves were produced for the second and the third models.

Model Diagnostics

The Cox proportional hazards model is considered a semi-parametric method. There is no assumption for the shape and nature of the underlying distribution of survival times (survivor function); however, the model assumes that the underlying hazard rate is a function of the independent variables (covariates) and is consistent over time (i.e., satisfying the proportional hazards assumption) (Dohoo et al., 2003; SAS, 2004)

[20] The median method was preferred over the mean method because it returned values that were reflective of actual covariate values and typical covariate patterns observed in the study sample.

To assess the proportional hazards assumption, the log-negative-log of the Kaplan-Meier estimates of the survivor functions versus the log of time were plotted for each categorical covariate and inspected.[21] Proportionality was confirmed if the plot of the lines representing the log-negative-log of the survivor function for each strata of the covariate variable were relatively parallel. Because the Cox proportional hazards model is fairly robust, slight violations to the proportionality assumption were not considered a cause for concern (Allison, 1995). Where there was some evidence of non-parallel lines, a statistical test using scaled Schoenfeld residuals was employed to confirm violations of the assumption of proportionality. The residuals are based on the contribution that an observation makes to the partial derivative of the log partial likelihood, which is computed when a Cox model is fitted (Dohoo et al., 2003). The residuals are scaled or adjusted using an estimate of the variance of the residual. If the proportional hazards assumption is satisfied the Schoenfeld residuals should have a slope of zero when plotted against follow-up time. Statistical tests (correlation) were conducted to rule-out significant non-zero slopes.

If there was a clear (i.e., statistically significant) violation of the proportionality assumption for a specific categorical covariate, the covariate was treated as a stratification variable (Allison, 1995). The advantage of stratification is that it allows for any kind of change in the effect of the stratification variable over time; however, no estimates can be obtained for the variable (Allison, 1995). Therefore, stratification was

[21] The Kaplan-Meier (KM) method of estimating the survivor function is the most widely used method of estimation (Allison, 1995). The KM estimator is defined for any time between 0 and the largest event or censoring time in a table of values. The value for the survivor function estimator only changes at the next observed event time in a table that is ordered by event times. The method of estimation is similar to that of Cox Proportional Hazards modelling; however KM is limited to models evaluating the effects of one or a small number of qualitative variables on survival time (Dohoo et al., 2003).

not applied to the main SDS covariate or other covariates of subject matter importance. Instead, if there was a clear violation of the proportionality assumption for the SDS covariate or other (continuous) covariates of importance, an interaction was added to the model between follow-up time and the covariate(s) to allow the effect(s) to vary over time (Dohoo et al., 2003).

Poorly fit observations (e.g., the model suggested a high probability of revocation for a particular observation, but the observation did not experience the event during the study period, or the model suggested a high probability of success, but the offender was revoked) were examined using the likelihood displacement (LD) statistic (Hosmer et al., 2008). The LD statistic measures the change in the partial log likelihood with deletion of a specific observation. The statistic essentially approximates the effect of the deletion of an observation on the overall fit of the model (Allison, 1995). Observations with large values for the LD statistic, relative to the values for other observations, are potentially influential in terms of their impact on the conclusions that can be derived from the model. For these potentially influential observations, additional sensitivity analyses (through their deletion) were conducted to examine their collective impact on the parameter estimates and the overall conclusions. The results from the sensitivity analyses were reported if deletion of the influential observations biased the results toward the null. If present, this type of bias was considered potentially problematic because a few influential observations were responsible for the significant findings rather than the actual covariate that was of subject matter importance (Hosmer et al., 2008).

An overall goodness of fit test was also conducted to assess how well the model fitted the data. The test involved creating 10 groups based on the ranked values of the estimated linear predictors (Hosmer et al., 2008). The test essentially compares the observed number of events in each group to the model-based estimate of the expected number of events in each group (i.e., the final model is compared to the model with the nine additional design variables). A non-significant chi-square value suggests that the model adequately fits the data. The test assumes that there is sufficient power to detect differences between the final model and the model with the nine additional design variables.

Psychological Drug Dependence as a Predictor of Relapse to Substance Use

In order to investigate the explanatory variables of relapse to substance use, the community-based urinalysis test results were modelled as ordered multiple events data. The method is referred to as the Prentice Williams Peterson (PWP) approach (Hosmer, et al, 2008). PWP is considered an extension of the Cox proportional hazards model (Allison, 1995), so the same model-building steps, model diagnostics and interpretations of the parameter estimates apply (see preceding section), except that a goodness-of-fit test for multiple events data does not exist (Hosmer et al., 2008).

The PWP approach treats each time period between successive events (defined as positive urinalysis test) for a given offender as a separate observation in the dataset. Thus, an offender with three events will contribute four observations: time to first event, time from first event to second event, time from second event to third event, and time following the third event to the end of the study period (Woodward, 2005).

Consequently, some offenders will contribute more observations to the dataset than others; the actual number of observations depends on the number of events during the follow-up period.

The PWP model is considered conditional insomuch as study subjects are not at risk for a subsequent event until a prior event has occurred; and the first, second and third, events, etc., are analyzed in separate strata (Hosmer et al., 2008). The total number of events was restricted to less than 10 to avoid basing estimates on a few extreme observations in which offenders registered more than 9 positive results. As a result, 99% (N=5953) of the observations were retained for all descriptive analyses and the modelling procedure. The dataset is structured in a counting-process style format where each data line corresponds to a new risk set for each offender. The offender enters into a new risk set upon an event (positive result) but also upon a change in time-varying predictors in the model.

Table 1 provides the data layout for two offenders from the study sample who underwent urinalysis testing while on supervision. Offender CNV503 was in the risk set for all tests occurring between 0 and 219 days. This offender contributed positive or negative tests results, which were defined by the risk sets 65, 83, and 146. The start and stop variables refer to when a test was administered from the time of release (as was the case for the first row for each offender) or since the last test was administered (as was the case for all subsequent rows for the same offender). The *start* and *stop* variables defined the risk interval. The variable, *number of positives* (stratification variable) includes the number of positives up until, but not including the current risk interval. The

number of negatives refers to the number of negative tests since the last positive test result (or since release if there were no positive results) up until, but not including the current risk interval. The *number of negatives* and the *number of positives* variables were included in the model, along with the covariates identified in Figure 1, to adjust for their potential effects on the hazard of a positive urinalysis result.

Table 1. Data Layout for Recurrent Community-based Urinalysis Testing

Offender ID	Start (days)	Stop (days)	Positive	Number of Positives (stratification variable)	Community Maintenance Program (CMP)	Days to CMP	Number of Negatives
CNV503	0	65	1	0	0	83	0
CNV503	65	83	0	1	0	83	0
CNV503	83	146	0	1	1	83	1
CNV503	146	219	0	1	1	83	2
D28347	0	215	0	0	0		0
D28347	215	229	0	0	0		1
D28347	229	265	0	0	0		2

The community maintenance program (CMP) was modelled as a time dependent variable. Therefore, it was necessary to adjust the risk intervals for offenders who were exposed to CMP so that exposure status was accurately coded in the dataset. For example, offender CNV503 was exposed to CMP at 83 days after release from custody (see Table 1). The offender was non-exposed during the first risk interval (0-65 days), but was exposed during the second risk interval (65-146 days). However, exposure occurred at day 83. Therefore, the risk interval was split at day 83 resulting in two risk intervals (65-83 and 83-146). He was non-exposed to CMP between days 65 and 83, but exposed to CMP between days 83 and 146. The second offender, coded as D28347, was

non-exposed to CMP, so the risk interval was strictly defined by the number of days between release and the first test administration (for the first row) or days between test administrations (all subsequent rows). The second offender did not register any positive test results so the value for the stratification variable reflected a single stratum.

In a usual regression model it is assumed that errors for each observation are independent and follow an appropriate distribution (Dohoo et al., 2003). With repeated events data, multiple observations for a given offender are dependent and therefore violate the assumption of independence between observations. To correct for this, a robust sandwich estimate clustered on offender was used for the covariance matrix of parameter estimates; this results in robust standard errors for the parameter estimates. The robust sandwich estimate usually produces a larger standard error and a wider confidence interval for the parameter estimate than the usual variance estimates, but has no impact on the point estimate for the parameter (Dohoo et al., 2003). The robust standard error estimate and the associated *p-value* was used to select significant covariates of the hazard of positive urinalysis results (i.e., relapse to substance use).

Pearson's chi-square and Cramer's-*V* statistics were used to augment the presentation of descriptive information relating to the types of drugs found across the classification categories of the SDS. Cramer's - *V* coefficients approximating values of 0.10, 0.30 and 0.50 or greater indicated a "weak", "moderate" and "large" effect, respectively (Keppel, Saufley, Kokunaga, 1992).

Chapter Four: Results

Introduction

The presentation of results spans six sections and parallels the statistical analyses that were performed to address the central thesis of this research.

1. In the first section, the results from the psychometric analyses are presented. The reliability (i.e., internal consistency) of both the DAST and the SDS instruments is described with specific reference to the degree to which DAST and SDS items converge to measure evidence of problematic drug use and the concept of psychological drug dependence, respectively.

2. The second section focuses on the dimensional relationship between the five SDS items and the 20 DAST items. See Appendix A for the complete list of DAST and SDS items. A number of "canonical variate pairs" or significant correlations between linear combinations of DAST items and linear combinations of SDS items are presented to determine how combinations of items co-vary across instruments.

3. Within the third section, the ROC-determined SDS cut-off for psychological drug dependence and the corresponding ROC curve are presented. The sensitivity, specificity and estimated probabilities for a range of SDS cut-off scores are also described in this section.

4. The fourth section presents the results from a series of logistic regression models. The covariates of psychological drug dependence within each, and across all seven need domains of the OIA are identified in terms of the odds of each covariate's

presence for the group of psychologically drug dependent. This section also sheds light on the significant antecedents or triggers that precipitated the offender's drug use during the 12-month period preceding arrest for current offence(s). Other descriptive information is also presented in this section to supplement the results from the logistic regression models.

5. The fifth section concentrates on revocations for the psychologically drug dependent offenders and the other group of offenders. Results are presented from three Cox proportional hazards models, which compare post-release revocation rates over a 24 month period for the two groups of offenders (after adjusting for the effects of other covariates on the hazard for failure.

6. The sixth section examines the covariates of relapse to substance abuse.

4.1 Assessing the Reliability of the SDS and DAST

Recall that the 12 month period prior to arrest was considered the time referent for the purposes of determining extant substance abuse problems. A total of 2094 offenders or 63% of the total study sample reported drug use during this time referent and were therefore given an opportunity to respond to the DAST and SDS items to establish the severity of existing drug problems. As well, this sub-sample of offenders was asked by CASA to identify the drug of choice during their responses to SDS questions. The majority of the respondents reported that their drug of choice during the 12 month period prior to arrest was marijuana and its derivatives (45%), followed by crack cocaine (16%), cocaine (15%), opioids (11%), heroin (4%), and amphetamines (3%). The remaining 6% of the sub-sample indicated other drugs of choice, such as

benzodiazepines, ecstasy (MDA), psilocybin (mushrooms), phencyclidine (PCP), lysergic acid diethylamide (LSD), steroids and quaaludes.

The results from the psychometric analyses of the sub-sample's responses to the SDS and DAST items confirmed excellent internal consistency reliability for both instruments. This was evidenced by high Cronbach's coefficient alpha values of .91 and .90, for the SDS and DAST, respectively.

Table 2 presents the results from the DAST and SDS item analyses, which includes item means and standard deviations, and each items correlation with the total score for each instrument. In general, strong correlations were observed between individual SDS items and the total score on the SDS, while the correlations between individual DAST items and the total score on the DAST were more variable. The two weakest item correlations for the DAST were observed for item one, "*Did you use drugs other than those for medical reasons?*" (r = .25) and for item 16, "*Were you ever arrested for possession of illegal drugs?*" (r = .05). With item 16 deleted the coefficient alpha for DAST increased to .911, the largest improvement in reliability with any one item deleted. With item one deleted, coefficient alpha marginally increased to .906. All other correlations between DAST items and the total exceeded .40, with the highest values observed for item nine, "*Did your drug abuse create problems between you and your spouse or your parents*?" (r = .73) and item 11, "*Did you neglect your family because of your use of drugs?*" (r = .73) (See Table 2). With item 11 deleted, Cronbach's alpha decreased to .89, the largest decrease with any one item deleted.

Less variability was observed for the SDS, with item-total correlations ranging between .69 and .82. Item four, *"Did you wish you could stop?"* had the weakest correlation (r = .69) with the SDS total score, while item one, *"Do you think your use of (named drug) was out of control?"* had the strongest correlation (r = .82) with the total (See Table 2). With item one deleted Cronbach's alpha decreased to .88, the largest decrease with any one item deleted. Alpha remained virtually unchanged with item four deleted (a change from .903 to .907).

In summary, much of the variation that was observed in drug abuse severity or psychological drug dependence was due to true differences (the signal) rather than differences caused by other factors (the error) (DeVellis, 1991). Only 9% and 10% of the variability in the SDS and DAST scores was due to error, respectively.

Table 2. DAST and SDS Item Means, Standard Deviations and Item-total Correlations for Offenders who Reported Drug Use During the 12 Month Period Prior to Arrest (N=2094).

	Item mean[a]	*SD*	Item-total correlation
DAST items			
1. Used drugs other than for medical reasons	.71	.45	.25
2. Abused prescription drugs	.25	.43	.43
3. Abused more than one drug at a time	.38	.49	.53
4. Could not get through week without using	.67	.46	.52
5. Unable to always stop using drugs	.56	.50	.67
6. Had "blackouts" or "flashbacks"	.21	.41	.45
7. Felt bad or guilty about drug use	.63	.48	.62
8. Spouse (or parents) complained about drug involvement	.60	.49	.66
9. Drug abuse created problems between spouse or parents	.53	.50	.73
10. Lost friends because of drug use	.38	.49	.69
11. Neglected family because of drug use	.46	.50	.73
12. In trouble at work because of drug abuse	.25	.43	.60
13. Lost a job because of drug abuse	.22	.42	.57
14. Got into fights when under the influence of drugs	.18	.39	.41
15. Engaged in illegal activities to get drugs	.51	.50	.66
16. Arrested for possession of illegal drugs	41	.49	.05
17. Experienced withdrawal symptoms	.42	.49	.68
18. Medical problems as a result of drugs	.26	.44	.49
19. Sought help for drug problem	.39	.49	.54
20. Involved in drug abuse treatment	.37	.48	.47
SDS Items[b]			
1. Drug was out of control	1.26	1.18	.82
2. Anxious or worried about missing a dose	.82	1.02	.76
3. Worried about drug use	1.04	1.10	.81
4. Wished could stop	1.47	1.19	.69
5. Found difficult to stop	.89	1.02	.75

[a]Means for the DAST items represent the proportion of offenders with the item endorsed as "yes". A score of one is assigned if the item is present for a possible total score of 20 on the DAST. The means for the SDS items represent the mean level of response for each item. [b]Responses to items one through four are given across four categories: "never or almost never", "sometimes", "often", and "always or nearly always". Item five is comprised of four response categories, "not difficult", "quite difficult", "very difficult" and "impossible". Scores on each item range from zero to three for a possible total score of 15.

4.2 Examining the dimensional relationship between DAST and SDS items

The canonical correlation between the first DAST variate and the first SDS variate was .85, representing 72% of the overlapping variance for the pair. The second canonical correlation was .45, representing 20% of the overlapping variance for the second pair of canonical variates. Although the relationships between sets of DAST and SDS variables for all canonical variates reached significance, very little of the overlapping variance was explained by the third, fourth and fifth canonical variate pairs. In order, the proportion of overlapping variance for these canonical variates was 4.6%, 3.0% and 2.3%.[22] Therefore, only data for the first two pairs of canonical variates are presented.

Table 3 provides the correlation between the variables and their canonical variates, standardized canonical variate coefficients, within-set percentage variance accounted for by the canonical variates, redundancies (i.e., percentage variance captured by the opposite canonical variate within each variate pair) and canonical correlations. Most of the variance that was captured by the DAST items occurred within the first DAST canonical variate (35%). The variables that comprised the second DAST canonical variate explained about 5% of the variance. As with DAST, most of the variance captured by the SDS items occurred within the first SDS canonical variate (72%). Only about 11% of the variance was captured by the SDS items which comprised the second SDS canonical variate.

[22] The total overlapping variance exceeds 100% because each variate pair is explaining a proportion of the same variance as other variate pairs.

With respect to redundancies, SDS items comprising the first SDS canonical variate extracted about 25% of the variance from the first DAST canonical variate, while DAST items from the first DAST canonical variate extracted about 52% of the variance from the first SDS canonical variate. Redundancy values for the second pair of canonical variates were negligible, which is not surprising given the relatively low level of variance which the pair explained. Since the second pair of canonical variates was minimally related, only the variables that comprised the first pair of canonical variates will be described.

Table 3 presents the canonical correlations for each variate. Because the squared correlation for each item measures the extent of overlapping variance, items with loadings (correlations) meeting or exceeding the .60 threshold - explaining 36% or more of the overlapping variance - were considered in the interpretation. These items were among the group that were most interesting because they explained the greatest proportion of overlapping variance.

A total of 10 DAST items exceeded the threshold. In order, the highest loadings (overlapping variance in parentheses) for the DAST were observed for the following items: *unable to always stop using drugs* (.71); *experienced withdrawal symptoms* (.59); *neglected family because of drug use* (.56); *drug abuse created problems between spouse or parents* (.52); *lost friends because of drug use* (.52); *felt bad or guilty about drug use* (.49); *engaged in illegal activities to obtain drugs* (.49); *could not get through week without using drugs* (.48); *spouse or parents complained about drugs* (.38); and *in trouble at work because of drug abuse* (.38).

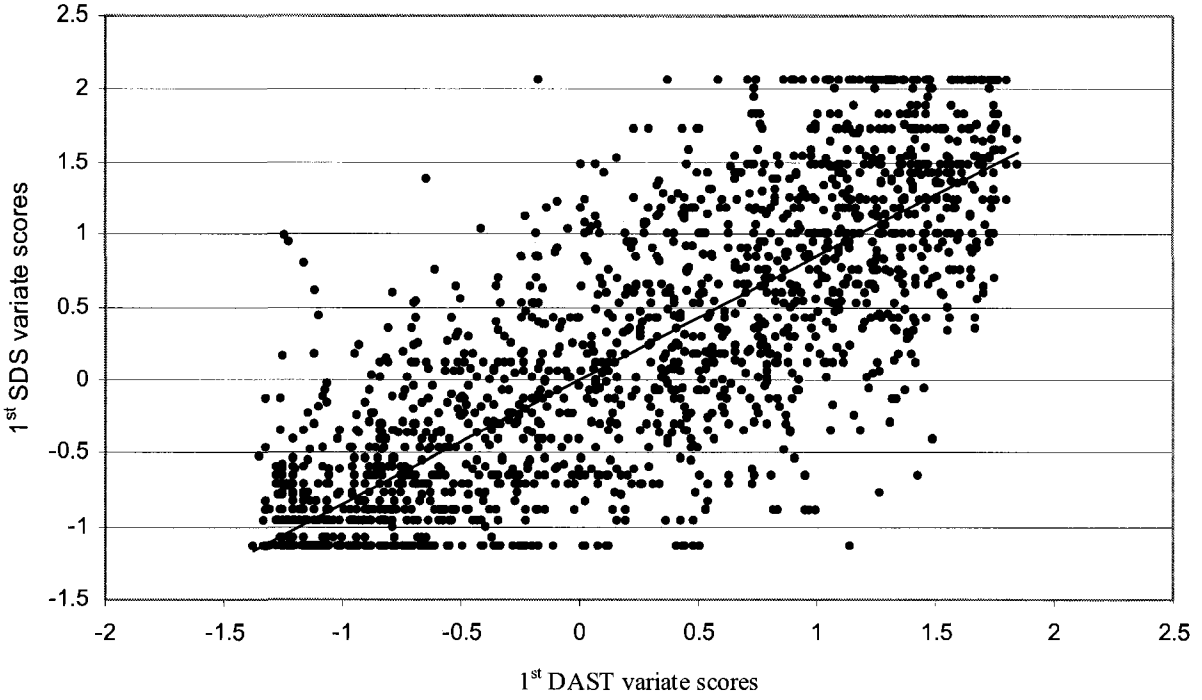
All five of the SDS items met or exceeded the correlation threshold of .60 for the first SDS canonical variate. The largest amount of overlapping variance was explained by the SDS item (overlapping variance in parentheses), *"Do you think your use of named drug was out of control?"* (.79); followed by *"How difficult did you find it to stop?"* (.79); *"Did the prospect of missing a fix or dose or not chasing make you anxious or worried?"* (.74); *"Did you worry about your use of named drug?"* (.67); and *"Did you wish you could stop?"*(.59).

Table 3. Correlations, Standardized Canonical Coefficients, Percents of Standardized Variance, and Redundancies for the first two Canonical Variates of the DAST and SDS Items, as well as the Canonical Correlations between them

	First canonical variate		Second canonical variate	
	Correlation	**Coefficient**	**Correlation**	**Coefficient**
DAST Items				
During the 12 month period prior to arrest:				
1. Used drugs other than for medical reasons	.22	-.023	-.05	-.067
2. Abused prescription drugs	.41	.003	-.22	-.057
3. Abused more than one drug at a time	.48	-.026	-.28	-.266
4. Could not get through week without using	.69	.205	-.42	-.430
5. Unable to always stop using drugs	.84	.273	-.17	-.251
6. Had "blackouts" or "flashbacks"	.48	.082	-.08	-.034
7. Felt bad or guilty about drug use	.70	.180	.56	.763
8. Spouse (or parents) complained about drugs	.62	-.033	.25	.046
9. Drug abuse created problems between spouse or parents	.72	.086	.27	.079
10. Lost friends because of drug use	.72	.101	.23	.262
11. Neglected family because of drug use	.75	.058	.18	.058
12. In trouble at work because of drug abuse	.62	.088	.03	-.085
13. Lost a job because of drug abuse	.57	.033	.02	-.063
14. Got into fights when under the influence of drugs	.37	-.020	-.17	-.129
15. Engaged in illegal activities to get drugs	.70	.097	.03	.023
16. Arrested for possession of illegal drugs	.00	-.022	.01	.018
17. Experienced withdrawal symptoms	.77	.185	-.17	-.215
18. Medical problems as a result of drugs	.50	.057	-.05	-.038
19. Sought help for drug problem	.51	.014	.34	.300
20. Involved in drug abuse treatment	.44	.030	.18	-.023
Percent of variance	**35**		**5.4**	**Total = 40.4**
Percent redundancy	**25**		**1.1**	**Total = 26.1**
SDS Items				
During the 12 month period prior to arrest:				
1. Drug was out of control	.89	.286	.06	-.042
2. Anxious or worried about missing a dose	.86	.245	-.18	-.380
3. Worried about drug use	.82	.068	.33	.596
4. Wished could stop	.77	.214	.53	.857
5. Found difficult to stop	.89	.351	-.31	-.887
Percent of variance	**72**		**11**	**Total = 83.0**
Percent redundancy	**52**		**2.2**	**Total = 54.2**
Canonical correlation	**.85**		**.45**	

Last, the normality, linearity and homoscedasticity within the first canonical variate pair were assessed to evaluate the assumptions underlying the canonical correlation procedure. Although there were no serious departures from linearity or homoscedasticity as evidenced by the linear shape and consistent width of the scatter plot of canonical variate scores in Figure 2, the distribution of responses to the items on both the SDS and DAST were not normally distributed. The 0-0 point departed from the centre of the horizontal and vertical axes in Figure 2, indicating a disproportionate number of cases with low scores and therefore a degree of positive skewness in the scores. Values for skewness of .19 and .45 for DAST and SDS scores provided additional evidence of departures from normality since both values deviated from zero (i.e., what would be expected under a normal distribution). Similarly, kurtosis values of -1.41 and -1.09 for DAST and SDS scores, respectively, verified distributions that were too flat to satisfy the normality assumption. Unfortunately correcting for the distribution of scores through statistical transformation of item responses was not possible given the response formats of the DAST items. Nonetheless, the canonical procedure allowed for the aforementioned descriptive analyses of the dimensional relationship between DAST and SDS.

Figure 2. Correlation of Canonical Variate Scores for the First DAST and SDS Canonical Pair



Note. Canonical variate scores were transformed to *z*-scores.

4.3 Estimating Psychological Drug Dependence with the SDS and DAST

With DAST as the reference standard, the ROC procedure was employed to generate coefficient estimates for sensitivity, specificity, positive and negative predictive values, and observed agreement between the DAST and SDS for the full range of SDS scores. These analyses allowed for the establishment of the optimal cut-off for a classification of psychological drug dependence. The classification table (see Table 4) presents the estimates, and the ROC curve (see Figure 3) provides a visual representation of the sensitivity and the false positive rates (1-specificity) for each SDS cut-off.

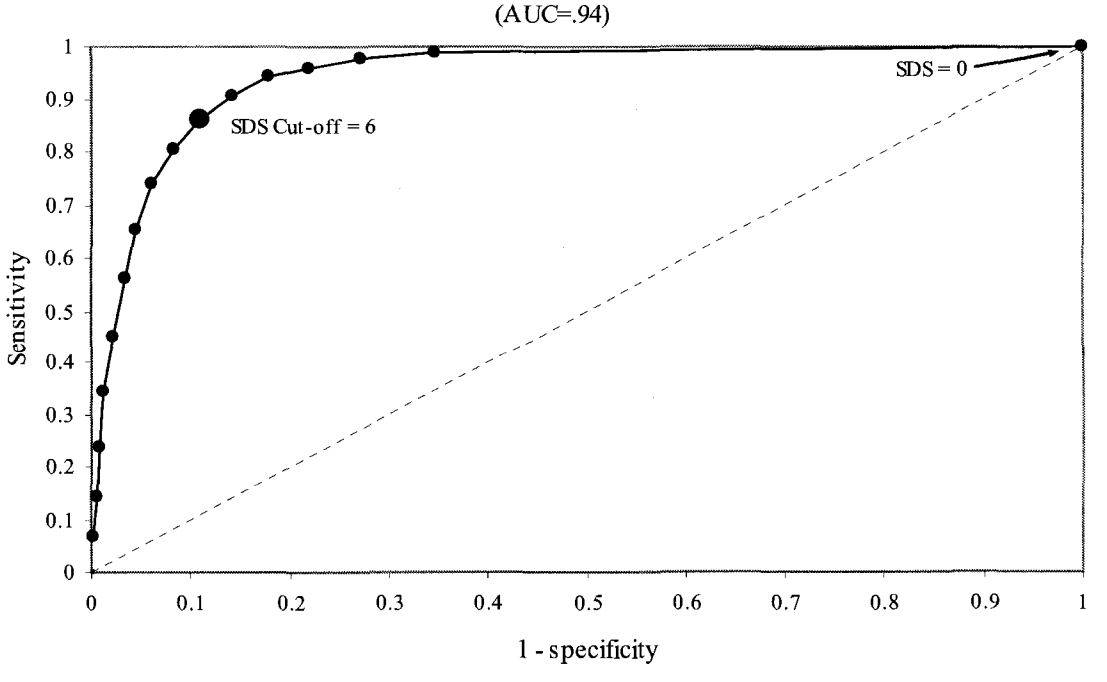
As can be seen in Table 4, the observed agreement between the SDS and DAST remained relatively stable between SDS cut-off scores of 6 and 9 (the optimal range) with the highest level of agreement for SDS cut-offs of 7 and 8. As SDS cut-off scores decreased from 9 to 6 within this optimal range of scores, sensitivity increased, while specificity decreased. The cut-off values of 4 and 5 were further away from the diagonal and therefore would produce fewer classification errors. Nevertheless, the best trade-off between sensitivity and specificity was observed for the cut-off 6. At this cut-off value the difference in sensitivity and specificity was at its lowest when compared to the other cut-offs within the optimal range of scores. Also, the observed agreement between SDS and DAST for the 6 cut-off was better compared to the 5 and 4 cut-offs - 88.3% versus 87% and 85%, respectively. Therefore, the 6 cut-off was deemed most appropriate in terms of minimizing the overall number of classification errors while maximizing the observed agreement between SDS and DAST. An offender was considered psychological drug dependent if his SDS cut-off score was 6 or higher.

The ROC curve in Figure 3, which represents the range of SDS cut-off scores, has an AUC of .94. This suggests a high degree of accuracy in terms of the SDS's ability to correctly classify offenders who were considered dependent on drugs by the DAST.

Table 4. Sensitivity, Specificity, Positive and Negative Predictive Values, and Observed Agreement over the Full Range of SDS Scores for a Classification of Psychological Drug Dependence ($N = 3350$)

SDS Cut-off Score	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Observed agreement
15	.069	.997	.885	.780	.782
≥14	.143	.995	.888	.793	.797
≥13	.237	.992	.898	.811	.817
≥12	.344	.987	.890	.833	.838
≥11	.453	.977	.859	.855	.856
≥10	.564	.966	.833	.880	.873
≥9	.653	.955	.813	.901	.884
≥8	.739	.938	.783	.922	.892
≥7	.803	.917	.745	.939	.890
≥6	.860	.890	.703	.955	.883
≥5	.906	.859	.659	.968	.870
≥4	.945	.821	.614	.980	.850
≥3	.958	.781	.569	.984	.822
≥2	.978	.728	.521	.991	.786
≥1	.990	.654	.464	.995	.732
0	1.00	.000	.232	-	.232

Figure 3. Sensitivity and Specificity of SDS Cut-off Scores for Predicting Psychological Drug Dependence using DAST as the Reference Standard



Recall that the majority of offenders who used drugs during the 12-month period prior to arrest (n=2094) reported that their drug of choice was marijuana and its derivatives (45%), followed by crack cocaine (16%), cocaine (15%), opioids (11%), heroin (4%), and amphetamines (3%). Using the a cut-off of 6, approximately 85%, 79%, 76%, 64% and 63% of the offenders who used crack cocaine, heroin, opioids, cocaine and amphetamines, respectively, would have been classified as psychologically dependent on drugs. In contrast, only 14% of the offenders who reported marijuana as their drug of choice exceeded the cut-off for the classification.

4.4 Examining the Covariates of Psychological Drug Dependence across Life Domains

Education/Employment Domain

A total of 34 education/employment indicators, the overall need rating on the domain, age at assessment, the SIR-R1 risk rating, and cultural background (Aboriginal vs. non-Aboriginal) were examined separately to evaluate the strength of their respective unconditional associations with psychological drug dependence. Only variables that were unconditionally associated with psychological drug dependence at a liberal *p-value* of <.20 were retained for further analyses within the multivariable logistic regression procedure. The SIR-R1 risk rating, overall need rating on the domain, age at assessment and a total of 28 education/employment indicators met the $p < .20$ criterion for inclusion in the modelling procedure. In the end, a total of eight covariates were retained by the

final logistic regression model through forward, backward and manual covariate selection methods.

Table C1 (Appendix C) presents the distribution of observations for variables that were unconditionally associated with psychological drug dependence at the $p<.05$ level of significance. A greater proportion of offenders classified as psychologically drug dependent were identified with concentration problems, but fewer with reading problems when compared to the group of offenders who were not classified as psychologically drug dependent. Also, a greater proportion of offenders classified as psychologically drug dependent experienced employment difficulties marked by an unstable employment history, unemployment at the time of arrest, at least one job termination, and difficulties meeting work load requirements. Similarly, a greater proportion of offenders who were classified as psychologically drug dependent were rated higher risk for recidivism on the SIR-R1 scale than the other group. More specifically, about 54% of the offenders classified as drug-dependent were rated fair/poor to poor risk for recidivism compared to only 31% of the offenders from the other group. The overall need rating on the domain was also positively associated with psychological drug dependence; however, there was no difference in the relative odds of psychological drug dependence beyond the *asset* rating. Offenders with ratings of *none*, *some* or *considerable* need had about 5.5 times the odds of psychological drug dependence compared to offenders with a rating of *asset* for the domain.

Offenders classified as psychologically drug depended were generally younger ($M = 33.4$) with a less dispersed age distribution [Range = 48, *Inter-quartile range (IQR)*

= 13)] compared to the other group of non-dependent offenders (M = 34.4, Range = 56, IQR = 17). The greatest difference between the two groups was observed for age ranges in the 90th percentile – offenders from the psychologically drug dependent group ranged in age between 45 and 66 compared to between 50 and 74 for the other group.

The multivariable logistic regression coefficients (β), standard errors of the estimates (SE β), likelihood ratio chi-square statistics (LRT χ^2), p-values, odds ratio estimates (OR), and the 95% confidence intervals (95% CI) for the OR estimates are presented in Table 5. After adjusting for the effects of the other covariates that were retained by the model, the predicted odds of psychological drug dependence for the offenders who were 33 years of age at assessment and unemployed at the time of arrest was 1.89 times higher than for the offenders who were employed. This was the strongest covariate within this domain in terms of its association with psychological drug dependence. Other education/employment covariates were not as strongly association with psychological drug dependence; however, all were significant and all produced odds ratios in the expected direction. That is, offenders who experienced an unstable job history, had difficulties meeting workload requirements or experienced at least one job termination were significantly more likely with respect to odds to be classified as psychologically drug dependent than the other group after adjusting for the effects of other covariates in the model (see Table 5). Despite significant associations between individual indicators and psychological drug dependence, the need rating for the domain did not emerge as a significant covariate of psychological drug dependence

The association between risk for recidivism, as measured by the SIR-R1 and psychological drug dependence, was quite strong. As can be seen in Table 5, offenders from the poor risk category were 3.56 times more likely with respect to odds to be classified as psychologically drug dependent than offenders from the very good risk category. In general terms, as risk for recidivism decreased so too did the probability of psychological drug dependence. However, the difference between the fair risk group and the good risk group was not statistically significant ($OR = 0.96$, $95\%\ CI = 0.71 - 1.31$). The group of offenders who were not administered the SIR-R1, of whom 92% were of Aboriginal ancestry, were just as likely to be psychologically drug dependent as offenders in the poor risk group ($OR = 0.81$, $95\%\ CI = 0.60 - 1.10$).

Not only did age at assessment (age) emerge as a significant covariate of psychological drug dependence, its effect also interacted with the offender's unemployment at the time of arrest. For the offenders who were employed at the time of arrest, the association between age and psychological drug dependence was curvilinear in nature, with the predicted probability of psychological drug dependence increasing from about age 20 to age 32 and then decreasing from about age 32 to 53 (see Figure 4). In contrast, for the offenders who were unemployed at the time of arrest, the effect of age was more pronounced in terms of its curvilinear association with psychological drug dependence. The predicted probability of psychological dependence peaked at about age 37, well above the predicted probability for offenders who were fully employed at the time of arrest and of the same age (Figure 4). The differences in predicted probabilities between employed and unemployed offenders at the time of arrest became less pronounced as age moved away from 37 toward either extreme on the age range.

Table 5. Final Multivariable Logistic Regression Model Examining the Covariates of Psychological Drug Dependence within the Domain of Education/Employment

Covariate[a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-2.23	0.14				
Concentration problems	0.34	0.09	14.29	<.001	1.41	1.17 - 1.69
Problems reading	-0.25	0.10	7.03	<.05	0.78	0.65 - 0.94
Unemployed at arrest	0.64	0.12	28.29	<.0001	1.89	1.49 - 2.39
Unstable job history	0.23	0.10	8.37	<.05	1.26	1.04 - 1.53
Difficulty meeting workload	0.41	0.10	16.24	<.001	1.50	1.24 - 1.84
Has been fired from a job	0.39	0.09	18.50	<.0001	1.48	1.24 - 1.77
Age			88.96	<.0001		
Age centred (at age 33)	-0.0032	0.01			-	-
Age centred and squared	-0.0016	0.001			-	-
SIR-R1 risk estimate[b]			103.68	<.0001	-	-
One out of three expected to succeed on release (poor risk)	1.27	0.14			3.56	2.72 - 4.65
Two out of five expected to succeed on release (fair/poor risk)	1.05	0.15			2.87	2.13 - 3.86
One out of two expected to succeed on release (fair risk)	0.63	0.15			1.87	1.39 - 2.52
Two out of three expected to succeed on release (good risk)	0.66	0.16			1.94	1.42 - 2.66
Not administered the SIR-R1	1.06	0.18			2.89	2.04 - 4.10
Interaction						
Age with unemployed at arrest			20.10	<.001	-	-
Age centred and unemployed at arrest	0.035	0.0011			-	-
Age centred and squared, and unemployed at arrest	-0.0022	0.0009			-	-

Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. [a]Parameter estimates for all covariates except for the age and SIR-R1 covariates compare the odds of drug dependence when the problem is present (rated as yes) versus when the problem is absent (rated as no). [b]All SIR-R1 risk categories are compared to reference group of offenders who were rated as very good risk to succeed on release from custody. Also, of the 256 offenders who were not administered the SIR-R1, 235 were of Aboriginal ancestry (92%).

The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 6.52, p = .59. R^2 = .18.

Figure 4. Predicted Probability (p) of Psychological Drug Dependence for the Interaction Between Age and Employment History

Note. The effect of the interaction between age and the employment history indicator on the predicted probability of drug dependence was restricted to ages that range between the 10th and 90th percentile because very few offenders comprised the group of offenders in the extreme age ranges. The other covariates in the model were held constant at their reference levels to establish the predicted probability of psychological drug dependence for the interaction.

Marital/Family Domain

The SIR-R1 risk rating, the overall need rating on the domain, age at assessment and 23 out of a possible 31 marital/family indicators were unconditionally associated with psychological drug-dependence at the liberal *p-value* of .20. Forward, backward and manual selection methods retained a total of six covariates in the final logistic model for this domain. Age at assessment, SIR-R1 risk rating and a total of four marital/family covariates emerged as significantly related to psychological drug dependence after adjusting for the effects of other covariates in the model.

Table C2 (Appendix C) presents the distribution of observations for variables that were unconditionally associated with psychological drug dependence at the $p<.05$ level of significance. One of the strongest unconditional associations was observed between *spousal abuse during childhood* and psychological drug dependence. Approximately, 36% of the group of psychologically drug dependent offenders witnessed spousal assault as children compared to 23% of the offenders in the other group. In addition, offenders who were classified as psychologically drug depended were significantly more likely to experience a myriad of difficulties in their marital relationships, such as spousal abuse, communication difficulties, financial problems and poor parenting of children. Significantly more of the psychologically drug dependent offenders were also single at the time of their admission to federal custody (70% vs. 60%). Generally, offenders with overall need ratings of *none*, *some* or *considerable* on the domain were more likely to be classified as psychologically drug dependent than offenders with a rating of *asset*. The unconditional association between psychological drug dependence and SIR-R1 risk rating are presented in Table C1 so they will not be described here.

The results from the multivariable logistic regression procedure are presented in Table 6. After adjusting the effects of other covariates that were retained by the model, a significant interaction emerged between *family members involved in crime* and *unable to handle parenting* responsibilities. When both were present in an offender's history, the predicted probability of psychological drug dependence was higher than when both were absent (OR= 1.34). In terms of proportions, 43% of the offenders who were classified as psychologically drug dependent and had family members involved in crime

were unable to manage their parenting responsibilities, compared to 30% of the psychologically drug dependent offenders who did not have family members involved in crime. Interestingly, the main effect of *family members involved in* crime (i.e., when *unable to manage parenting responsibilities* was not identified as a problem) suggested a lower probability of psychological drug dependence. The same was true for the main effect of *unable to handle parenting responsibilities*; however, the association was rather weak in comparison. The overall need rating for the domain was not significantly associated with psychological drug dependence.

The predicted odds of psychological drug dependence was 1.59 times higher for offenders who witnessed spousal abuse as children compared to offenders who did not. Also, the predicted odds of psychological drug dependence for offenders who were single at the time of admission to federal custody was 1.43 times higher than for offenders who were involved in a marital relationship. The relationship between age and psychological drug dependence was curvilinear, with the highest predicted probability of psychological drug dependence occurring at age 36.

As with previous domains, SIR-R1 risk rating covaried with psychological drug dependence. The group of offenders who were rated poor risk were close to five times more likely with respect to odds to satisfy the criteria for psychological drug dependence when compared to offenders in the very good risk group. As ratings on SIR-R1 predicted better post-release outcomes, the *OR* estimates suggested lower probabilities of psychological drug dependence (see Table 6). The group of offenders who were not administered the SIR-R1, of whom 92% were of Aboriginal ancestry, were just as likely

to be psychologically drug dependent as offenders in the fair/poor risk group (*OR* = 0.97, *95% CI* = 0.70 – 1.35).

Table 6. Final Multivariable Logistic Regression Model Examining the Covariates of Psychological Drug Dependence within the Domain of Marital/family

Covariate[a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-1.85	0.13				
Spousal abuse during childhood	0.46	0.09	25.47	<.0001	1.59	1.32 - 1.90
Family members involved in crime	-0.31	0.10	16.86	<.001	0.73	0.61 - 0.88
Currently single	0.36	0.09	16.91	<.001	1.43	1.20 - 1.70
Unable to handle parenting responsibilities	-0.03	0.17	10.76	<.05	0.97	0.69 - 1.37
Age[b]			62.00	<.0001		
Age centred (at age 33)	0.0176	0.0049			-	-
Age centred and squared	-0.0030	0.00043			-	-
SIR-R1 risk estimate[c]			165.36	<.0001		
One out of three expected to succeed on release (poor risk)	1.56	0.13			4.75	3.66 - 6.17
Two out of five expected to succeed on release (fair/poor risk)	1.23	0.15			3.43	2.56 - 4.59
One out of two expected to succeed on release (fair risk)	0.83	0.15			2.30	1.72 - 3.07
Two out of three expected to succeed on release (good risk)	0.73	0.16			2.08	1.52 - 2.84
Not administered the SIR-R1	1.20	0.18			3.33	2.36 - 4.70
Interaction						
Family members involved in crime and unable to handle parenting responsibilities[d]	0.64	0.25	17.31	<.05	1.34	0.94 - 1.91

Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. The *LRT* statistic for indicators that comprised the interaction term assessed the average effect of each indicator across categories of the other indicator that comprised the interaction term. [a]Parameter estimates for all covariates except for the age and SIR-R1 covariates compare the odds of drug dependence when the problem is present (rated as yes) versus when the problem is absent (rated as no). [b]The relationship between age and drug dependence is curvilinear with the highest predicted probability of drug dependence occurring at age 36. [c]All SIR-R1 risk categories are compared to reference group of offenders who were rated as "very good risk" on release from custody. Also, of the offenders who were not administered the SIR-R1, 92% were of Aboriginal ancestry. [d]The Odds ratio estimate and confidence interval compares the odds when both covariates are present to when both covariates are at their respective reference levels.

The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 5.25, p =.73. R^2 = .16.

Associates/Social Interactions Domain

The SIR-R1 risk rating, age at assessment, all eleven of the indicators from the associates/social interactions domain, and the overall need rating on the domain were unconditionally associated with psychological drug-dependence at the liberal *p-value* of .20. Forward, backward and manual selection methods retained a total of 6 covariates in the final logistic model. Age at assessment, SIR-R1 risk rating and a total of four covariates from the domain emerged as significantly related to psychological drug dependence after adjusting for the effects of other covariates in the model.

The significant ($p<.05$) unconditional associations between domain indicators and psychological drug dependence are presented in Table C3. An overwhelming majority (92%) of the offenders who associated with other substance abusers were classified as psychologically drug dependent compared to just over 67% of the offenders in the other group. Also, offenders who associated with criminal others, lived in criminogenic areas, and were unattached to any pro-social community groups were more likely to be classified as psychologically drug dependent than the other group. The unconditional association between gang affiliation and psychological drug dependence was relatively weak, with slightly fewer offenders with gang affiliations classified as psychologically drug dependent (see Table C3). Offenders classified as psychologically drug dependent were also more likely to be victimized in social situations and more easily influenced by others than the group of offenders who were not classified as such. Offenders with overall need ratings of *none*, *some* or *considerable* on the domain were between 29 and 36 times more likely, with respect to odds, to be classified as psychologically drug dependent than offenders with a rating of *asset* (see Table C3).

The results from the multivariable logistic regression procedure are presented in Table 7. As with the other domains, the relationship between age and psychological drug dependence was curvilinear, with the highest predicted probability of psychological drug dependence occurring at age 38. Offenders who were socially isolated, associated with substance abusers, and had mostly criminal friends were significantly more likely with respect to odds to be classified as psychologically drug dependent after adjusting for the effects of other covariates that were retained by the model (see Table 7). Interestingly, the odds of psychological drug dependence for offenders with a gang affiliation was only 71% of the odds for offenders without a gang affiliation. Although individual indicators within the domain were associated with psychological drug dependence, the overall need rating on the domain was not.

The SIR-R1 rating was also associated with psychological drug dependence; however, its effect was generally more pronounced in the presence of social isolation, especially for offenders rated poor risk or fair risk. Almost all of the *OR* parameter estimates increased for each level of the interaction term compared to the main effects of SIR-R1 and the *socially isolated* covariates There was one exception, however. The size of the *OR* estimate for the interaction between fair/poor risk rating on the SIR-R1 and the *socially isolated* covariate was about the same as the size of the *OR* estimates for the covariates' main effects.

Table 7. Final Multivariable Logistic Regression Model Examining the Covariates of Psychological Drug Dependence within the Domain of Associates/Social Interactions.

Covariate[a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-2.66	0.17				
Socially isolated	0.94	0.27	13.49	<.05	2.55	1.51 - 4.31
Associates with substance abusers	1.30	0.14	105.42	<.0001	3.66	2.79 - 4.79
Mostly criminal friends	0.38	0.09	21.44	<.0001	1.46	1.22 - 1.75
Has been affiliated with a gang	-0.34	0.16	11.18	<.05	0.71	0.52 - 0.96
Age[b]			62.94	<.0001	-	-
Age centred (at age 33)	.028	0.0050			-	-
Age centred and squared	-0.0030	0.00044			-	-
SIR-R1 risk estimate[c]			74.84	<.0001		
One out of three expected to succeed on release (poor risk)	1.25	0.15			3.49	2.57 - 4.72
Two out of five expected to succeed on release (fair/poor risk)	1.03	0.17			2.81	2.02 - 3.92
One out of two expected to succeed on release (fair risk)	0.45	0.17			1.56	1.12 - 2.19
Two out of three expected to succeed on release (good risk)	0.65	0.18			1.90	1.34 - 2.71
Not administered the SIR-R1	0.91	0.20			2.49	1.68 - 3.69
Interaction						
SIR-R1 risk estimates and socially isolated[d]			14.52	<.05	-	-
Poor risk and socially isolated	-0.79	0.32			4.05	2.77 - 5.92
Fair/poor risk and socially isolated	-1.14	0.39			2.30	1.31 - 4.03
Fair risk and socially isolated	-0.09	0.36			3.66	2.27 - 5.89
Good risk and socially isolated	-0.63	0.42			2.59	1.39 - 4.85
Not administered SIR-R1 and socially isolated	-0.75	0.41			2.99	1.66 - 5.40

Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. The *LRT* statistic for indicators that comprised the interaction term assessed the average effect of each indicator across categories of the other indicator that comprised the interaction term. [a]Parameter estimates for all covariates except for the age and SIR-R1 covariates compare the odds of drug dependence when the problem is present (rated as yes) versus when the problem is absent (rated as no). [b]The relationship between age and drug dependence is curvilinear with the highest predicted probability of drug dependence occurring at age 38. [c]All SIR-R1 risk categories are compared to reference group of offenders who were rated as having a very good risk of success on release from custody. Of the offenders who were not administered the SIR-R1, 92% were of Aboriginal ancestry. [d]Odds ratio estimates and confidence intervals compare the odds when both covariates are present to when both covariates are at their respective reference levels.

The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 6.21, p =.62. R^2 = .20.

Substance Abuse Domain

All of the indicators from the substance abuse domain and the overall domain rating were unconditionally associated with psychological drug-dependence at the liberal *p-value* of .20. Through forward, backward and manual selection methods, the overall need rating on the domain and a total of eight domain indicators were identified as significant covariates of psychological drug dependence in the final logistic regression model. As with the previous models, age at assessment was retained as a significant covariate of psychological drug dependence; however, the SIR-R1 risk rating was not after adjusting for the effects of the other covariates in the model.

All 29 substance abuse domain indicators were unconditionally associated with the psychological drug dependence at the $p<.05$ level of significance (see Table C4, Appendix C). The strongest associations were observed for the 16 drug-related indicators and all associations were in the expected direction. Over 94% of the offenders who were classified as psychologically drug dependent used drugs on a regular basis. Drug use resulted in law violations for over 95% of offenders who exceeded the threshold for the classification of psychological drug dependence. An overwhelming majority also abused drugs (99%) and had gone on drug-taking sprees in the past (91%). Additionally, for a sizeable proportion of offenders who were classified as psychologically drug dependent, the use of drugs interfered in their social relationships (80%) and with their employment (78%), and caused them physical health problems (61%). For the majority (88%) of the offenders, the overall need rating on the domain reflected a considerable need for intervention. Although all of the alcohol-related indicators were also positively associated with psychological drug dependence,

the strength of association between individual alcohol-related indicators and psychological drug dependence was relatively weaker than for the drug-related indicators (see Table C4)

The results from the multivariable logistic regression procedure are presented in Table 8. The associations between the SDS-derived classification of psychological drug dependence and the eight covariates within the substance abuse domain provided strong evidence in support of the SDS's concurrent validity. After adjusting for the effects of the other covariates that were retained by the model, offenders who drank regularly had only 65% the odds of psychological drug dependence compared to offenders who did not drink alcohol on a regular basis. Equivalently, by taking the reciprocal of 0.65, the odds of psychological drug dependence for the offenders who did not drink alcohol on a regular basis was 1.54 times the odds of that for the offenders who drank alcohol regularly. All other covariates in the model identified drug problems, and all pointed to higher predicted odds of psychological drug dependence when a specific drug problem was present (see Table 8).

Offenders who were rated as requiring considerable intervention to address their substance abuse problems were 4.5 times more likely with respect to odds to be classified as psychologically drug dependent than offenders rated as requiring no intervention in the area of substance abuse. In terms of the relative strength of conditional associations with psychological drug dependence, the next strongest covariate was *abuses drugs*($OR = 3.56$) , followed by: *uses drugs on a regular basis* ($OR = 2.92$), *has gone on drug taking sprees* ($OR = 2.56$), *drug use resulted in law*

violations (*OR* = 1.62), *drug use interferes with employment* (*OR* = 1.61), *drug use interferes with health* (*OR* = 1.58), and *drug use interferes with social relations* (*OR* = 1.43). Clearly, the predicted odds of psychological drug dependence was significantly higher when a drug-specific problem was present compared to when it was absent. Interestingly, indicators within the substance abuse domain that focussed on patterns of use (e.g., drug use in social situations or during leisure time, combining drugs), prior participation in substance abuse services (e.g., prior substance abuse treatment or assessments), and the SIR-R1 risk rating were not associated with psychological drug dependence after adjusting for the effects of the other covariates in the final logistic model.

Table 8. Final Multivariable Logistic Regression Model Examining the Covariates of Psychological Drug Dependence within the Domain of Substance Abuse

Covariate [a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-5.09	0.39				
Substance Abuse Domain rating			69.04	<.0001		
Some need for intervention	0.40	0.32			1.49	0.79 - 2.81
Considerable need for intervention	1.49	0.32			4.44	2.37 - 8.34
Drinks on a regular basis	-0.43	0.11	20.95	<.0001	0.65	0.53 - .81
Uses drugs on a regular basis	1.07	0.19	41.75	<.0001	2.92	2.00 - 4.24
Has gone on drug-taking sprees	0.94	0.16	39.85	<.0001	2.56	1.87 - 3.51
Abuses drugs	1.27	0.44	7.25	<.05	3.56	1.49 - 8.48
Drug use interferes with employment	0.48	0.14	16.45	<.0001	1.61	1.23 - 2.10
Drug use interferes with social relations	0.36	0.14	9.53	<.001	1.43	1.09 - 1.87
Drug use resulted in law violations	0.48	0.22	4.23	<.001	1.62	1.05 - 2.49
Drug use interferes with health	0.46	0.12	15.53	<.0001	1.58	1.25 - 1.99
Age[b]			25.86	<.0001	-	-
Age centred (at age 33)	0.022	0.0062			-	-
Age centred and squared	-0.0016	0.00055			-	-

Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. [a]Parameter estimates for all covariates except for the age covariate are comparing the odds of drug dependence when the problem is present (rated as yes) versus when the problem is absent (rated as no). [b]The relationship between age and drug dependence is curvilinear with the highest predicted probability of drug dependence occurring at age 40.

The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 1.71, p =.99. R^2 = .58.

Community Functioning Domain

Eighteen out of the 21 indicators from the community functioning domain and the overall domain rating were unconditionally associated with psychological drug dependence at the liberal *p-value* of .20. After adjusting for the effects of other variables in the logistic model through backward, forward and manual selection methods, a total of 5 out of the 18 indicators, age at assessment and SIR-R1 risk rating emerged as significant covariates of psychological drug dependence.

The distribution of observations for the significant ($p<.05$) unconditional associations between domain indicators and psychological drug dependence are presented in Table C5 (Appendix C). Offenders with a history of unstable accommodations, a residence that was poorly maintained, financial difficulties, reliance on social assistance, and poor use of leisure time were generally more likely to be classified as psychologically drug dependent than offenders without such a history. The one exception was the covariate, *difficulties with writing*. It was negatively associated with psychological drug dependence. Generally, offenders with overall need ratings of *none*, *some* or *considerable* on the domain were more likely to be classified as psychologically drug dependent than offenders with a rating of *asset*.

The results from the multivariable logistic regression procedure are presented in Table 9. After adjusting for the effects of other covariates that were retained by the model, offenders with unstable accommodations or poorly maintained accommodations had roughly 1.60 times the odds of psychological drug dependence compared to the group of offenders who did not have the deficits identified. Similarly, offenders who

experienced difficulties meeting bills resulted in a 1.47 times increase in the odds of psychological drug dependence. Interestingly, for offenders who did not experience difficulties with writing, the odds of psychological drug dependence was 1.59 times higher than the odds for offenders who had the difficulty identified. Although a number of indicators within the domain were significantly associated with psychological drug dependence, the overall need rating on the domain was not after adjusting for the effects of other covariates in the model.

No bank account was the strongest covariate of psychological drug dependence (see Table 9). This covariate also produced a significant interaction with SIR-R1 risk rating. Generally, the odds of psychological drug dependence was greater across SIR-R1 risk ratings for the offenders who did not have a bank account compared to the reference category (i.e., offenders with a bank account and a very good risk rating). Also, when compared to the main effects for each interaction term, the combined effects of SIR-R1 and the *no bank account* covariate were generally more pronounced (except for *the fair risk and no bank account* group) in terms of the odds of psychological drug dependence. The *not administered and no bank account* group (91 % of who were of Aboriginal ancestry) had the same odds of psychological drug dependence as the *poor risk and no bank account* group, ($OR = 0.91$, *95% CI* $= 0.61 - 1.36$).

Table 9. Final Multivariable Logistic Regression Model Examining the Covariates of Psychological Drug Dependence within the Domain of Community Functioning

Covariate[a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-2.10	0.14				
Unstable accommodation	0.47	0.09	25.36	<.0001	1.60	1.33 - 1.92
Residence poorly maintained	0.50	0.17	8.39	<.05	1.64	1.16 - 2.30
Difficulty meeting bills	0.39	0.09	18.87	<.0001	1.47	1.24 - 1.75
No bank account	1.00	0.25	15.77	<.001	2.72	1.68 - 4.42
Problems writing	-0.46	0.12	15.55	<.001	0.63	0.50 - 0.80
Age[b]			59.62	<.0001		
Age centred (at age 33)	0.024	0.0050			-	-
Age centred and squared	-0.0029	0.00043			-	-
SIR-R1 risk estimate[c]			18.86	.0001		
One out of three expected to succeed on release (poor risk)	1.52	0.18			4.56	3.21 - 6.46
Two out of five expected to succeed on release (fair/poor risk)	1.46	0.20			4.29	2.91 - 6.32
One out of two expected to succeed on release (fair risk)	0.93	0.19			2.54	1.75 - 3.69
Two out of three expected to succeed on release (good risk)	0.88	0.20			2.40	1.62 - 3.56
Not administered the SIR-R1	1.05	0.27			2.85	1.67 - 4.87
Interaction						
SIR-R1 risk estimates and no bank account[d]			18.86	<.05		
Poor risk and no bank account	-0.85	0.29			5.30	3.75 - 7.49
Fair/poor risk and no bank account	-1.07	0.32			3.99	2.67 - 5.98
Fair risk and no bank account	-0.96	0.33			2.64	1.73 - 4.02
Good risk and no bank account	-0.75	0.35			3.09	1.91 - 5.00
Not administered SIR-R1 and no bank account	-0.47	0.39			4.82	3.07 - 7.58

Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. The *LRT* statistic for indicators that comprised the interaction term assessed the average effect of each indicator across categories of the other indicator that comprised the interaction term. [a]Parameter estimates for all covariates except for the age and SIR-R1 covariates compare the odds of drug dependence when the problem is present (rated as yes) versus when the problem is absent (rated as no). [b]The relationship between age and drug dependence is curvilinear with the highest predicted probability of drug dependence occurring at age 37. [c]All SIR-R1 risk categories are compared to the reference group of offenders who were rated as very good risk to succeed on release from custody. Of the offenders who were not administered the SIR-R1, 92% were of Aboriginal ancestry. [d]Odds ratio estimates and confidence intervals compare the odds when both covariates are present to when both covariates are at their respective reference levels.

The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 11.50, p =.18. R^2 = .18.

Personal/Emotional Orientation Domain

The overall need rating on the domain and 37 out of a possible 47 personal/emotional orientation indicators were unconditionally associated with psychological drug dependence at the liberal *p-value* of .20. A total of 10 indicators were retained by the final logistic model through backward, forward and manual covariate selection methods. Age at assessment and the SIR-R1 risk rating also contributed to the model's explanation of the variation in psychological drug dependence.

Table C6 (Appendix C) presents the distribution of observations for domain indicators that were unconditionally associated with psychological drug dependence at a $p<.05$ level of significance. Although very few offenders were hospitalized for a mental health problem during the time of assessment, of those who were, a greater proportion of them were classified as psychologically drug dependent. Similarly, a greater proportion of offenders from the group who were classified as psychologically drug dependent were currently prescribed medication for a mental health problem compared to the other group. Prior involvement in the mental health system was also associated with psychological drug dependence, with a greater number of the offenders from the psychologically drug dependent group having undergone prior mental health assessments and prior hospitalizations for a mental health problem. In addition, offenders who had existing cognitive-behavioural deficits (e.g., impulsiveness, low frustration tolerance, anxiety, difficulty solving interpersonal problems, poor decision making, unrealistic goal setting, poor stress management, poor use of leisure time, etc.) were generally more likely to be classified as psychologically drug dependent than

offenders who did not have the deficits identified (see Table C6). Interestingly, grandiosity, an inability to recognize problem areas, gang affiliations, and inappropriate sexual preferences and attitudes were negatively associated with psychological drug dependence. Generally, offenders with overall need ratings of *some* or *considerable* on the domain were more likely to be classified as psychologically drug dependent than offenders with a rating of *none*.

The results from the multivariable logistic regression procedure are presented in Table 10. After adjusting for the effects of other covariates that were retained by the final logistic model, offenders with problematic family ties had 1.23 times the odds of psychological drug dependence compared to offenders who did not have the indicator identified as a problem. The probability of psychological drug dependence was higher for impulsive offenders than for offenders without the cognitive deficit identified (*OR* = 1.55). In contrast, offenders who were identified as narrow and rigid in their thinking had 65% the odds of psychological drug dependence compared to offenders without the cognitive deficit identified.

The extent to which offenders were involved in the mental health system was also associated with psychological drug dependence. Offenders who had undergone a prior personal/emotional assessment had 75% the odds of psychological drug dependence compared to offender who had never undergone an assessment. The same was not true for the offenders who had been previously hospitalized for a mental health problem for they were 1.35 times more likely, with respect to odds, to be classified as psychologically drug dependent. Offenders who were hospitalization for a mental health

problem at the time of assessment had 3.24 times the odds of psychological drug dependence compared to offenders who were not hospitalized. Also the probability of psychological drug dependence was greater for offenders who were currently medicated for a mental health problem compared to those offenders who were not (*OR* = 1.41). The overall need rating on the domain was not retained by the final model as a significant covariate of psychological drug dependence after adjusting for the effects of other covariates in the model.

As with previous models, the SIR-R1 rating was also a significant covariate of psychological drug dependence. Generally, as the risk rating on the SIR-R1 suggested a lower probability of success on release, the relative odds of psychological drug dependence increased. The group of offenders who were not administered the SIR-R1, of whom 92% were of Aboriginal ancestry, were just as likely to be psychologically drug dependent as offenders in the fair/poor risk group (*OR* = 0.92, *95% CI* = 0.66 – 1.29) and marginally less likely than the poor risk group (*OR* = 0.74, *95% CI* = 0.54 – 1.01).

Table 10. Final Multivariable Logistic Regression Model Examining the Covariates of Psychological Drug Dependence within the Domain of Personal/Emotional Orientation

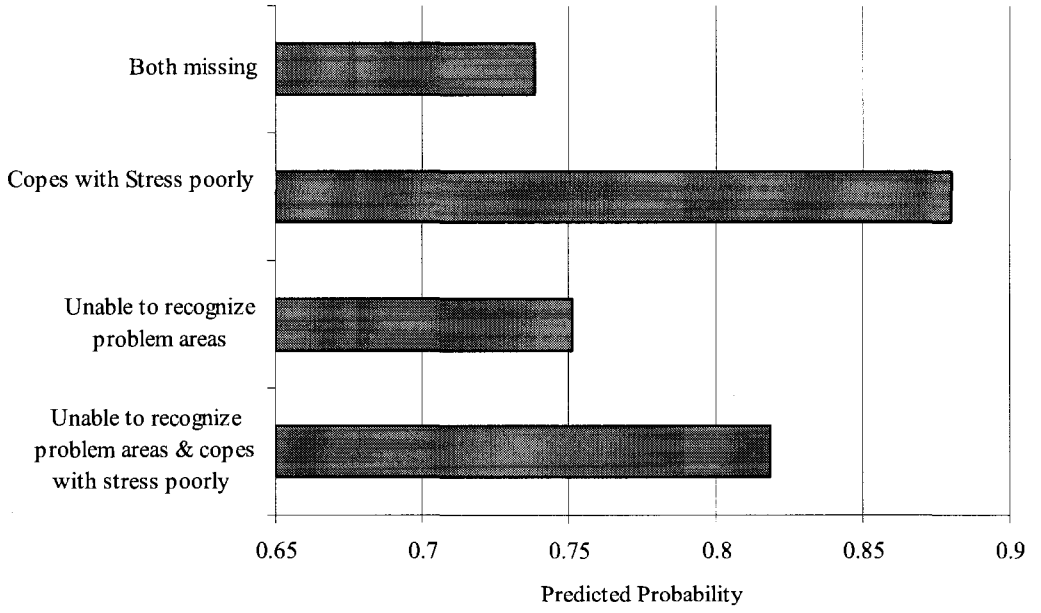
Covariate[a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-2.45	0.17				
Family ties are problematic	0.20	0.09	5.71	.06	1.23	1.03 - 1.46
Unable to recognize problem areas	0.07	0.19	.12	.73	1.07	0.74 - 1.54
Impulsive	0.44	0.12	15.32	<.001	1.55	1.23 - 1.96
Narrow and rigid thinking	-0.39	0.09	19.94	<.0001	0.68	0.57 - 0.81
Copes with stress poorly	0.96	0.15	46.98	<.0001	2.60	1.95 - 3.47
Manages time poorly	0.34	0.09	13.96	<.001	1.40	1.17 - 1.67
Prior personal/emotional assessments	-0.28	0.10	8.17	<.05	0.75	0.62 - 0.92
Currently prescribed medication for mental health problems	0.34	0.34	15.97	<.001	1.41	1.15 - 1.73
Past hospitalization for mental health problems	0.30	0.13	12.09	<.05	1.35	1.05 - 1.72
Current hospitalization for mental health problems	1.17	0.32	17.39	<.001	3.24	1.72 - 6.08
Age[b]			60.81	<.0001		
Age centred (at age 33)	0.024	0.0051			-	-
Age centred and squared	-0.0030	0.00044			-	-
SIR-R1 risk estimate[c]:			111.05	<.0001		
One out of three expected to succeed on release (poor risk)	1.37	0.14			3.92	2.96 - 5.18
Two out of five expected to succeed on release (fair/poor risk)	1.15	0.16			3.15	2.32 - 4.27
One out of two expected to succeed on release (fair risk)	0.68	0.15			1.98	1.46 - 2.68
Two out of three expected to succeed on release (good risk)	0.65	0.16			1.92	1.39 - 2.65
Not administered SIR-R1	1.06	0.18			2.90	2.02 - 4.15
Interaction						
Unable to recognize problems and copes with stress poorly[d]	-0.55	0.21			1.60	1.90 -2.16

Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. The *LRT* statistic for indicators that comprised the interaction term assessed the average effect of each indicator across categories of the other indicator that comprised the interaction term. [a]Parameter estimates for all covariates except for the age and SIR-R1 covariates compare the odds of drug dependence when the problem is present (rated as yes) versus when the problem is absent (rated as no). [b]The relationship between age and drug dependence is curvilinear with the highest predicted probability of drug dependence occurring at age 37. [c]All SIR-R1 risk categories are compared to reference group of offenders who were rated as very good risk to succeed on release from custody. Of the offenders who were not administered the SIR-R1, 92% were of Aboriginal ancestry. [d]The odds ratio estimate and confidence interval compares the odds when both covariates are present to when both covariates are at their respective reference levels.

The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 8.70, p =.37. R^2 = .21.

A significant interaction was also observed between *unable to recognize problem areas* and *copes with stress poorly*. With both problems present, offenders were 1.60 times more likely, with respect to odds, to be classified with psychological drug dependence than when both problems were absent. In addition, and what is of particular interest, is that the main effect of *copes with stress poorly* was more strongly associated with psychological drug dependence when an offender was able to recognize his problem areas versus when he was not. Figure 5 provides the predicted probabilities of psychological drug dependence for the four combined categories of the two variables.

Figure 5. The Predicted Probability of Psychological Drug Dependence for the Four Combined Categories of *Unable to recognize problem areas* and *Copes with Stress Poorly*



Note. The regression equation assumed an offender who was 33 years of age at the time of admission with the following problems identified in the OIA: family ties are problematic, unable to recognize problem areas, impulsive, narrow and rigid thinking, manages time poorly, prior personal/emotional assessments, currently prescribed medication for mental health problems, past hospitalization for mental health problems, current hospitalization for mental health problem, and of the poorest risk for post-release success.

Attitude Domain

A total of 20 out of a possible 24 indicators from the domain were unconditionally associated with psychological drug dependence at a liberal *p-value* of .20. Through forward, backward and manual selection methods, a total of five indicators from the domain were retained as significant covariates of psychological drug dependence in the final logistic model. As with previous models, age at assessment and the SIR-R1 risk rating were also retained by the model.

Table C7 (Appendix C) presents the distribution of observations for domain indicators that were unconditionally associated with psychological drug dependence at a $p<.05$ level of significance. In general terms, offenders who expressed a negative opinion of correctional services and rehabilitation were more likely to be classified as drug dependent. Also, a markedly greater number of offenders classified as drug dependent valued substance abuse compared to the other group, (84% vs. 52%). Offenders who were classified as drug dependent were also more likely to be disrespectful of personal belongs, public property and commercial property than the other group. Also, when compared to the other group, a larger proportion of offenders who were classified as psychologically drug dependent devalued employment, marital/family relations, interpersonal relations, basic life skills, and personal/emotional stability. They were also more likely to be supportive of spousal and instrumental violence and more likely to be non-conforming than the group of offenders who were not classified as psychologically drug dependent (see Table C7). Offenders with overall need ratings of *none*, *some* or *considerable* on the domain were more likely to be classified as psychologically drug dependent than offenders with a rating of *asset.*

The results from the multivariable logistic regression procedure are presented in Table 11. After adjusting for the effects of the other covariates that were retained by the model, offenders who valued substance abuse were 3.89 time more likely, with respect to odds, to be classified as drug dependent. Offenders who were disrespectful toward commercial property were also more likely to be classified as psychologically drug dependent (*OR* = 1.83). Interestingly, having negative attitudes toward corrections was positively associated with psychological drug dependence (*OR* = 1.30), while harbouring negative attitudes toward police (*OR* = 0.62) and rehabilitation (*OR*= 0.77) were negatively associated with psychological drug dependence. As with previous models the probability of psychological drug dependence was greatest for the *poor risk* group. Generally, as risk improved the probability of psychological drug dependence decreased. The group of offenders who were not administered the SIR-R1, of whom 92% were of Aboriginal ancestry, were just as likely to be psychologically drug dependent as offenders in the poor risk group (*OR* = 0.78, *95% CI* = 0.57 – 1.07) and the fair/poor risk group (*OR* = 1.03, *95% CI* = 0.73 – 1.44).

Table 11. Final Multivariable Logistic Regression Model Examining the Covariates of Psychological Drug Dependence within the Domain of Attitude

Covariate [a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-2.34	0.14				
Negative toward police	-0.48	0.10	25.27	<.0001	0.62	0.51 - 0.76
Negative toward corrections	0.26	0.12	5.93	<.05	1.30	1.04 - 1.64
Negative toward rehabilitation	-0.27	0.11	8.35	<.05	0.77	0.61 - 0.96
Values substance abuse	1.36	0.10	200.08	<.0001	3.89	3.18 - 4.77
Disrespectful commercial property	0.61	0.093	43.44	<.0001	1.83	1.53 - 2.20
Age[b]						
Age centred (at age 33)	0.020	0.005	51.92	<.0001	-	-
Age centred and squared	-0.0029	0.00044			-	-
SIR-R1 risk estimate [c]			61.58	<.0001		
One out of three expected to succeed on release (poor risk)	1.09	0.15			2.97	2.22 - 3.98
Two out of five expected to succeed on release (fair/poor risk)	0.82	0.16			2.27	1.66 - 3.10
One out of two expected to succeed on release (fair risk)	0.47	0.16			1.60	1.18 - 2.17
Two out of three expected to succeed on release (good risk)	0.50	0.16			1.65	1.19 - 2.27
Not administered SIR-R1	0.85	0.18			2.34	1.63 - 3.34

Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. [a]Parameter estimates for all covariates except for the age and SIR-R1 covariates are comparing the odds of drug dependence when the problem is present (rated as yes) versus when the problem is absent (rated as no). [b]The relationship between age and drug dependence is curvilinear with the highest predicted probability of drug dependence occurring at age 37. [c]All SIR-R1 risk categories are compared to the reference group of offenders who were rated as having a four in five probability of succeeding (very good risk) on release from custody. Of the offenders who were not administered the SIR-R1, 92% were of Aboriginal ancestry.

The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 8.52, p =.38. R^2 = .24.

All Seven Domains

Of the total number of covariates that were identified within each of the seven domains, a total of 14 emerged as significantly associated with psychological drug dependence in the final logistic model. One covariate from the education/employment domain was identified, followed by two from the marital/family domain, a total of seven from the substance abuse domain, the overall need rating on the substance abuse domain, and three from the personal/emotional orientation domain. Age at assessment

was also retained by the model. The multivariable logistic regression coefficients (β), standard errors of the estimates (SE β), likelihood ratio chi-square statistics (LRT χ^2), *p*-values, odds ratio estimates (*OR*), and the 95% confidence intervals (95% CI) for the *OR* estimates are presented in Table 12.

Predictably, the indicators that identified drug-specific problems were the strongest covariates of psychological drug dependence. Offenders who abused drugs and regularly used drugs were 3.46 and 3.0 times more likely in terms of odds to be classified as psychologically drug dependent, respectively. Similarly, the predicted odds of psychological drug dependence for the offenders with a history of drug sprees was 2.70 times the odds for offenders without a history of drug sprees. For offenders whose drug use precipitated law violations, the odds of psychological drug dependence was approximately 1.90 times the odds for the group of offenders who did not have a history of drug-related law violations. Offenders identified with drug-related physical health problems, employment difficulties and social problems were more likely classified as psychologically drug dependent than offenders who did not have the problems identified. In order, the *OR* estimates for the covariates examining the negative impact of drugs on physical health, employment and social relations were 1.62, 1.55, and 1.42.

Other covariates from the education/employment, personal/emotional, and marital/family domains also contributed to the model's explanation of the variation in the outcome. For instance, the odds of psychological drug dependence was 32% greater for the offenders who experienced a job termination in the past compared to the group of offenders who did not. Concerning personal/emotional difficulties, offenders who were

currently hospitalized for a mental health problem had approximately 2.70 times the odds of psychological drug dependence, compared to the group of offenders who were not hospitalized for mental health reasons. Also, offenders who had difficulties coping with stress had a 33% greater odds of psychological drug dependence compared to offenders who did not have this deficit identified. Interestingly the cognitive deficit, *rigid thinking*, was negatively associated with psychological drug dependence. The predicted odds of psychological drug dependence for the *rigid thinking* offenders *was* only 59% of the odds for the group of offenders who were not identified with this deficit. As with previous models, a curvilinear association between age at assessment and psychological drug dependence was also observed, with the highest probability of psychological drug dependence occurring at age 39 (see Figure 6).

Table 12. Final Multivariable Logistic Regression Model Examining the Covariates of Psychological Drug Dependence Across All Seven Life Domains

Covariate[a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-5.31	0.40				
Education/Employment Domain						
Fired from a job	0.28	0.12	5.84	<.05	1.32	1.09 - 1.71
Marital/Family Domain[b]						
Victim – spousal abuse	-0.51	0.40	2.49	.29	0.60	0.28 - 1.31
Perpetrator - spousal abuse	-0.0058	0.13	.07	.97	0.99	0.77 - 1.28
Substance Abuse Domain			56.21	<.0001		
Overall Rating						
Some need for intervention	0.17	0.32			1.19	0.65 - 2.31
Considerable need for intervention	1.17	0.32			3.22	1.77 - 6.19
Uses drugs on a regular basis	1.12	0.20	44.60	<.0001	3.05	2.10 - 4.51
Has gone on drug sprees	0.99	0.16	40.67	<.0001	2.68	1.95 - 3.70
Abuses drugs	1.24	0.45	8.70	<.05	3.46	1.50 - 8.74
Drug use interferes with employment	0.44	0.14	13.29	<.05	1.55	1.18 - 2.04
Drug use interferes with social relations	0.35	0.14	9.14	<.05	1.42	1.07 - 1.87
Drug use has resulted in law violations	0.66	0.22	9.21	<.05	1.93	1.26 - 3.02
Drug use interferes with physical health	0.48	0.12	15.92	<.001	1.62	1.28 - 2.05
Personal/Emotional Orientation Domain						
Narrow and rigid thinking	-0.52	0.11	23.53	<.0001	0.59	0.48 - 0.74
Copes with stress poorly	0.28	0.14	8.33	<.05	1.33	1.02 - 1.74
Current hospitalization for mental health reasons	0.98	0.42	7.65	<.05	2.67	1.22 - 6.28
Age[c]			14.56	<.05		
Age centered (at age 33)	0.021	0.0065			-	-
Age centered and squared	-0.0017	0.00056			-	-
Interaction[d]						
Victim & perpetrator of spousal assault	1.31	0.46	9.84	<.05	2.21	1.44 - 3.40

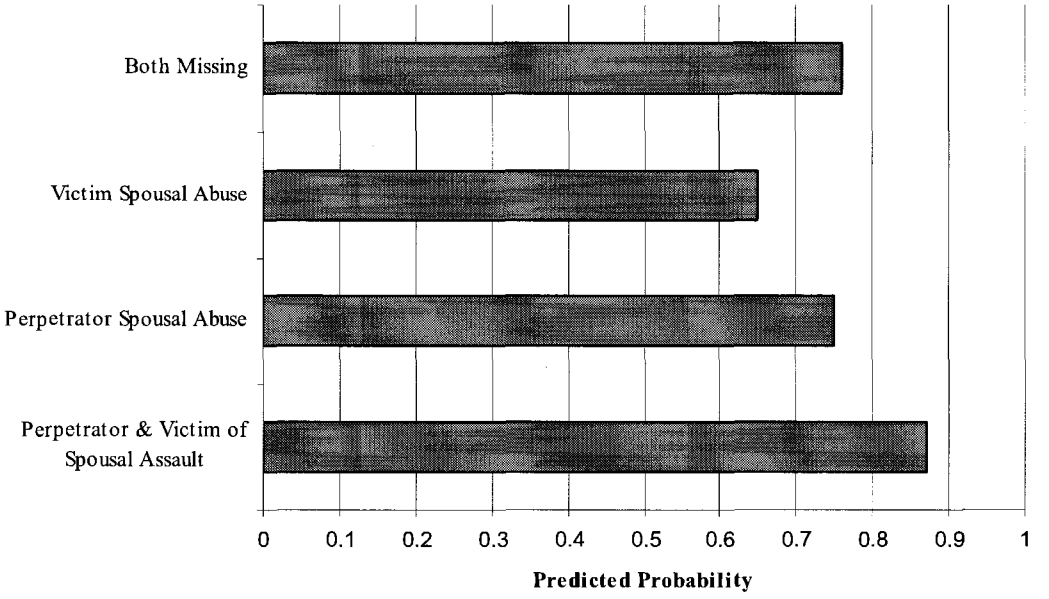
Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. The *LRT* statistic for indicators that comprised the interaction term assessed the average effect of each indicator across categories of the other indicator that comprised the interaction term. [a]Parameter estimates for all covariates except for the age covariate are comparing the odds of drug dependence when the problem is present (rated as yes) versus when the problem is absent (rated as no). [b]Both covariates did not reach statistical significance in the initial model that examined the associations within the marital/family domain; however the estimates suggested evidence of a weak association so they were both included in this model to assess their potential association with psychological drug dependence. [c]The relationship between age and drug dependence is curvilinear with the highest predicted probability of drug dependence occurring at age 39. [d]The Odds ratio estimate and confidence interval compares the odds when both covariates are present to when both covariates are at their respective reference levels.
The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 3.82, p = 0.87. R^2 = .60.

Figure 6. Predicted Probability (p) of Psychological Drug Dependence for the Main Effect of Age (full model)

Note. The main effect of age on the predicted probability of drug dependence is restricted to ages that range between the 10th and 90th percentile. The other covariates in the model were held constant at their reference levels.

Marital tumult was also associated with psychological drug dependence as evidenced by the interaction between the covariates, *victim of spousal abuse* and *perpetrator of spousal abuse*. The presence of both problems was a significant contributor to the model's explanation of variation in psychological drug dependence. The interaction between the two suggested a 2.21 increase in the odds of psychological drug dependence compared to when both were absent. Figure 7 provides the predicted probabilities of psychological drug dependence for the four combined categories of the two variables.

Figure 7.The Predicted Probability of Psychological Drug Dependence for the Four Combined Categories of *Victim of Spousal Abuse* and *Perpetrator of Spousal Abuse*



Note. The covariates – *fired from a job, narrow and rigid thinking, copes with stress poorly, and current hospitalization for mental health problems* – were held constant at their respective reference levels (i.e., problem absent). The substance abuse domain rating was held fixed at the "considerable" rating. All other drug-specific covariates were considered problems. The regression equation assumed an offender who was 33 years of age at the time of admission to federal custody.

Triggers of Drug Use and their Association with Psychological Drug Dependence

Recall that the 12 month period prior to arrest was considered the time referent for the purposes of determining extant substance abuse problems. A total of 2094 offenders (63%) reported drug use during this time referent and were therefore given an opportunity to indicate what type(s) of trigger(s) precipitated their drug use during this period.

After adjusting for the effect of age at assessment, a total of 5 composite categories, which were based on the 13 triggers, were retained as significant covariates

of psychological drug dependence through forward, backward and manual selection methods. The distribution of results, including unconditional *OR* estimates for all eight composite categories are presented in Appendix D. In summary, offenders classified as psychologically drug dependent were more likely to use drugs because of negative affective states during the 12 month period prior to arrest than offenders who did not meet the criteria for a classification of psychological drug dependence. In contrast, offenders who were not classified as psychologically drug dependent were more likely than the psychologically drug dependent offenders to use drugs because of positive circumstances. An offender's need to manage withdrawal symptoms through the use of drugs emerged as the strongest covariate of psychological drug dependence.

The results from the multivariable logistic regression procedure are presented in Table 13. After adjusting for the effects of other triggers of drug use, offenders who used drugs to manage their withdrawal symptoms had fully 13 times the odds of psychological drug dependence compared to the offenders who did not identify these triggers as precipitating their drug use. On the other hand, the predicted odds of psychological drug dependence for the offenders who used drugs because of positive circumstances was only 53% of the odds for the group of offenders who did not identify these trigger. In order, offenders who identified negative affective states and physical discomfort as precipitating their drug use had 2.69 and 1.70 times the odds of psychologically drug dependence compared to the offenders who did not identify these as giving rise to their drug use. The predicted odds of psychological drug dependence for the group of offenders who used drugs to lift their courage was approximately 3.90times higher than for the offenders who did use drugs to cope in this way.

Table 13. Final Multivariable Logistic Regression Model Examining the Association between the Triggers of Drug Use and Psychological Drug Dependence

Triggers of drug use[a]	β	SE β	LRT χ^2	*p*	OR	95% CI
Intercept	-0.57	0.13				
Because of positive circumstances	-0.64	0.12	28.28	<.0001	0.53	0.42 - 0.67
Because of negative affective states	0.99	0.12	71.60	<.0001	2.69	2.14 - 3.38
To cope with physical discomfort	0.53	0.13	17.57	<.0001	1.70	1.33 - 2.17
To manage withdrawal symptoms	2.59	0.18	312.56	<.0001	13.38	9.44 - 18.95
To get courage	1.37	0.26	32.14	<.0001	3.93	2.38 - 6.48
Age[b]			30.02	<.0001		
Age centred (at age 33)	0.032	0.0063			-	-
Age centred and squared	-0.00208	0.00055			-	-

Note. [a]Parameter estimates compare the odds of drug dependence for offenders who identify the predictor as usually triggering drug use versus when the predictor is not identified. [b]The relationship between age and drug dependence is curvilinear with the highest predicted probability of drug dependence occurring at age 40.
The model adequately fits the data, Hosmer-Lemeshow goodness of fit χ^2 (8, number of groups = 10) = 9.20, p = 0.33. R^2 = .42.

Model Diagnostics

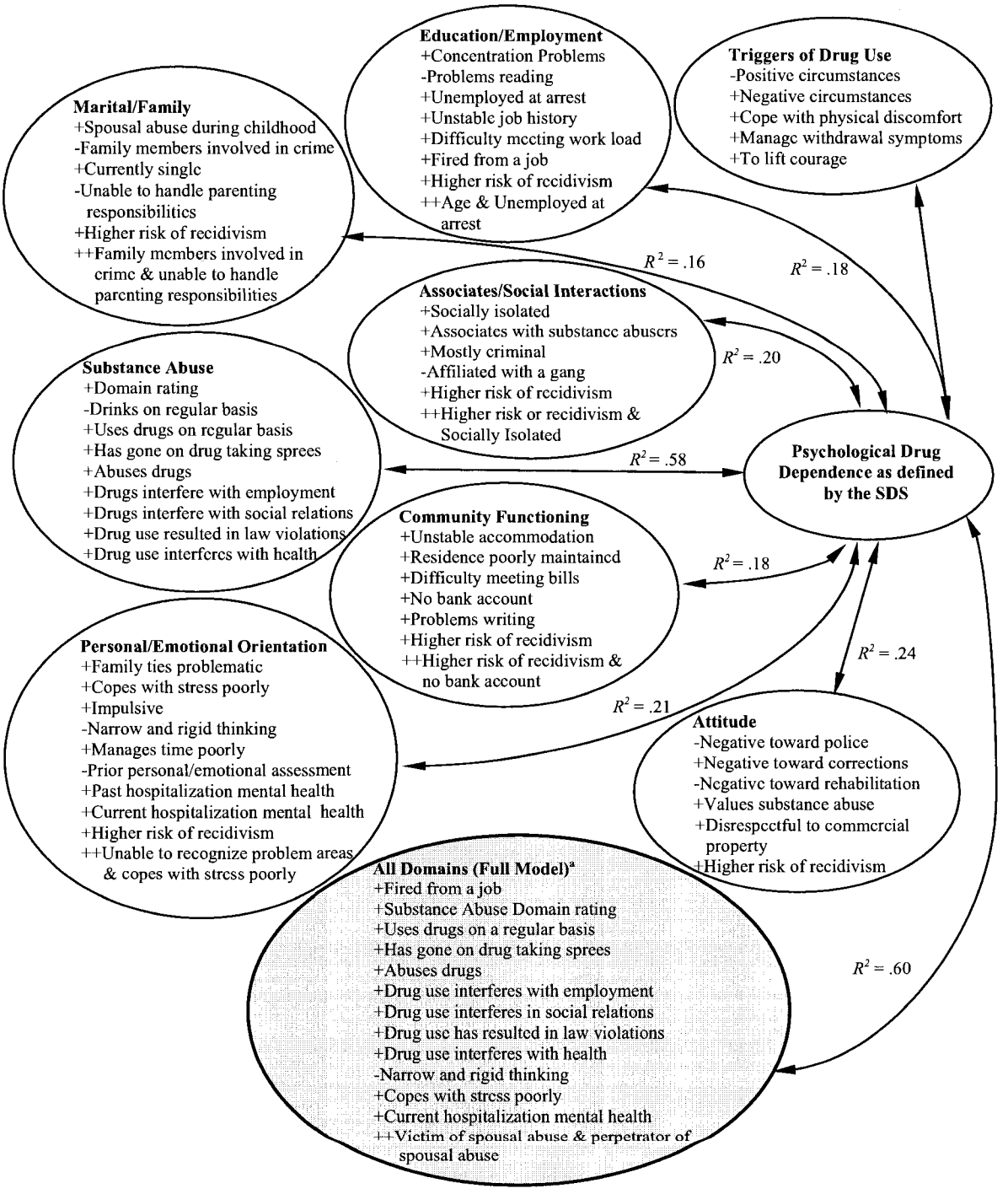
Individual plots of the changes in the Pearson chi-square statistic versus the predicted values were inspected for each of the models in order to uncover covariate patterns that were poorly fit by the model. A number of sensitivity analyses, (through the deletion of influential observations) were conducted to determine what effects, if any, the influential observations had on the models with the reduced sample. With the observations removed, the models produced parameter estimates that moved away from the null, suggesting stronger associations between some of the covariates and psychological drug dependence. This was not considered cause for concern because with the full sample of offenders retained for the modelling procedures, the significant findings, although weaker, were still attributable to the covariates that were of subject matter importance. The overall conclusions did not change with influential observations

retained in the models.

The Relative Predictive Power of the Models

The full model explained the greatest amount of variation in psychological drug dependence, followed by the domains of substance abuse, attitude, personal/emotional orientation, associates/social interactions, education/employment, and marital/family (see Figure 8) . The R^2 statistic was not reported for the model examining the triggers of drug use. The model relied on a subset of offenders that was different than the sample used for the other models so the R^2 statistic was considered inappropriate as a measure of relative predictive power (Hosmer & Lemeshow, 2000).

Figure 8. The Covariates of Psychological Drug Dependence within, and the Relative Predictive Power of, the Seven Domains, the Full Model (all domains) and the Model Examining the Triggers of Drug use



Note. Minus signs indicate negative associations. Single plus sign indicate positive associations. Double plus signs indicate interaction. Bi-directional arrows between psychological drug dependence and the groups of indicators within each of the seven domain areas indicate that associations exist. They do not imply a causal relationship. The (pseudo) R^2 Statistic indicates the relative predictive power of psychological drug dependence for the group of indicators within each of the seven domains. [a]The full model represents significant covariates of psychological drug dependence from all seven domains. Age was a significant covariate within all models.

4.5 SDS as a Covariate of Revocation

Introduction

Three Cox proportional hazards models were used to examine the effects of SDS on post-release outcomes. The first model examined differences in the rates of revocation between offenders who were classified as psychologically drug dependent by the SDS and the other group of offenders who did not exceed the threshold on the SDS for the classification. It was hypothesized that with exposure to substance abuse programs included as intermediate covariates between SDS classification and the outcome (see Figure 1), the group of offenders who were classified as psychologically drug dependent would be revoked at a higher rate (with or without a new offence) than the group of offenders who were not classified as such. The second model excluded the intermediate covariates from the model in order to examine the total effect of SDS classification on the relative hazard of revocation.

The third Cox proportional hazards model examined the effects of treatment intensity on the rates of revocation for the SDS classified offenders. It was hypothesized that the psychologically drug dependent offenders who participated in the current high intensity substance abuse (NSAP-H) program had a lower relative hazard of revocation than the psychologically drug dependent offenders who participated in the current moderate intensity program (NSAP-M). It was believed that the high intensity program better addressed criminogenic need than the moderate intensity program when compared to psychologically drug dependent offenders who were not exposed to a treatment program prior to release.

The Covariates of Revocation

Descriptive Information

Through backward, forward and manual selection methods, a total of 10 variables were retained by the first proportional hazards model. The variables that emerged as significant were the SDS classification of psychological drug dependence, age at the time of release, the ADS severity rating of alcohol problems, need ratings for the domains of associations/social interactions and community functioning, the overall need rating as measured by OIA, risk rating as measured by the SIR-R1, exposure to substance abuse programs (including the community-based maintenance program) and region of origin. The domains of education/employment, marital/family, personal/emotional orientation, attitude, and substance abuse were not retained as significant covariates of revocation by the final model.

Table 14 provides descriptive information relating to the proportion of offenders who were revoked with or without a new offence, the average time to first revocation, and the average time at risk for the censored cases, distributed across each significant covariate that was retained by the model. All measures of association between individual covariates and the outcome in Table 14 are unadjusted for the effects of other covariates. To summarize, a larger proportion of offenders who were classified as psychologically drug dependent by the SDS were returned to custody compared to the group of offenders who were not classified as such. As the need ratings on the domains of community functioning and associates/social interactions moved from asset to considerable, the proportion of offenders who were revoked with or without a new offence or charge increased. The same trend was observed for the OIA overall need

rating, the SIR-R1 risk rating and the ADS rating of alcohol abuse severity. Generally, offenders who were identified with lower ratings on need, risk, and alcohol abuse severity were revoked less often than offenders with higher need ratings. Also fewer offenders who participated in a substance abuse program were revoked compared to the group of offenders who were identified with a substance abuse problem but were never exposed to a substance abuse program. However, exposure to OSAPP was the one exception to this trend. More offenders from the OSAPP exposure category were revoked than from any other program exposure category. Generally, the mean length of time to first revocation decreased as need ratings for the domains of community functioning and associates/social interactions, the SIR-R1 risk rating and the ADS severity level increased. Similarly, offenders who were classified as psychologically drug dependent were revoked earlier, on average, than offenders were not classified as such.

There was some variation in the mean days at risk, especially for the program exposure categories. Prior to 2004, OSAPP was the core program for CSC so more offenders in the release cohort were exposed to this program than any other program. OSAPP-exposed offenders were also available for a longer period of follow-up because they were admitted to federal custody earlier (prior to 2004) and therefore eligible for release earlier during the study period than offenders from other program exposure categories. Although fewer offenders from the other program exposure categories were available at 24 months, this was not considered a problem for the modelling procedures. Notwithstanding, the year of release was included in all Cox models to assess for potential confounding.

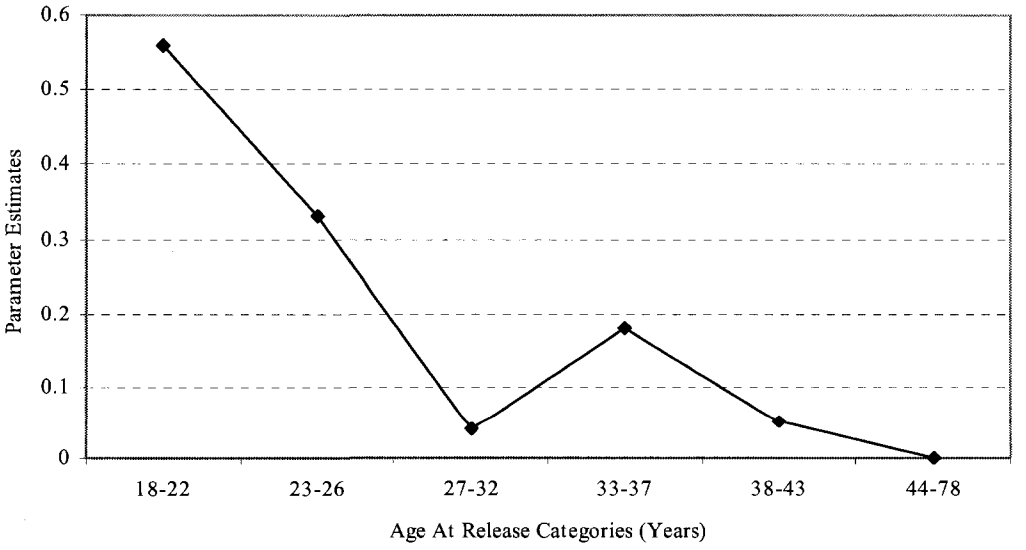
Table 14. Percentage of Offenders Revoked, the Mean number of Days to Revocation, and the Mean Number of Days at Risk for the Censored Offenders, Stratified by Each Significant Covariate of Revocation

Covariate	% Revoked		Mean Days to First Revocation	Mean Days at Risk for Censored Offenders	Total Offenders (%)
	Without Offence	Offence or Charge			
SDS Psychological Drug Dependence					
No	30	11	245	800	1269 (76)
Yes	48	14	205	732	408 (24)
Age Category					
≤ 26 years of age at release	38	19	224	771	526 (31)
> 26 years of age at release	32	9	237	795	1151 (69)
ADS Severity					
None	30	12	235	795	971 (58)
Low	37	12	238	794	552 (33)
Moderate	34	12	207	734	92 (6)
Substantial	54	8	183	688	39 (2)
Severe	61	17	202	646	23 (1)
Community Functioning					
Asset	9	1	296	951	70 (4)
None	33	12	238	767	1324 (79)
Some	45	14	214	846	253 (15)
Considerable	50	30	180	772	30 (2)
Associates/Social Interactions					
Asset	2	2	347	858	49 (3)
None	31	8	251	780	505 (30)
Some	35	13	236	800	771 (46)
Considerable	40	17	205	757	352 (21)
Overall Need Rating on the OIA:					
Low	7	4	321	917	222 (13)
Moderate	32	10	271	751	615 (37)
High	42	15	406	756	840 (50)
SIR-R1 risk estimate:					
Poor risk	44	20	211	712	415 (25)
Fair/poor risk	43	15	215	687	246 (15)
Fair risk	34	12	208	811	262 (16)
Good risk	29	10	278	780	213 (13)
Very good risk	17	3	351	857	436 (26)
Not administered SIR-R1	51	12	185	698	105 (6)
Substance Abuse Program Exposure					
No program required	18	11	283	377	529 (32)
Former Offender Pre-release Program (OSAPP)	51	15	248	1147	225 (13)
High Intensity Programs	42	8	227	309	62 (4)
Moderate Intensity Program	32	7	168	350	119 (7)
Substance abuse problem identified but did not receive program	40	13	214	771	742 (44)
Community Maintenance Program					
No	35	13	216	746	1473 (88)
Yes	24	6	411	1021	204 (12)
Region					
Atlantic	36	12	232	709	854 (51)
Ontario	32	12	232	865	823 (49)
Total Cohort	34	12	232	789	1677

Covariate-Adjusted Direct Effects of Psychological Drug Dependence on the Hazard of Revocation (Including Substance Abuse Program Exposure)

The parameter estimates, standard errors, Wald χ^2, p-values and hazard ratios (*HR*) (with confidence intervals) for each significant covariate, from a multiple Cox regression model stratified by substance abuse program exposure categories, are presented in Table 15. It was first necessary to dichotomize the age at release covariate because it did not satisfy the linearity assumption for entry into the model as a continuous variable (see Figure 9). The parameter estimates for offenders 27 years of age or older were relatively the same and significantly different from the parameter estimates for offenders under the age of 27. In the absence of psychological drug dependence, offenders under the age of 27 at the time of release had a hazard of revocation that was 1.63 times the hazard of the group of offenders from the older age category (see Table 15).

Figure 9. Assessing the Linearity Assumption for Age at Release



Note. Parameter estimates are adjusted for the effects of other covariates in the model. Parameter estimates represent the log(hazard) differences to the baseline category (44-78 years).

The main hypothesis was confirmed: offenders who were classified as psychologically drug dependent by the SDS were revoked at a higher rate than offenders who were not classified as such. Psychological drug dependence also produced a significant interaction with age at release. Offenders from the younger age category were just as likely to be revoked during the 24 month follow-up period irrespective of psychological drug dependence (see Table 15). Conversely, for older offenders (> 26 years of age at assessment), the presence of psychological drug dependence increased the hazard of revocation by 1.55 times. Older offenders who were not classified as psychologically drug dependent represented the lowest risk category - at approximately 60-65% hazard compared to the other categories.[23]

For the domains of community functioning, and associates/social interactions, offenders with ratings of asset, none and some had significantly lower hazards of revocation during the 24 month follow-up period compared to offenders with a rating of considerable. Offenders with a rating of asset on the domain of community functioning had a hazard for failure that was 0.26 times that of the group of offenders rated as considerable, followed by offenders who were rated as none (0.49 times) and some (0.57 times). Similar trends were also observed for the domain of associates/social interactions and overall need rating on the OIA. In the case of the associates/social interactions domain, the trend was not as pronounced, with offenders rated as some on the domain just as likely to be revoked as the offenders with a considerable rating. Also, the confidence intervals for the parameter estimates for the asset and none ratings

[23] The approximation is based on the reciprocal of hazard ratio for each category in question.

included a *HR* of 1.0, so the estimates should be interpreted with some caution. Nevertheless, the covariate, which is considered a criminogenic need area (Brown & Motiuk, 2005), was included in the model because the general trend suggested an increase in hazard for revocation with a corresponding increase in the need rating. Interestingly, offenders from the Ontario Region had a significantly lower hazard of revocation after adjusting for other significant covariates of revocation.

The parameter estimates for the ADS ratings of substantial and severe also suggested a higher relative hazard of revocation compared to the *none* rated group (reference category). However, the confidence interval for the point estimate for the substantial rating was somewhat wide and included a *HR* of 1.0, so the estimate should be interpreted with some caution.

The predicted probability of recidivism was also associated with revocation. When the SIR-R1 risk for recidivism rating suggested a higher probability of re-offending during the first three years after release, there was a corresponding increase in the hazard of revocation. Also, the group of offenders who were not administered the SIR-R1, of whom 91% are of Aboriginal ancestry, were just as likely to be revoked at any point during the 24 month follow-up period as the Fair/poor risk and poor risk groups.[24]

[24] Not administered SIR-R1 vs. Fair/Poor, *Wald* χ^2 (1, N = 1677) = .14, p =.70, *HR* = 0.95, (95% *CI:* 0.71 – 1.26). Not administered SIR-R1 vs. Poor Risk, *Wald* χ^2 (1, N = 1677) = .02, p =.88, *HR* = 1.02, (95% *CI:* 0.76 – 1.39).

Table 15. Covariate Adjusted Parameter Estimates, Standard Errors (*SE*), Wald χ^2, *p*-values and Hazard Ratios (*HR*) (With Confidence Intervals) for the SDS Classification of Psychological Drug Dependence and each Significant Covariate of Revocation, from a Cox Model Stratified by Program Exposure Categories

Covariate	Estimate (β)	*SE*	*Wald* χ^2	*p*-value	*HR* for Revocation (95% CI)
SDS Classification					
Psychologically drug dependent	0.44	0.10	18.12	<.0001	1.55 (1.27 - 1.89)
Age Category					
≤26 years of age at release	0.49	0.093	27.15	<.0001	1.63 (1.35 - 1.95)
ADS Severity Level[a]			11.25	<.05	
Low	-0.084	0.08			0.92 (0.78 - 1.09)
Moderate	-0.29	0.17			0.75 (0.54 - 1.04)
Substantial	0.27	0.22			1.31 (0.85 - 2.01)
Severe	0.54	0.25			1.71 (1.04 - 2.81)
Need Domains[b]**:**					
Community Functioning			14.60	<.01	
Asset	-1.36	0.45			0.26 (0.11 - 0.62)
None	-0.71	0.22			0.49 (0.32 - 0.75)
Some	-0.56	0.23			0.57 (0.37 - 0.89)
Associates/Social Interactions			7.36	<.10	
Asset	-1.34	0.73			0.26 (0.06 - 1.09)
None	-0.18	0.11			0.84 (0.68 - 1.03)
Some	0.008	0.093			1.01 (0.84 - 1.21)
Overall Need Rating on the OIA:			21.61	<.0001	
Moderate	0.84	0.22			2.31 (1.50 - 3.55)
High	1.02	0.23			2.79 (1.79 - 4.33)
SIR-R1 risk estimate[c]**:**			49.00	<.0001	
Poor risk	0.88	0.14			2.40 (1.83 - 3.15)
Fair/poor risk	0.80	0.15			2.22 (1.67 -2.95)
Fair risk	0.54	0.15			1.72 (1.29 - 2.30)
Good risk	0.38	0.16			1.46 (1.07 - 2.00)
Not administered SIR-R1	0.82	0.18			2.27 (1.60 - 3.23)
Community Maintenance Program					
Completed program	-0.93	0.14	43.47	<.0001	0.40 (0.30 - 0.52)
Region					
Ontario	-0.37	0.082	20.10	<.0001	0.69 (0.59 - 0.81)
Interaction[d]					
Psychologically drug dependent & Age	-0.45	0.17	7.10	<.01	1.60 (1.21 - 2.12)

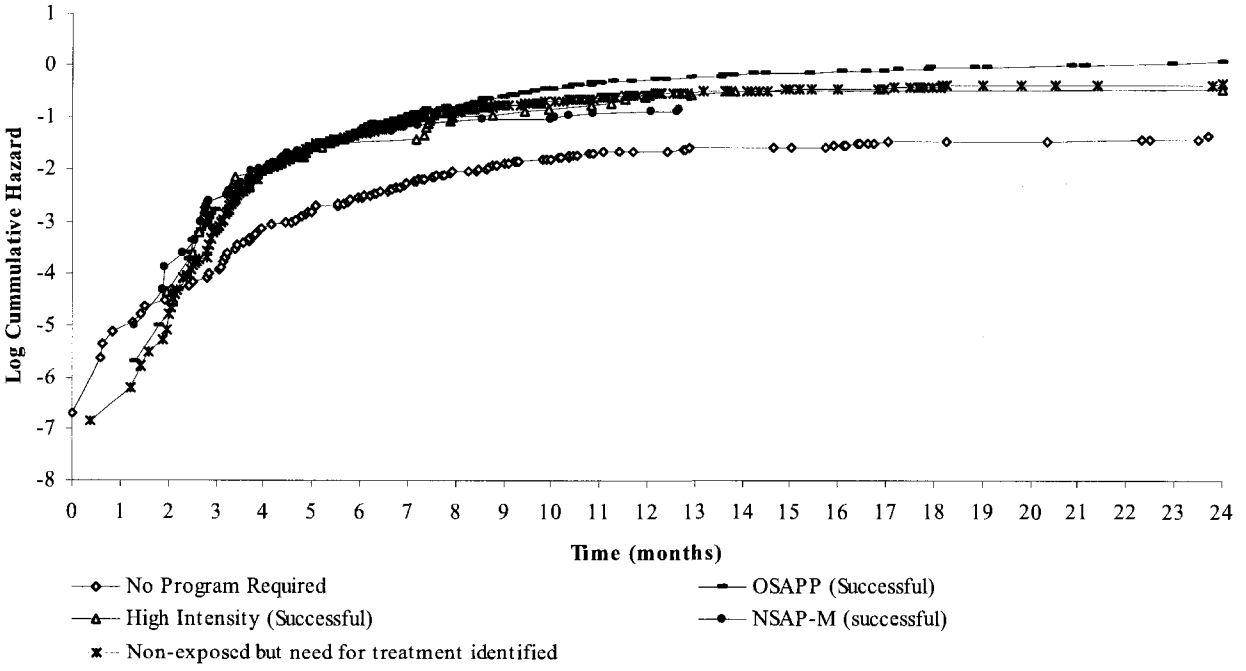
Note. Blanks indicate that estimates were not applicable. Due to differences in the length of follow-up for substance abuse program categories, year of release was included in the initial model to assess for its potential (confounding) effect on other estimates. Although significant, year of release had a negligible impact on other parameter estimates. Therefore, it was not included in the final model. [a]The reference level is the group of offenders with a rating of none on ADS. [b]For the community functioning and associates/social interactions domains the reference category is the rating of considerable. [c]Of the offenders who were not administered the SIR-R1, 91% were of Aboriginal Ancestry. The reference category for the SIR-R1 is the group of offenders identified as very good risk. [d]The hazard ratio estimate and confidence interval compares the hazard of revocation for a psychologically drug dependent offender who was under the age of 27 at the time of release to the hazard for a non-psychologically drug dependent offender who was greater than 26 years of age at the time of release.

The model adequately fits the data, *Goodness of fit* χ^2 (9, N = 1677) = 9.71, p = .37.

Generally, offenders who participated in a substance abuse treatment program had a lower hazard of revocation when compared to the group of offenders who needed a substance abuse program based on their substance abuse need but who did not participate in a program. However, there was some evidence of violation of the assumed proportional hazards for the substance abuse program covariate so the covariate was used as stratification variable for the above noted modelling procedure. Figure 10 presents the log of the covariate-adjusted cumulative hazard function, plotted against time (measured in months). For approximately the first 8 months, the OSAPP-exposed offenders had about the same hazard of revocation as the group of offenders who were identified as requiring a substance abuse program, but who did not participate in a program (non-exposed). After approximately 8 months the cumulative hazard of revocation gradually increased and surpassed the cumulative hazard of that of non-exposed group. In contrast, NSAP-M and high intensity[25] interventions had a slightly higher hazard of revocation compared to the non-exposed group for about the first three months, with a gradual decrease in cumulative hazard to below the level of that of the non-exposed group (see Figure 10). The offenders who did not require a program (i.e., did not have a substance abuse problem and did not participate in a program) had the lowest hazard of revocation compared to all other categories.

[25] Out of the 62 offenders who participated in a high intensity program, the majority (70%) of offenders participated in the current National Substance Abuse Program - High Intensity (NSAP-H), followed by 21% in the former High Intensity Program (HISAP) and approximately 10% in the current Aboriginal Offender Substance Abuse Program (AOSAP).

Figure 10. The Covariate-Adjusted Log Cumulative Hazards Plot for the Substance Abuse Program Covariate



Note. All covariates in the model were set at respective baseline values.

Exposure to a community-based maintenance program also reduced the hazard of revocation. This variable was modelled as a time dependent covariate because exposure to the program did not necessarily occur immediately after release from custody, and the time to exposure varied (Allison, 1995). After accounting for the waiting time to exposure, offenders who participated in the community-based maintenance program had a hazard of revocation that was only 0.40 times that of the group of offenders who did not participate in the maintenance program. It is important to note that of the 204 offenders who were exposed to community maintenance, 60% of them were exposed to the former Community Correctional Brief Treatment, Relapse Prevention and

Maintenance Program (Choices). The remaining offenders were exposed to the current Community Maintenance Program.

The Covariate-Adjusted Total Effects of Psychological Drug Dependence on the Hazard of Revocation (without Substance Abuse Program Exposure)

Table 16 provides the parameter estimates, standard errors, Wald χ^2, p-values and hazard ratios (*HR*) (with confidence intervals) for each significant covariate. With substance abuse program exposures excluded from the model, parameter estimates changed in value for the overall need rating on the OIA, SIR-R1 risk rating, the SDS classification, and the ADS alcohol severity rating. Parameter estimates for other covariates in the model remained virtually unchanged.

With substance abuse programs removed from the model, the hazard ratio comparing offenders who were psychologically drug dependent and over 26 years of age at the time of release to similar age offenders without psychological drug dependence increased from 1.55 to 1.68 (see Tables 15 and 16). Similarly, the hazard ratio comparing offenders with a severe rating on ADS to offenders with a rating of none increased from 1.71 to 1.86. The interaction between age at release and psychological drug dependence produced the same effect as with the previous model. That is, psychological drug dependence increased the hazard of a revocation for offenders 27 years of age or older but not for offenders under the age of 27.

Table 16. Covariate Adjusted Parameter Estimates, Standard Errors (*SE*), Wald χ^2, p-values and Hazard Ratios (*HR*) (With Confidence Intervals) for the SDS Classification of Psychological Drug Dependence (Substance Abuse Program Exposures Removed from the Model)

Covariate	Estimate (*β*)	*SE*	*Wald* χ^2	*p*-value	*HR* for Revocation (95% CI)
SDS Classification					
Psychologically drug dependent	0.52	0.10	28.35	<.0001	1.68 (1.39 - 2.03)
Age Category					
≤26 years of age at release	0.45	0.093	23.83	<.0001	1.57 (1.31 - 1.89)
ADS Severity Level[a]			10.13	<.05	
Low	0.0012	0.08			1.00 (0.85 - 1.17)
Moderate	-0.23	0.17			0.80 (0.58 - 1.10)
Substantial	0.25	0.21			1.29 (0.85 - 1.96)
Severe	0.62	0.25			1.86 (1.14 - 3.05)
Need Domains[b]**:**					
Community Functioning			12.19	<.01	
Asset	-1.23	0.44			0.29 (0.12 - 0.70)
None	-0.62	0.22			0.54 (0.35 - 0.84)
Some	-0.47	0.23			0.62 (0.40 - 0.97)
Associates/Social Interactions			6.47	.10	
Asset	-1.38	0.73			0.25 (0.06 - 1.05)
None	-0.14	0.11			0.87 (0.71 - 1.07)
Some	0.025	0.092			1.03 (0.86 - 1.23)
Overall Need Rating on the OIA:			28.24	<.0001	
Moderate	0.91	0.22			2.48 (1.62 - 3.79)
High	1.13	0.22			3.11 (2.01 - 4.79)
SIR-R1 risk estimate[c]**:**			60.73	<.0001	
Poor risk	0.95	0.14			2.58 (1.98 - 3.37)
Fair/poor risk	0.86	0.14			2.37 (1.79 - 3.14)
Fair risk	0.62	0.15			1.85 (1.39 - 2.46)
Good risk	0.39	0.16			1.48 (1.09 - 2.02)
Not administered SIR-R1	0.92	0.18			2.51 (1.78 - 3.54)
Region					
Ontario	-0.27	0.081	11.47	<.0001	0.76 (0.65 - 0.89)
Interaction[d]					
Psychologically drug dependent & Age	-0.48	0.17	7.96	<.01	1.65 (1.25 - 2.16)

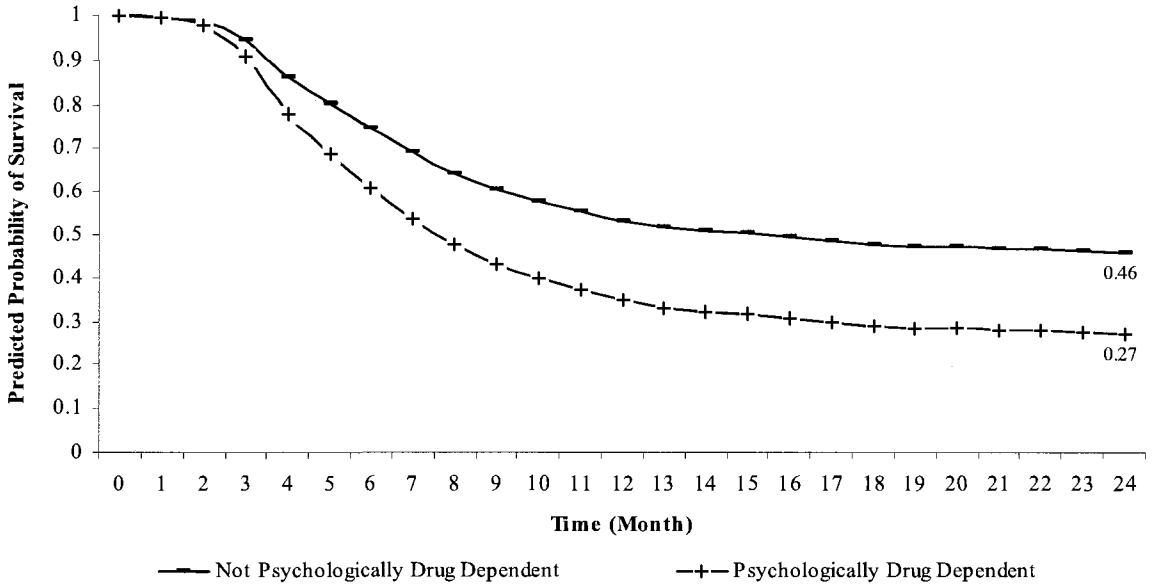
Note. Blanks indicate that estimates were not applicable. [a]The reference level is the group of offenders with a rating of none on ADS. [c]For the community functioning and associates/social interactions domains the reference category is the rating of considerable. [d]Of the offenders who were not administered the SIR-R1, 91% were of Aboriginal Ancestry. The reference category for the SIR-R1 is the group of offenders identified as very good risk. [d]The hazard ratio estimate and confidence interval compares the hazard of revocation for a psychologically drug dependent offender who was under the age of 27 at the time of release to the hazard for a non-psychologically drug dependent offender who was greater than 26 years of age at the time of release.

The model adequately fit the data, *Goodness of fit* χ^2 (9, N = 1677) = 3.94, p = .91.

Adjusted survival curves for the main effects of psychological drug dependence were plotted to supplement the results presented in Table 16. After adjusting for the effects of the other covariates on the hazard of revocation, offenders who were 27 years or older and psychologically drug dependent had an estimated probability of survival of

27% at 24 months (see Figure 11). In contrast, offenders of similar age and characteristics, who did not meet the threshold on the SDS for a classification of psychological drug dependence, had a 46% probability of survival at 24 months.

Figure 11. Adjusted Survival Curves Representing the Estimated Probabilities of Survival for Offenders (>26 years of age) who were Classified by the SDS as Psychological Drug Dependent.



Note. The predicted probability of survival assumes an offender (>26 years of age) from the Atlantic Region who was rated high on overall need, some on the domains of community functioning and associates/social interactions, rated none on the ADS, and rated fair risk on the SIR-R1.

Effects of NSAP-H and NSAP-M on the Hazards of Revocation for the Psychologically Drug Dependent Offenders

The sample of offenders, distributed by program exposure categories and stratified by the SDS classification of psychological drug dependence, is presented in Table 17. The sample was restricted to offenders who were either exposed to NSAP-M, or NSAP-H, or were non-exposed to a substance abuse program. As a result a total of 1433 offenders were available for the analysis.

Table 17. Distribution of Sub-sample of Offenders who were Either Exposed to NSAP-H or NSAP-M, or Non-exposed to a Substance Abuse Treatment Program, stratified by SDS's Classification of Psychological Drug Dependence

Program Exposure Category Stratified by SDS Classification	**Number (%)**
No substance abuse program required (substance abuse was not identified as a problem)	529 (37)
Completed NSAP-H	
Non-psychologically drug dependent	14 (1)
Psychologically drug dependent	29 (2)
Completed NSAP-M	
Non-psychologically drug dependent	72 (5)
Psychologically drug dependent	47 (3)
Required substance abuse program but did not participate	
Non-psychologically drug dependent	531 (37)
Psychologically drug dependent	211 (15)
Total Offenders	1433

The parameter estimates, standard errors, Wald χ^2, p-values and hazard ratios (*HR*) (with confidence intervals) for each significant covariate are presented in Table 18. As with previous models, age at release, need ratings on community functioning and OIA overall need, SIR-R1 risk ratings, region of origin, and program exposure emerged as significant covariates of the outcome. The ADS and associates/social interactions covariates exceeded the $p<.10$ threshold for statistical significance and did not produce a confounding or interacting effect so they were excluded from the final model.

There was support for the main hypothesis. Offenders who were classified as psychologically drug dependent by the SDS and exposed to the NSAP-H intervention had a lower relative hazard of revocation (*HR* = 0.60; 95% *CI*: 0.34 - 1.07; $p < .10$) compared to psychologically drug dependent offenders who required treatment but were not exposed to a substance abuse program (the reference category). In contrast, the NSAP-M intensity program was less protective in terms of mitigating the hazard of a revocation for the psychologically drug dependent offenders. The comparison between

the psychologically drug dependent offenders who were exposed to NSAP-M and the group of offenders from the reference category yielded a hazard ratio of 0.76 (95% *CI*: 0.47 - 1.22; $p = .25$). Although the point estimate of 0.76 suggests a reduction in hazard, the estimate was far from statistically significant. Therefore, the estimate should be interpreted with some caution given the wide confidence interval that includes the *HR* of 1.0. While there was some evidence of a differential treatment effect based on the SDS classification, there was no evidence suggesting that program effectiveness depended on risk of recidivism as measured by the SIR-R1.

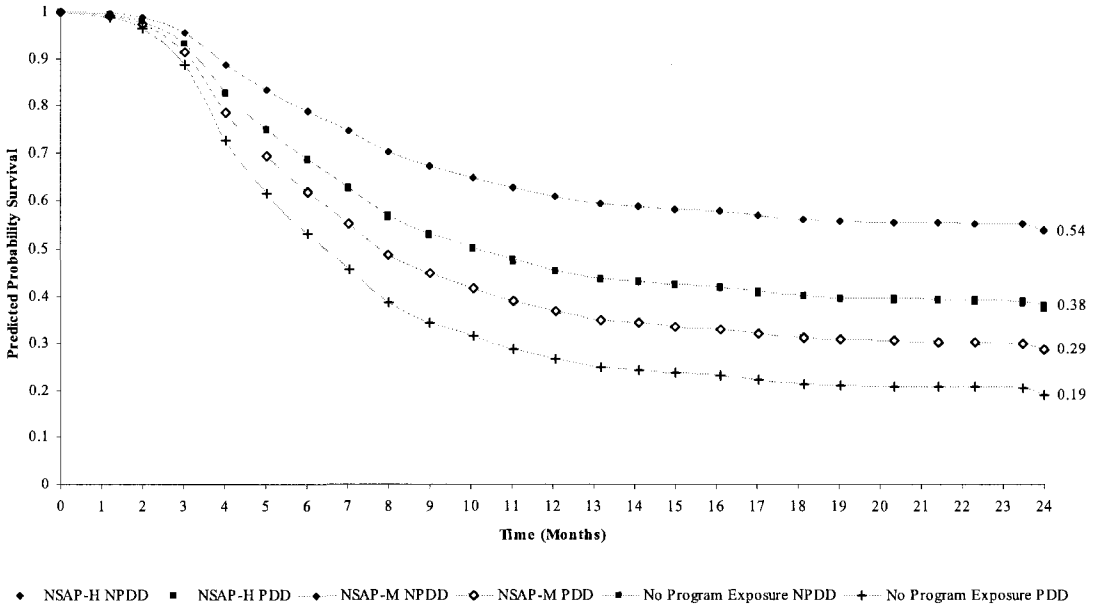
The adjusted survival curves for the relevant comparisons are presented in Figure 12. Psychologically drug dependent offenders who were exposed to NSAP-H had a higher predicted probability of survival ($P = .38$) at 24 months compared to the reference group ($P = .19$). Similarly, psychologically drug dependent offenders who were exposed to NSAP-M had a higher predicted probably of survival ($P = .29$) at 24 months than the reference group; however, the predicted probability was lower than for the psychologically drug dependent offenders who were exposed to NSAP-H. Interestingly, the predicted probability of survival for the non-psychologically drug dependent offenders who were exposed to NSAP-H was approximately the same as for those exposed to NSAP-M. The same was true for the group of psychologically drug dependent offenders who were exposed to NSAP-H and the non-psychologically drug dependent offenders who required treatment but were not exposed to a substance abuse program prior to release.

Table 18. Covariate Adjusted Parameter Estimates, Standard Errors (*SE*), Wald χ^2, p-values and Hazard Ratios (*HR*) (With Confidence Intervals) for the Sub-sample of Offender who were Either Exposed to NSAP-H, NSAP-M or Non-exposed to a Substance Abuse Program

Covariate	Estimate (β)	*SE*	*Wald* χ^2	*p*-value	*HR* for Revocation (95% CI)
Program Exposure Category[a]			31.36	<.01	
No substance abuse program required (substance abuse not a problem)	-0.70	0.14			0.50 (0.38 - 0.66)
Completed NSAP-H					
Not psychologically drug dependent	-0.98	0.46			0.37 (0.15 – 0.92)
Psychologically Drug Dependent	-0.51	0.29			0.60 (0.34 - 1.07)
Completed NSAP-M					
Not psychologically drug dependent	-0.98	0.23			0.37 (0.24 - 0.59)
Psychologically Drug Dependent	-0.28	0.24			0.76 (0.47 - 1.22)
Non-exposed, required program but was not psychologically drug dependent	-0.52	0.13			0.59 (0.46 - 0.77)
Age Category[b]					
≤26 years of age at release	0.54	0.10	31.10	<.0001	1.72 (1.42 – 2.08)
Need Domain[c]**:**					
Community Functioning			14.70	<.05	
Asset	-1.76	0.56			0.17 (0.06 - 0.52)
None	-0.69	0.23			0.56 (0.32 - 0.79)
Some	-0.51	0.24			0.60 (0.38 - 1.97)
Overall Need Rating on the OIA[d]			19.76	<.0001	
Moderate	0.82	0.22			2.27 (1.46 - 3.52)
High	1.00	0.23			2.73 (1.74 - 4.27)
SIR-R1 risk estimate[e]			59.95	<.0001	
Poor risk	1.10	0.16			3.01 (2.20 - 4.12)
Fair/poor risk	1.07	0.17			2.92 (2.10 - 4.05)
Fair risk	0.84	0.17			2.32 (1.67 - 3.24)
Good risk	0.56	0.18			1.75 (1.23 - 2.50)
Not administered SIR-R1	1.22	0.20			3.90 (2.82 - 5.03)
Region					
Ontario	-0.27	0.09	9.13	<.01	0.77 (0.65 - 0.91)
Interaction[f]					
Psychologically drug dependent & age	-0.75	0.20	13.80	<.001	-

Note. Dashes indicate that parameters were not estimated. Blanks indicate that estimates were not applicable. [a]The reference level is the group of offenders who were classified as psychologically drug dependent by the SDS, but who did not did not participate in a substance abuse program. [b] The reference level is the group of offenders who were 26 years of age or younger at the time of release and not psychologically drug dependent. [c] For the community functioning domain the reference category is the rating of considerable. [d]The reference category is the group of offenders with a rating of low. [e]Of the offenders who were not administered the SIR-R1, 91% were of Aboriginal Ancestry. The reference category for the SIR-R1 is the group of offenders rated very good risk. [f]The *HR* estimate is not provided because the effect of drug dependence depended on the level of program exposure. The *HR* parameter estimate for the interaction between age and psychological drug dependence is provided in Table 15.
The model adequately fits the data, *Goodness of fit* χ^2 (9, N = 1433) = 9.09, p = .43.

Figure 12. The Covariate-Adjusted Predicted Probabilities of Survival for Psychologically Drug Dependent Offenders who Participated in the NSAP-H or NSAP-M Interventions, and for the Psychologically Drug Dependent Offender who were not Exposed to a Substance Abuse Program Prior to Release from Custody.



Note. Predicted probabilities assume an offender from the Atlantic Region who was at least 27 years of age at release. The offender was rated high overall need and rated some need on the domain of community functioning, with a fair risk rating on the SIR-R1. PDD= Psychologically Drug Dependent. NPDD= Not Psychologically Drug Dependent. The two "no program exposure" groups are comprised of offenders who should have received substance abuse programming based on the OIA rating on the substance abuse domain, but did not.

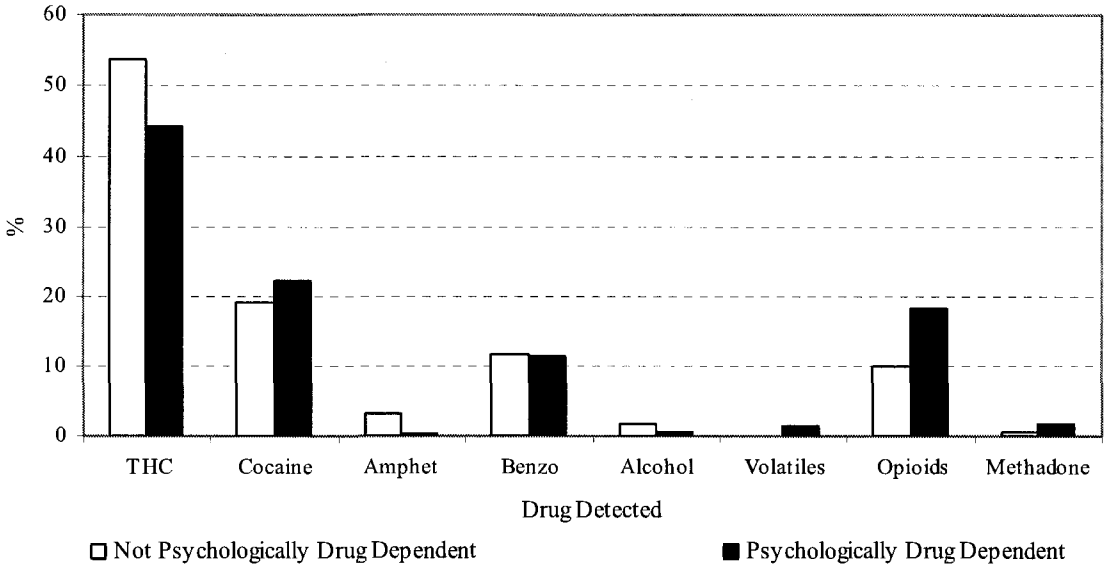
Model Diagnostics

The three preceding models were assessed for violations to the proportional hazards assumption. Apart from the Substance Abuse Program covariate (see Figure 10) no serious departures from the assumption were observed for any of the other covariates. A number of potentially influential observations were identified. However, their collective impact on the parameter estimates did not bias the results away from the null.

4.6 SDS as a Covariate of Relapse to Substance Use

A total of 968 offenders (58%) from the release cohort were administered a total of 5953 community-based urinalysis tests during the follow-up period. Offenders classified as psychologically drug dependent were tested an average of 6.5 times (Median [*Mdn*] = 4.0; *SD* = 7.3) during the follow-up period compared to an average of 5.9 times (*Mdn* = 4.0; *SD* = 7.0) for the offenders who were not classified as such. Of the total number of urinalysis tests, 1255 (21.1%) produced positive results for drugs. Marijuana (and its derivates) (THC) was the drug that was most often detected (49.9%), followed by cocaine (20.4%), opioids (13.5%), benzodiazepines (11.5%), amphetamines (2.0%), alcohol (1.3%), methadone (1.0%) and volatiles (0.6%). Figure 13 shows the distribution of drugs that were detected, stratified by the SDS classification of psychological drug dependence. Offenders who were classified as psychologically drug dependent by the SDS were less likely to produce a positive test result for THC when compared to the other group, but more likely to produce positive results for cocaine, opioids, volatiles, and methadone (see Figure 13).

Figure 13. Types of Drugs Found Stratified by the SDS Classification of Psychological Drug Dependence



Note. THC= Marijuana and its derivatives. Amphet=Amphetamines. Benzo=Benzodiazepines. Pearson's χ^2 (7, N = 1255) = 50.02, p < .0001, V = .20

Table 19 provides descriptive information relating to: the proportion of offenders who tested positive for substances of abuse; the proportion of positive tests; the mean and median number of positive and negative test results; the mean and median number of days to first positive test; the proportion of offenders who were administered a urinalysis test; and the mean and median days at risk distributed across selected covariates that were retained by the final model. The mean days at risk was defined as the period of time between release from custody, re-admission, warrant expiry or the end of the study period (defined as January 1, 2008), whichever came first. All measures of association between individual covariates and the outcome in Table 19 are unadjusted for the effects of other covariates. To summarize, a larger proportion of offenders who were classified as psychologically drug dependent by the SDS produced a positive test result compared to the group of offenders who were not classified as such. As the need

ratings on the domains of associates/social interactions and attitude reflected a greater need for intervention, the proportion of offenders who tested positive increased. The same trend was observed for the SIR-R1 risk rating, with poorer risk offenders more likely to produce a positive urinalysis result. Generally, the median number of days to the first positive result decreased as need ratings for the domains of associates/social interactions and community functioning suggested a higher need for intervention, and the SIR-R1 risk rating indicated a poorer risk. Similarly, offenders who were classified as psychologically drug dependent tested positive earlier than offenders who were not classified as such.

The proportion of offenders from the release cohort who were tested varied considerably across covariate categories (see Table 19). Recall, that as part of the supervision process, CSC relies on urinalysis testing to monitor released offenders and to deter drug use if/when there is reason to believe that an offender is at risk of using substances of abuse. Accordingly, a greater proportion of higher risk, higher need offenders from the release cohort were tested to monitor and deter drug use. To be specific, fewer offenders who received a rating of asset on either of the need domains were tested compared to offenders with ratings of none, some or considerable. Similarly, fewer offenders from the release cohort with a very good risk rating on the SIR-R1 were tested compared to the higher risk categories. Of the offenders from the release cohort who were classified as psychologically drug dependent, the majority were tested; whereas, only half of the offenders who were not classified as such were tested.

Table 19. Proportion of Offenders who Produced a Positive Urinalysis Result, Proportion of Total Tests that Produced a Positive Urinalysis Result, *M (Mdn)* Number of Positive Tests, Negative Tests, Days to First Positive Test and Days to First Test, Proportion of Release Cohort that was Tested and the *M (Mdn)* Days at Risk for those who were Tested while on Community Supervision ($N = 968$)

Covariates	Proportion of Release Cohort Tested	Tested Positive %	Positive Tests %	Number Positive Tests *M (Mdn)*	Number Negative Tests *M (Mdn)*	Days to First Positive *M (Mdn)*	Days to First Test *M (Mdn)*	Days at Risk *M (Mdn)*
Region								
Ontario	52.2	48.7	17.5	0.9 (0.0)	4.3 (3.0)	105 (56)	71 (33)	312 (248)
Atlantic	63.4	61.7	24.2	1.7 (1.0)	5.4 (2.0)	81 (39)	77 (29)	324 (253)
Need Domains								
Associates/Social Interactions								
Asset	32.9	34.8	14.8	0.8 (0.0)	4.7 (3.0)	112 (112)	111 (17)	500 (547)
None	57.8	55.6	21.3	1.3 (0.0)	4.8 (3.0)	96 (49)	73 (28)	323 (257)
Some	64.0	51.9	20.9	1.1 (0.0)	4.3 (3.0)	96 (52)	77 (34)	320 (251)
Considerable	60.0	66.7	22.5	1.5 (0.0)	5.2 (1.5)	83 (35)	71 (28)	305 (245)
Attitude								
Asset	37.5	50.0	7.5	0.8 (0.5)	9.3 (4.5)	92 (99)	58 (44)	517 (339)
None	54.0	51.4	19.4	1.3 (1.0)	5.5 (3.0)	98 (50)	80 (32)	351 (288)
Some	58.7	56.5	22.8	1.3 (1.0)	4.5 (3.0)	103 (57)	83 (35)	320 (246)
Considerable	64.0	57.0	22.8	1.2 (1.0)	4.2 (2.0)	73 (36)	58 (28)	264 (244)
SIR-R 1 Risk Estimate								
Poor risk	69.6	63.0	27.4	1.5 (1.0)	3.9 (2.0)	79 (40)	66 (29)	269 (240)
Fair/poor risk	72.4	52.8	21.3	1.1 (1.0)	4.2 (2.0)	81 (40)	62 (30)	276 (222)
Fair risk	62.6	62.2	23.7	1.5 (1.0)	5.0 (3.0)	82 (40)	69 (32)	309 (246)
Good risk	59.2	46.0	17.3	1.2 (0.0)	5.9 (3.0)	99 (59)	84 (29)	359 (286)
Very good risk	34.4	40.7	12.8	1.0 (0.0)	6.9 (4.0)	171 (146)	109 (45)	463 (428)
Not administered	58.1	52.5	22.3	1.1 (1.0)	3.8 (2.0)	81 (29)	67 (26)	264 (238)
SDS Psychological Drug Dependence								
No	49.7	49.6	20.0	1.2 (0.0)	4.8 (3.0)	98 (54)	79 (32)	332 (257)
Yes	82.6	64.1	22.9	1.5 (1.0)	5.0 (2.0)	85 (37)	67 (29)	294 (244)

Through backward, forward and manual selection methods, a total of eight variables were retained by the final model which examined the hazard of testing positive. The significant covariates included region of origin, the number of negative tests since the last positive result (or since release if there were no positive results) and

the number of positive test results since release from custody, ratings on the domains of Associations/Social Interactions and Attitude, the SIR-R1 risk rating, exposure to the community maintenance program (CMP), and the SDS-derived classification of psychological drug dependence. Exposure to institutionally-based substance abuse programs, age at release, ratings on the other five OIA domains, and alcohol severity as measured by the Alcohol Dependence Scale (ADS) were not predictive of relapses (i.e., testing positive). These covariates exceeded the $p<.10$ threshold for statistical significance and they did not produce a confounding or interacting effect with other covariates in the model so they were excluded from the final model.

The parameter estimates, robust standard errors, Wald χ^2, p-values and hazard ratios (*HR*) (with confidence intervals) for each significant covariate from a multiple PWP Cox regression model, stratified by the number of positive urinalysis tests, are presented in Table 20. There was support for the main hypothesis that offenders who were classified as psychologically drug dependent had a higher hazard of producing a positive urinalysis result than the offenders who were not classified as such. However, this effect was only present among offenders who were not exposed to CMP. Among such offenders, those who were classified as psychologically drug dependent had a hazard of testing positive that was 1.27 times higher than for the offenders who did not exceed the threshold on the SDS for the classification. Among offenders who were exposed to CMP, there was no indication of a substantive difference between psychologically drug dependent and non-psychologically drug dependent offenders, (LRT $\chi^2 = .37, p = .54$)

Table 20. Covariate Adjusted Parameter Estimates, Robust Standard Errors (*SE*), Wald χ^2, p-values and Hazard Ratios (*HR*) (With Confidence Intervals) for the SDS Classification of Psychological Drug Dependence and each Significant Covariate of the Hazard of a Positive Urinalysis Result, Stratified by the Number of Positive Test Results

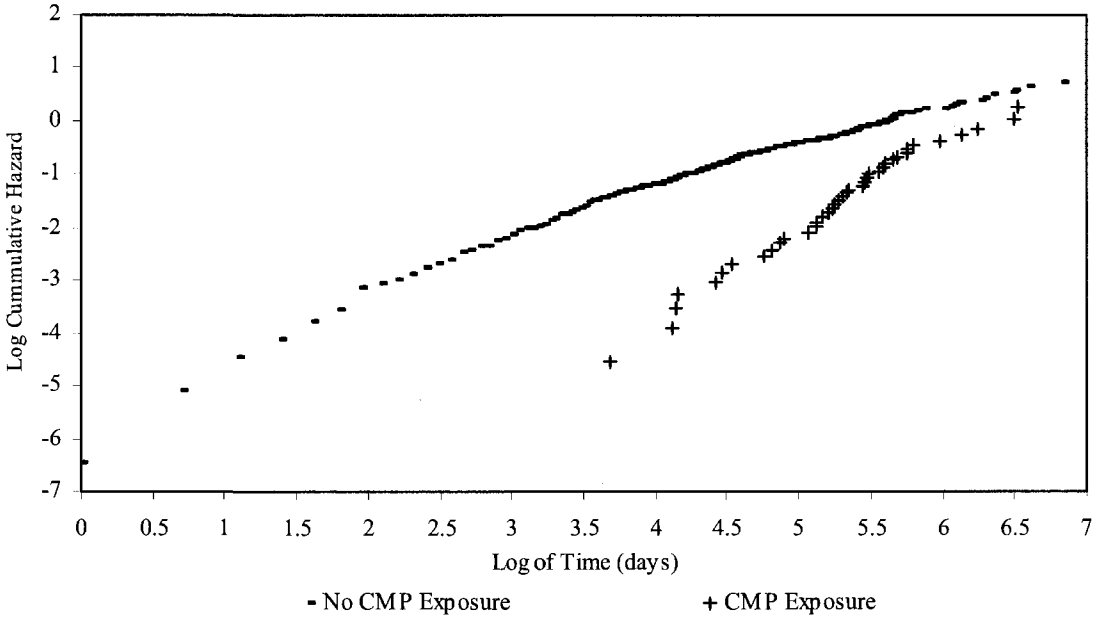
Covariate	Estimate (β)	Robust *SE*	*Wald* χ^2	*p*-value	*HR* for Positive (95% CI)
Region			88.01	<.0001	
Ontario	-0.62	0.07			0.54 (0.47 - 0.61)
Number of Negative Urinalysis Test Results	-0.058	0.01	23.66	<.0001	0.94 (0.92 - 0.97)
Need Domains[a]:					
Associates/Social Interactions			9.50	<.05	
Asset	-1.37	1.03			0.25 (0.03 - 1.92)
Some	0.20	0.08			1.23 (1.06 - 1.43)
Considerable	0.18	0.09			1.20 (1.00 - 1.43)
Attitude			10.15	<.05	
Asset	-0.15	0.24			0.86 (0.53 - 1.39)
Some	0.19	0.08			1.20 (1.04 - 1.40)
Considerable	0.24	0.08			1.27 (1.08 - 1.49)
SIR-R1 risk estimate[c]:			19.64	<.01	
Fair/poor risk	-0.17	0.10			0.84 (0.70 - 1.02)
Fair risk	-0.03	0.09			0.97 (0.82 - 1.15)
Good risk	-0.26	0.11			0.77 (0.62 - 0.95)
Very good risk	-0.41	0.11			0.66 (0.54 - 0.82)
Not administered SIR-R1	-0.19	0.14			0.83 (0.62 - 1.09)
Community Maintenance Program (CMP)			16.62	<.0001	
Completed program	-0.62	0.15			-
Interactions					
Psychologically drug dependent & CMP	0.24	0.20	13.11	<.001	1.27 (1.12 - 1.45)
CMP * Time	0.0026	0.0007	14.59	<.001	-

Note . Dashes indicate that paramcters were not estimated. Blanks indicate that estimates were not applicable. [a]For the community functioning and associates/social interactions domains the reference category is the rating of none. [c]Of the offenders who were not administered the SIR-R1, 91% were of Aboriginal Ancestry. The reference category for the SIR-R1 is the group of offenders identified as poor risk.

Exposure to the community maintenance program (CMP) reduced the hazard for a positive urinalysis result and its effect was time dependent. The covariate-adjusted proportional hazards diagnostic plot (see Figure 14) shows that for the first 164 days [ln(time) $\approx$ 5.10)] CMP was most protective in terms of reducing the rate of positive urinalysis results. As the time since CMP exposure extended beyond 164 days, the program was less protective. From about day 164 to day 245 [ln(time) $\approx$ 5.5), the

cumulative hazard representing the group of offenders who were exposed to CMP gradually increased to the same level as for the group of offenders who were not exposed to CMP. Therefore, it was necessary to create an interaction between CMP and time (defined as the time since CMP exposure) so that the parameter estimates would reflect the time dependent effects of CMP on the hazard of a positive urinalysis result. As shown in Table 20, the parameter estimate for the interaction between CMP and time indicated that by the 238th day (- 0.62/0.0026) after CMP exposure, offenders who were exposed to CMP had the same hazard rate as the offenders who were never exposed to the program.

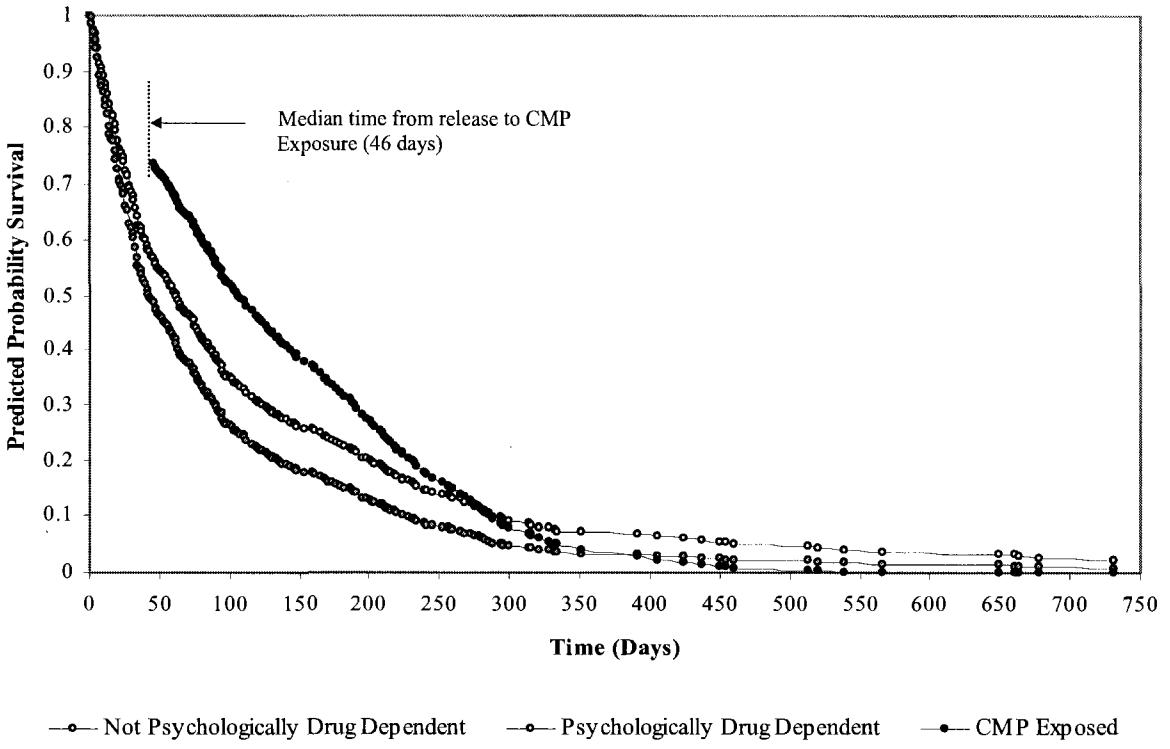
Figure 14. The Covariate-Adjusted Log Cumulative Hazard for the Community Maintenance Program Illustrating the Time Varying Effect of CMP on the Hazard for a Positive Urinalysis Result



Note. All covariates in the model were set at respective baseline values. Plot was restricted to observations from the first stratum for the number of positives (i.e., positives ≤ 1)

CMP's time varying effect also interacted with the SDS classification of psychological drug dependence. Of the group of offenders who were never exposed to CMP, those who were classified as psychologically drug dependent were more likely to test positive than offenders who were not classified as such. In contrast, offenders who were exposed to CMP had a lower hazard of testing positive compared to both groups of offenders who were never exposed, irrespective of psychological drug dependence. Figure 15 shows the adjusted survival curves for the SDS classification of psychological drug dependence and the effects of CMP exposure. Offenders exposed to CMP had a higher probability of survival (i.e., not testing positive), than either of the other two groups who were never exposed to CMP. Only a single curve is shown following CMP exposure because there were no significant differences between the two SDS groups after CMP exposure. The protective effect of CMP degraded over time, however. By approximately the 238th day after exposure to CMP commenced, CMP-exposed offenders were just as likely to test positive as the offenders who were never exposed. Two additional plots, for the second and third strata (i.e., time to event after the second positive and third positive test result, respectively), are presented in Appendix E. By the third stratum the offenders who were not classified as psychologically drug dependent were about as likely to test positive as the offenders classified as psychologically drug dependent; and the rate of testing positive was higher than for the second and first strata.

Figure 15. The Covariate-Adjusted Predicted Probabilities of Not Producing a Positive Urinalysis Result During Release for the Psychologically Drug Dependent, Not-Psychologically Drug Dependent Offenders and the group of Offenders who were Exposed to CMP (Time to first positive test)



Note. All covariates in the model were set at median values. Predicted CMP-exposed probabilities assume an offender from the Ontario Region who started CMP 46 days after release from custody. The offender was rated some need on the domains of associates/social interactions and attitude, with a fair risk rating on the SIR-R1 and no negative tests since last positive result. Observations were restricted to the first stratum (number of positives ≤ 1).

In addition to the SDS classification of psychological drug dependence and CMP exposure, the domains of Associations/Social Interactions and attitude were also predictive of testing positive (see Table 20). Offenders who were rated as requiring some or considerable intervention within the domains of Associations/Social Interactions and attitude were more likely to test positive than offenders who were rated as requiring no intervention within the domains. The point estimates for the asset rating on both domains suggested a lower hazard of producing a positive test result; however,

very few offenders received a rating of asset on either of the two domains so the robust standard errors were quite large for both parameter estimates which resulted in confidence intervals for the point estimates that were quite wide and included a *HR* value of 1.0 (see Table 20). The estimates for the asset ratings on both domains should be interpreted with some caution. The SIR-R1 risk estimate was also predictive of positive urinalysis results. Specifically, offenders rated as good to very good risk had lower hazards of testing positive than offenders with a rating of poor risk. Offenders with a fair rating and offenders who were not administered the SIR-R1 (of whom 91% are of Aboriginal ancestry) were just as likely to test positive as the group of offenders rated as poor risk. The number of negative tests that an offender produced also predicted a positive test. That is, for each negative test result that an offender produced (since the last positive result or since release if there were no positive results), the hazard of producing a positive result on a subsequent test decreased by approximately 6%. Additionally, offenders from the Ontario Region had a lower hazard of testing positive than offenders from the Atlantic Region

Model Diagnostics

The model was assessed for violations to the proportional hazards assumption. Apart from the Community Maintenance Program covariate (see Figure 14) no serious departures from the assumption were observed for any of the other covariates. The linearity assumption for the number of negative test was assessed and found to be linearly related to the outcome so it was modelled as a continuous variable. All possible two way interactions between significant covariates were assessed.

Chapter 5: Discussion

The theoretical framework that guided this thesis study was based on the general personality and social psychological theory of criminal behaviour. The theory holds that the probability of a criminal act increases with an increase in the density of rewards and decreases as the costs that are associated with a criminal act increase (Andrews & Bonta, 2006). The process is mediated through personal and interpersonal controls, such as criminal sentiments, personality characteristics, behavioural history, and anti-social peer influences (considered the "big four" predictors of recidivism) and is potentially influenced by other indicators within the major life domains (criminogenic need areas) of family, education, employment, community functioning, leisure activities and substance abuse (Andrews & Bonta, 2006, p. 75). Generally, the more deficits in a given criminogenic need area, the greater the likelihood of recidivism and the greater the need for intervention and treatment (Brown & Motiuk, 2005).

This thesis study focussed on the criminogenic need area of substance abuse. The general aim was to assess the clinical utility of the Severity of Dependence Scale (SDS) (Gossop et. al, 1995) as a measure of psychological drug dependence in a population of male offenders. It was anticipated that further case differentiation within the criminogenic need area would uncover additional offender characteristics useful for client-treatment matching, and provide additional information concerning the link between psychological drug dependence, the deficits within other domains of an offender's life, and community-based outcomes.

The study's methodology was consistent with recent developments in the area of assessment and measurement which have focussed on the possibility of incorporating categorical and dimensional approaches to classifying substance abuse problems (Helzer et al., 2006; Muthén, 2006). With this approach, the dimensional components (i.e., the individual covariates) are directly linked to the categorical definition (i.e., SDS-derived classification of psychological drug dependence), which allows for further case differentiation within a classification category (Helzer et al., 2006). This approach necessarily involves the application of multivariable statistical models to identify the multidimensional factors (e.g., individual characteristics, contextual characteristics) that are linked to the classification, while at the same time adjusting for the associations between other offender characteristics and the classification (Compton et al., 2005). Accordingly, the study design included a number of logistic and Cox proportional hazards models to a) assess the clinical utility of SDS as a classification instrument for psychological drug dependence and client-treatment matching; b) uncover the important covariates of psychological drug dependence as measured by the SDS and c) determine if the SDS classification was able to predict community-based outcomes, such as revocations and relapse to substance use.

The results confirmed that the SDS classification of psychological drug dependence identified an important criminogenic need that requires intensive treatment services and community aftercare to reduce the risk of revocation and relapse to substance abuse. The findings that follow generally supported the main hypotheses that were proposed:

1. Offenders who exceeded the threshold on the SDS for a classification of psychological drug dependence were more likely than offenders who did not exceed the threshold (comparison group) to experience deficits in a number of life domains that are known to be associated with criminal activity. Therefore, there was evidence in support of the SDS's construct validity.

2. Psychologically drug dependent offenders were more likely to identify negative life circumstances as triggering their drug use. In contrast, offenders from the comparison group were more likely to identify positive life circumstances as precipitating their drug use. Of all the triggers of drug use, an offender's need to manage withdrawal symptoms emerged as the strongest covariate of psychological drug dependence. The associations between negative life circumstances, withdrawal symptoms and the SDS classification provided additional evidence in support of the instrument's construct validity.

3. The SDS classification of psychological drug dependence was predictive of community-based outcomes which provided additional evidence in support of SDS's predictive validity. Offenders who were classified as psychologically drug dependent by the SDS and released to the community were revoked at a higher rate over a 24-month period of follow-up than the comparison group. However, the hazard of revocation for both groups of offenders was reduced by exposure to the institutionally-based National Substance Abuse Program (NSAP) high intensity intervention. While the NSAP moderate intensity intervention reduced the hazard of revocation for the offenders who were not classified as psychologically drug dependent, it only had a

minimal effect on the hazard of revocation for the psychologically drug dependent offenders that was far from statistically significant.

4. The SDS classification of psychological drug dependence was also predictive of relapse to substance abuse which provided additional support for the instrument's predictive validity. The group of offenders who were classified by the SDS as psychologically drug dependent produced positive urinalysis results at a higher rate over the 24 month period of follow-up than the comparison group; however, exposure to a community-based aftercare program reduced the hazard of testing positive.

The discussion that follows will be divided into six sections. The first section delves into the psychometric properties of the SDS and the DAST reference standard, the dimensional relationship between the two instruments, and the optimal threshold score on the SDS for a classification of psychological drug dependence. The second section focuses on the dimensional characteristics of the offenders who exceeded the threshold score on the SDS for a classification of psychological drug dependence. The third section discusses the important link between psychological drug dependence, exposure to substance abuse treatment programs and post-release outcomes, with specific reference to the potential impact of client-treatment mismatching on the rates of revocation. The fourth section discusses the SDS's ability to predict post-release rates of relapse to substance abuse. The fifth section will consider some of the study's limitations and future research possibilities in this area, and the final section recommends a research dissemination plan that may facilitate the uptake of this research.

The Properties of the DAST and SDS

The results indicated that the DAST reference standard and the SDS were reliable. High inter-item correlations and item-total correlations were observed for both scales, which resulted in Cronbach's coefficient alpha values of .90 for the DAST and .91 for the SDS. These results are consistent with previous findings from research studies that have examined the properties of both instruments (Yudko et al., 2007; Gossop et al., 1995). With this sample of offenders, much of the variation that was observed in the DAST and SDS was due to the true score rather than differences caused by other factors, such as error (DeVellis, 1991). The findings confirmed that the DAST and SDS maintain a high level of measurement accuracy when administered (by computer) to an offender population within a correctional context.

While it cannot be said that all instruments that are highly internally consistent necessarily measure a single construct or dimension, it can be argued that instruments that purport to measure a single construct or dimension ought to have a high degree of internal consistency (Cortina, 1993; Nunnally & Bernstein, 1994). Although this research did not specifically assess dimensionality, other research has confirmed the unidimensional nature of both instruments (Gossop, et al., 1995; Skinner, 1982). Still, this research did examine a somewhat related concept to dimensionality through a multivariate method called canonical correlation analysis (Tabachnik & Fidell, 2001). The method essentially investigates the degree to which linear combinations of items from one instrument correlate with linear combinations of items from another instrument to form unique pair(s) of canonical variate(s). The pair(s) of canonical variate(s) can be thought of as superordinate or latent construct(s) (Tabachnik & Fidell, 2001). The

canonical correlation analysis revealed linear combinations of DAST and SDS items that were highly correlated ($r = .85$) along a single dimension or construct. The majority of the variance that was captured by the DAST and SDS was captured by items that comprised the first canonical variate for each instrument. The items with the highest loadings (i.e., with the greatest amount of explained overlapping variance) dealt with the compulsive nature of drug use, drug withdrawal symptoms, drug-related interpersonal problems, employment difficulties, and illegal activities precipitated by the need to acquire drugs. Interestingly, the item composition for the first canonical variate closely approximated the dependence syndrome as defined by the *DSM-IV* (American Psychiatric Association, 2004). The item loadings not only reflected the central feature of drug dependence within the syndrome - namely, the psychological component (e.g., compulsiveness as measured by the SDS) - the item loadings also revealed the important interpersonal, employment-related and physiological components of dependence as measured by the DAST and the link between dependence and crime (e.g., engaging in illegal activities to obtain drugs).

The strong canonical correlation between linear combinations of DAST and SDS items, along a single dimension, was also important for the purposes of establishing a SDS-derived classification of psychological drug dependence. Since DAST was used as the reference standard to estimate the optimal SDS cut-off score for a classification of psychological drug dependence, it was important to demonstrate how linear combinations of items from the two instruments converged to describe a unidimensional construct that approximated the central features of drug dependence. These findings, coupled with previous research on the DAST and over 15 years of clinical application

within Correctional Service Canada (CSC), provided additional support for DAST as a suitable reference standard for the SDS (Gavin et al., 1989; Kunic & Grant, 2005; Robinson et al., 1991; Vanderburg, Weekes & Millson, 1994; Weekes, Vanderburg & Millson, 1995).

The results from the Receiver Operating Characteristics (ROC) analysis further underscored the strong relationship between DAST's classification of drug dependence and the SDS. The ROC curve, which represented the range of SDS cut-off scores, had an area under the curve (AUC) of .94. The large AUC indicated a high degree of accuracy in terms of the SDS's ability to correctly classify offenders who were considered depended on drugs by the DAST. The large AUC also confirmed the strong association between psychological drug dependence (i.e., compulsive use of drugs) and the drug dependence syndrome, which may be important for service delivery (Gossop et al., 1995; Swift, Copeland & Hall, 1998). Intervention services will not only have to target the physiological, interpersonal and behavioural components of dependence, services will also have to address the psychological dimensions that are so closely associated with the components of dependence.

The cut-off value of ≥ 6 on the SDS produced the best trade-off between sensitivity (detecting true positives for psychological drug dependence) and specificity (ability to rule out false positives). At this cut-off the difference in sensitivity and specificity was at its lowest when compared to the other cut-offs within the optimal range of scores. Although there were other potential cut-offs within the optimal range, the ≥ 6 cut-off was deemed most appropriate because it minimized the overall number of

classification errors while maximizing the observed agreement between SDS and DAST. The choice of cut-off value on the SDS was an objective one; however, one could adjust the cut-off to increase the sensitivity of the SDS (by lowering the cut-off score) in situations where the risks associated with producing false negatives (misclassifying the respondent as not being psychologically drug dependent) outweigh the risks of producing false positives (misclassifying the respondent as being psychologically drug dependent) (Maruish, 2003; McNeece & DiNitto, 1998).

Using the ≥6 cut-off value, the majority of the offenders who used crack cocaine, heroin, opioids, cocaine and amphetamines would have been classified by SDS as psychologically dependent on drugs. In contrast, less than 15% of the offenders who reported marijuana as their drug of choice exceeded the cut-off for the classification. These findings are not surprising since opioids, cocaine and crack cocaine have long been considered highly addictive because of their biochemical mechanisms of action and their behavioural and physical effects on the user (Nutt, King, Saulsbury & Blakemore, 2007; WHO, 2004). In a correctional context, offenders who use these drugs will require intensive programming and community aftercare to mitigate the drug-related health risks, and address the psycho-social and behavioural problems associated with the intractable nature of dependence on these classes of drugs (Burdon, Dang, Prendergast, Messina & Farabee, 2007; Hubbard, Craddock & Anderson, 2003; Nutt et al., 2007; WHO, 2007).

The Dimensions of Psychological Drug Dependence

The association between psychological drug dependence as assessed by the SDS and the established criterion, namely the drug-related indicators within the substance abuse domain of the OIA (Brown and Motiuk, 2005), provided additional evidence in support of SDS's criterion-related validity. Significant, covariate-adjusted associations between the SDS-derived classification of psychological drug dependence, the overall rating for the substance abuse domain and indicators within the domain confirmed SDS's criterion-related validity and clinical utility.

Out of all of the OIA indicators within the seven domains, the drug-specific indicators within the domain of substance abuse were the strongest covariates of psychological drug dependence. Offenders who were classified as psychologically drug dependent were significantly less likely than the comparison group to fit the profile of an alcohol user, and significantly more likely to use drugs regularly, abuse drugs and binge use. Their pattern of drug use resulted in employment difficulties, interpersonal problems, law violations and physical health problems. Of particular importance from a service delivery perspective is that offenders who were classified by SDS as psychologically drug dependent were over three times more likely than the comparison group to be rated by the OIA substance abuse domain as requiring considerable intervention in the area of substance abuse. In terms of proportions, close to 90% of the psychologically drug dependent offenders were identified by the substance abuse domain of the OIA as requiring considerable services to address their substance abuse needs, while only 30% of the comparison group were identified for such services.

For the majority of offenders with the classification of psychological drug dependence, treatment services will need to be of sufficient breadth and length to effectively respond to the compulsive nature of drug use and the related criminogenic, social, behavioural and physiological dimensions that are associated with the classification. This view is supported by the principles of effective correctional treatment, which argue that offenders who present with higher needs that are associated with criminal behaviour should be matched to more intensive and extensive services so that the probability of recidivism is diminished (Andrews & Bonta, 2006). Moreover, from a public health perspective, psychologically drug dependent individuals will need intensive services to mitigate the risk of relapse to substance abuse and chronic disease (WHO, 2008).

The covariates within the substance abuse domain were the strongest in terms of their ability to predict variability in psychological drug dependence. Nevertheless, age at assessment and other covariates within the domains of education/employment, marital/family, and personal/emotional were also associated with psychological drug dependence within the full model (which examined indicators across all seven life domains). The relationship between age at assessment and psychological drug dependence was curvilinear, with the highest predicted probability of psychological drug dependence occurring at age 39. Additionally, evidence of poor coping, at least one job termination, reciprocal spousal abuse, and current hospitalized for a mental health problem were positively associated with psychological drug dependence. Interestingly, offenders classified as psychologically drug dependent were less likely to be narrow and rigid in their thinking. Their ability to accept new ideas and perspectives may prove

beneficial for a treatment process that relies on cognitive-behavioural approaches, within a group setting, to effect changes in the individual. This ability may allow the psychologically drug dependent offender to more willingly acquire/abstract rehabilitative information from treatment services and contribute to the treatment process.

While the full model, and the model examining the covariates within the substance abuse domain were the most informative in terms of explaining variability in psychological drug dependence, the six models examining the associations between indicators and psychological drug dependence within the individual domains of employment/education, marital/family, associates/social interactions, personal/emotional orientation, community functioning and attitude were also informative. The individual models and the significant unconditional associations between individual domain indictors and psychological drug dependence uncovered a host of additional deficits that are important from a theoretical perspective. As is suggested by the personality and social psychological theory of criminal behaviour, for effective treatment services to be effective, they will need to offset the density of rewards for substance abuse in order to reduce the risk of relapse and recidivism. This will require changes within each domain of an individual's life to tip the balance in favour of rewards that signal non-abuse (Andrews & Bonta, 2006). Therefore, in addition to developing the offender's cognitive and behavioural skills to cope with high-risk situations for drug use, effective treatment services will also need to increase the offender's competencies and sense of self-control by targeting areas that reward continued drug use, such as attitudes (e.g., placing value on substance abuse), interpersonal and psychological dimensions that precipitate drug

use (e.g., associating with a substance abusing peer group, poor coping, impulsivity), and the maladaptive community functioning that often provides the context in which drug use is reinforced and maintained (e.g. unstable accommodations, financial insufficiency) (Andrews & Bonta, 2006; Witkiewitz & Marlatt, 2004).

The myriad of problems that are associated with psychological drug dependence, which include mental and physical health problems, may warrant new approaches involving collaborative care models that provide a single network of services, and assistance from others within the family and community so that a number of life domains are positively impacted. Emerging research in this area has demonstrated that effective integration of concerned significant others (e.g., family members) as treatment collaborators within the broader community (e.g., network of health and correctional services) potentially increases the density of positive reinforcers for non-drug use behaviour, promotes social inclusion, reduces stigmatization, and protects against relapse (Meyers, Miller, Smith & Tonigan, 2002; WHO, 2008). Similarly, McNeece and DiNitto (1998) have argued that conceptualizations of dependence, like conceptualizations of public health issues, are best informed by an understanding of the complex interaction between the individual, the host (the specific drug) and the environment. Given the multiple and interacting biopsychosocial manifestations of dependence, a multimodal approach to treatment may have the most to offer because it accounts for the myriad relationships among the multiple antecedents and consequences of dependence (Shaffer et al., 2004).

The model that specifically explored the potential associations between the triggers of drug use and psychological drug dependence uncovered a number of other dimensions that are highly predictive of relapse to substance use (Baker, Piper, McCarthy, Majeskie & Fiore, 2004; Hodgins, el-Guebaly & Armstrong, 1995; Sklar et al., 1997; Witkiewitz & Marlatt, 2004). Offenders classified as psychologically drug dependent were more likely than the comparison group to use drugs because of negative affective states; due to conflict with others; as a result of having to cope with physical discomfort; and to manage withdrawal symptoms. Accordingly, in order to sufficiently mitigate the risk of relapse for the psychologically drug dependent offender, effective treatment services will need to integrate relapse prevention components that are of sufficient breadth and duration to help the offender build self-efficacy to deal with high risk situations; and identify, learn and maintain the necessary skills to manage the factors that are highly predictive of drug relapse, such as negative affective states, conflict with others and poor coping, (Carroll, 1996; Witkiewitz & Marlatt, 2004).

It is important to emphasize the important link between withdrawal symptoms and psychological drug dependence. Offenders who used drugs to manage their withdrawal symptoms had fully 13 times the odds of psychological drug dependence compared to the offenders who did not identify this trigger as precipitating drug use. Therefore, in addition to cognitive-behavioural treatment, pharmacological interventions, such as the delivery of methadone maintenance to offenders who use opioids (of whom the majority have been identified with psychological drug dependence) may also prove beneficial in alleviating the symptoms of withdrawal and

reducing the risks that are associated with relapse and recidivism (Dolan et al., 2005; Lind, Chen, Weatherburn & Mattick, 2005).

The Covariates of Revocation

The results from the survival analysis add to the weight of evidence from other research which has examined the strong link between substance abuse and recidivism (Andrews & Bonta, 2006; Dowden & Brown, 2002). The study's findings are particularly noteworthy because they disaggregated the effects of substance abuse, and in so doing, isolated the distinct effects of psychological drug dependence on the rates of revocation. Offenders who were classified by the SDS as psychologically drug dependent were more likely to be revoked over the 24-month period; however the effect depended on age. Offenders from the younger age category ($\leq$ 26 years of age at release), who were classified as psychologically drug dependent, were just as likely to be revoked during the 24 month follow-up period as the group of offenders from the same age category who did not exceed the cut-off for the classification. Conversely, for older offenders (> 26 years of age at assessment), psychological drug dependence increased the hazard of revocation by 1.68 times. The hazard of revocation was the same for offenders over the age of 26 and it was significantly different from the hazard for offenders 26 years of age or younger.

The interaction effect between psychological drug dependence and age at release emerged after adjusting for the main effects of other significant covariates of revocation. They included need ratings on the OIA domains of community functioning and associates/social interactions, ratings on OIA's overall need for intervention, the SIR-R1

risk estimate, ratings on the Alcohol Dependence Scale (ADS), and region of origin. Generally, the hazard of revocation increased as the need ratings on the OIA indicated a higher need for intervention; the risk rating on the SIR-R1 suggested a higher probability of general recidivism; and the ADS identified a more severe alcohol problem.

Interestingly, there was some evidence suggesting that exposure to the current substance abuse treatment programs reduced the hazard of revocation for the psychologically drug dependent offenders. However, the magnitude of the treatment effect depended on the duration of treatment exposure. Recall, that the current NSAP-M and NSAP-H are delivered over 26 and 89, 2-hour group sessions, respectively. They are designed to match with the severity of an offender's substance abuse problems. Offenders who were classified as psychologically drug dependent by the SDS and exposed to the NSAP-H intervention had a lower relative hazard of revocation of 0.60 (95% *CI*: 0.34 - 1.07; $p < .10$) compared to psychologically drug dependent offenders who were not exposed to a substance abuse program prior to release from custody. In contrast, the NSAP-M intensity program was less protective in terms of mitigating the hazard of a revocation for the psychologically drug dependent offenders. The comparison between the psychologically drug dependent offenders who were exposed to NSAP-M and the group of offenders from the reference category yielded a hazard ratio of 0.76 (95% *CI*: 0.47 - 1.22; $p = .25$). Although the point estimate of 0.76 suggests a slight reduction in hazard, the estimate was far from statistically significant. Based on these findings, offenders classified as psychologically drug dependent were best served by exposure to the high intensity program.

While there was evidence suggesting that treatment effectiveness varied as a function of psychological drug dependence, there was no evidence indicating that there was a significant interaction between the SIR-R1 risk rating, psychological drug dependence and program exposure. In other words, the effect of program exposure on the hazard of revocation did not depend on the level of risk as measured by the SIR-R1. On the surface, this appears to contradict literature that supports the inclusion of risk ("the risk principal") in the decision matrix when matching offenders to treatment intensity (Andrews & Bonta, 2006, p. 342). The fact that a significant interaction between SIR-R1 risk and program exposure categories did not emerge may be attributable to the strong association between the SIR-R1 risk rating and psychological drug dependence. The overwhelming majority of offenders classified as psychologically drug dependent were considered poor to fair risk on the SIR-R1; i.e., the two were strongly associated. Therefore, most of the offenders who were psychologically drug dependent and treatment exposed fit the profile of a higher risk offender. The fact that the psychologically drug dependent group were best served by the NSAP-H intensity program emphasizes the importance of considering the dimensional characteristics of criminogenic need - in this case, the strong association between risk and psychological drug dependence - when matching offenders to treatment services.

Exposure to community-based maintenance programs also reduced the hazard of revocation, irrespective of the SDS classification of psychological drug dependence. After accounting for the waiting time to exposure, offenders who participated in community-based maintenance programs had a hazard of revocation that was only 0.40 times that of the group of offenders who did not participate. This finding supports

emerging evidence from best-practices in offender reintegration and crime prevention (Griffiths, Dandurand & Murdoch, 2007; WHO, 2008). Offenders who are exposed to treatment prior to release and continue with treatment in the community have the best outcomes in terms of reductions in rates of recidivism. In the case of offenders who have an identified drug problem, exposure to a community-based intervention may help them manage problems that become relevant only at community re-entry, such as sustaining/re-learning the skills that are necessary to effectively manage the situations that may arise and lead to relapse; learning how to live drug-free in the community; and developing a peer support network that reinforces a drug-free lifestyle (Field, 1998).

The Covariates of Relapse to Substance Abuse

Community-based urinalysis testing was used to estimate the rate of relapse to substance use. It was considered a reliable estimate of relapse because the collection of urine was supervised to reduce the possibility of an offender's attempt to alter or falsify the urine sample (MacPherson, 2004). Also, the unpredictability of testing provided an additional safeguard against potential false positives due to a drug's rate of urinary clearance. Because drug metabolites remain in urine for varying periods of time (MacPherson, 2004), the samples were collected without prior notification and at irregular intervals to circumvent an offender's attempt to alter a test result by abstaining during the days leading to a sample request (CSC, 2007b). Although a positive urinalysis result could not determine when, or how much a drug was used, it provided a measure of drug use during each time interval between tests.

As predicted, offenders who were classified as psychologically drug dependent had a higher hazard of testing positive while on release than the comparison group. They were more likely to test positive for cocaine, opioids, volatiles and methadone and less likely to test positive for marijuana and its derivates (THC) than the comparison group. Not only did psychological drug dependence predict a positive test result, its effects also interacted with CMP. After CMP exposure, both groups had a lower hazard of testing positive compared to the offenders who did not participate in CMP; and both groups were just as likely to test positive after CMP exposure. The protective effect of CMP for both groups degraded over time, however. By about the 238th day after CMP exposure, offenders who participated in CMP were just as likely to test positive as the non-exposed offenders.

Increasingly, literature in the area of substance abuse treatment has focussed on aftercare because of concerns that treatment that is provided prior to release may be insufficient to protect the exiting offender against the threat of relapse (Brown et al., 2001). While CMP reduced the hazard of testing positive with this study sample, institutionally-based substance abuse programs had no significant effect. It may have been the case that exposure to community-based intervention provided an additional opportunity for offenders to consolidate and apply the skills they had developed in previous programming. In addition, CMP may have provided an effective means by which offenders were better able to monitor and cope with the cues that illicit drug use that only became relevant upon return to the community (Brown et al., 2001; Field, 1998). Whatever the case, CMP exposure had a significant mitigating effect on the hazard of testing positive for a substantial period of time after exposure commenced.

Other significant covariates of testing positive also emerged and are worth noting. For instance, for each negative test result (i.e., for each negative test since the last positive test result or since release if there were no positive results) that an offender produced, the hazard of producing a positive result on a subsequent test decreased by approximately 6%. Additionally, offenders who were identified with need in the OIA domain areas of attitude and associates/social Interactions were also more likely to test positive, which supports previous research on the predictors of recidivism (Andrews & Bonta, 2006). Interpersonal controls, such as criminal sentiments (i.e., attitude) and anti-social peer influences (i.e., associates/social interactions) have long been considered two of the "big four" predictors of recidivism (Andrews & Bonta, 2006, p. 75). The fact that both predicted relapse to substance use may shed additional light on some of the antecedents within the offence process. By intervening in both areas, correctional interventions may reduce the risk of relapse, thereby reducing the likelihood of recidivism for those offenders who have substance abuse identified as a criminogenic need.

The SIR-R1 risk estimate was also predictive of testing positive after adjusting for the effects of other covariates in the model. Offenders in the poor to fair risk groups, and the group of offenders who were not administered the SIR-R1 (of whom 91% are of Aboriginal ancestry) were more likely to test positive than offenders in the good to very good risk groups. This finding is consistent with previous research, which has uncovered significant correlations between substance abuse and crime (Lightfoot, 2001). However, describing the relationship in causal terms has been a major challenge for researchers. It may be the case that values, beliefs, rationalizations and cognitions that

are supportive of a criminal lifestyle lead to patterns of substance abuse. Or alternatively, individuals who first develop a substance abuse problem are more likely to then engage in criminal activity to support the problem (Lightfoot, 2001). If one of the goals of treatment is to reduce the risk of relapse to substance abuse and crime, then higher risk offenders will require services of sufficient breadth and duration to adequately address the risks irrespective of the causal pathway.

Limitations of the Study and Future Research Possibilities

The selection of the study sample and misclassification of the exposure were two potential sources of bias; however this study did not empirically examine the extent to which either was present. Selection bias can arise if the procedure that is used to select the sample leads to differences in the composition of the sample when compared to the target population from which the sample was drawn (Dohoo et al., 2003). If the association between the exposure and the outcome for the study sample differed from that observed in the target population then bias was present. To examine the extent to which this occurred would have necessitated the analyses of all relevant information for those offenders who were admitted to the regional assessment units during the same time period during which CASA was administered, but who did not complete the CASA.

It is important to note that the risk of sample selection bias was considered minimal because referral to the CASA assessment did not depend on offender-specific characteristics/factors. Offenders were assessed with the existing Computerized Lifestyle Assessment Instrument (CLAI) because the rates of admission at the regional intake units exceeded the capacity of CASA during the phase-in of the CASA project.

Therefore, assignment to the CASA depended on the availability of the CASA work-stations and not on offender-specific characteristics. Notwithstanding, an examination of the potential for sample selection bias may have been warranted given the observational nature of the study.

It is important to highlight that one potential source of selection bias was identified and controlled for through sample restriction. Recall that the release cohort was restricted to offenders from the Atlantic and Ontario Regions because of bias in the yearly distribution of CASA completions and releases to the community from the Pacific and Quebec Regions. Prior to 2005, there were no CASA completions within the Pacific and Quebec Regions because CASA was not yet available in these two regions. Therefore, very few offenders who completed the CASA within these two regions were available for follow-up into the community. Of those who were available for follow-up, the majority were released in 2007. As a result, the period between release and the end of the study period was relatively short. The shorter period of follow-up precluded a thorough examination of post-release outcomes. Unfortunately, sample restriction potentially impacted on the external validity of the findings because not all offenders could be included in the study. As CASA gains a foothold in all five regions and as more offenders who have completed the CASA get released from custody, a replication study with a larger, more representative sample from all five CSC regions may help increase the external validity of the findings.

On a somewhat related matter, the Prairies Region – a region with 41% Aboriginal representation - could not be included in the study so the size of the release

cohort of Aboriginal offenders (7% of total) was under-representative of the total population of Aboriginal offenders under CSC's jurisdiction. This region is still in the process of phasing-in CASA so data were unavailable for offenders from this region. As a result findings could not be disaggregated for the Aboriginal sample to the extent that they should have been. Also, the extent to which results could be extrapolated and generalized to the Aboriginal offender population, which accounts for 18% of the total population of offenders, was limited because relatively few Aboriginal offenders were available for the study. Future research could employ the same methodologies to a thorough examination of the dimensions and outcomes of psychological drug dependence for CSC's Aboriginal offender population.

Data from the community-based urinalysis testing may have also produced a type of selection bias. Unlike institutionally-based random urinalysis testing in which 5% of offenders in custody are randomly selected for urinalysis each month (MacPherson & Fraser, 2006), offenders are not randomly selected for community-based testing. Testing is part of the supervision process and is used to monitor released offenders and to deter drug use if/when there is reason to believe that an offender is at risk of using substances of abuse. As a result a greater proportion of higher risk, higher need offenders from the release cohort were tested to monitor and deter drug use. The greater likelihood of being tested may have had a deterrent effect for the higher risk/higher need offenders, thus reducing the rate of positive urinalysis results. As a result, fewer significant covariates of the outcome may have been identified. Equally, fewer offenders from the release cohort with lower need/lower risk were tested, so estimates

were based on relatively fewer offenders, which may have introduced some instability in the estimates.

There was also the possibility of misclassification bias because this study used the DAST as the reference standard for the establishment of a diagnostic cut-off on the SDS. DAST was benchmarked against the criteria for substance abuse disorders in the DSM-III (Gavin et al., 1989) and is considered a valid and reliable instrument (Gavin et al., 1989; Kunic & Grant, 2005; Robinson et al., 1991; Vanderburg et al., 1994; Weekes et al., 1995). However, DAST is not considered a "gold standard" like DSM. Assessing for potential misclassification bias would have involved a thorough examination of other reliable/valid sources of information to estimate the proportion of true "false positives" and true "false negatives". The estimates could then have been used to adjust the threshold score on the SDS for the classification and determine the impact, if any, on the dimensions of the classification and the outcomes associated with it. Future research, that builds on the this study's methodology, could identify the extent to which misclassification bias may be present and provide a framework for adjusting the SDS cut-off if/when bias is present.

Future research could also focus on the possibility of increasing the specificity of the classification through serial administration of both the DAST and SDS [i.e., requiring that offenders exceed a certain threshold on both instruments to meet the criteria for admission to a high intensity substance abuse program (testing positive on both)]. In order to investigate whether or not there is support for the serial administration of the SDS and DAST, the covariates of psychological dependence from

this study could be examined within a multinomial logistic model (Tabachnick & Fidell, 2001) to determine if the group of offenders who test positive to both are characteristically different from the groups of offenders who do not test positive on one or both of the instruments.

Recommendations

CSC's implementation of a formal thesis linkage and dissemination plan may facilitate the uptake of this research by policy makers. For the plan to be effective, four levels of decision-makers at the legislative, administrative, and clinical levels should comprise the audience for this research. Other stakeholders at the international, federal, provincial and territorial levels are also potential consumers of this thesis research.

At the legislative level, CSC is headed by the Commissioner of Corrections, who reports to the Minister of Public Safety. National Headquarters (NHQ) in Ottawa performs overall planning and policy development for the Service, while each of the five regional offices implements CSC activities in various facilities within its respective region. The Commissioner is supported by the Executive Committee (EXCOM), which is made-up of the Senior Deputy Commissioner, a Deputy Commissioner for Women, five Regional Deputy Commissioners, and seven Assistant Commissioners who are responsible for various Sectors, including the Research Branch and Correctional Operations and Programs.

EXCOM formulates its Strategic Plan and Corporate Objectives based on information from various Sectors, including the Research Branch, and more specifically the Addictions Research Centre. EXCOM's Report on the Plans and Priorities captures

and disseminates this evidence-based information on an annual basis to Parliament and to various stakeholders within the bureaucracy. For fiscal year 2005-2006, the Report on the Plans and Priorities for CSC listed as one of its priorities the need to "develop and implement targeted programs and case management strategies for higher risk offenders, women offenders and Aboriginal offenders". This research has contributed to this priority by highlighting the dimensional characteristics of psychological drug dependence and the effects of targeted programs on the rates of revocation and relapse to substance abuse. To be specific, this research provided evidence suggesting that the needs of psychologically drug dependent offenders are best served through their participation in high intensity programming and as a result of their exposure to community-based aftercare. Not only did community aftercare significantly mitigate the risk of recidivism, it also reduced the likelihood of relapse to substance abuse, irrespective of SDS's classification. Unfortunately, few offenders participated in CSC's community maintenance programs and a sizeable proportion of offenders who were identified with psychological drug dependence were not exposed to services that best addressed their needs. Translating and disseminating the results to senior decision-makers may impact on future policy initiatives within the areas of assessment, correctional planning, continuity of care and capacity building.

Decision-makers at the administrative level, specifically individuals who occupy positions within the Correctional Operations and Programs (COP) Sector, are responsible for the integrity of community and institutional operations across CSC, and for improving the delivery of effective correctional interventions, including substance abuse programs. For more than a decade, this sector has been developing research-based

programs that are designed to reduce the likelihood of re-offending after release from federal custody. The Program Accreditation process is the formal mechanism by which this Sector evaluates program integrity and impact on offender outcomes. This process includes a formal program review by the International Accreditation Panel of experts who then provide recommendations for policy development. The Panel assesses the underlying scientific basis for the program using eight criteria:

1. Follow an explicit, empirically-based model of change.
2. Target needs that are related to criminal risk.
3. Use effective methods.
4. Be skills oriented.
5. Address responsivity issues.
6. Provide continuity of care.
7. Be of the appropriate program intensity.
8. Include ongoing monitoring and evaluation of the program results and integrity of delivery, (i.e. performance measurement and continuing research to evaluate results).

The thesis directly maps onto criteria seven because it examined a new approach to case classification and program referral that may enhance client-treatment matching; i.e., ensuring that intensity of substance abuse treatment matches the needs of the offender thereby reducing the likelihood of misclassification. It is, therefore, recommended that the study's results be included in the formal submission to the Accreditation Panel in December 2008 so that the service's policy response is evidence-informed and potentially supported by expert consensus.

Decision-makers with the COP Sector's Reintegration Programs Division also provide input into the research agenda. Within the last year, administrative decision-makers from this division requested that the Addictions Research Centre investigate the possibility of adjusting the program referral system for the Service's substance abuse treatment program. This study was the first step in addressing their policy needs. Not only did the classification identify important offender characteristics for the purposes of correctional planning, the classification was also predictive of post-release outcomes, irrespective of the SIR-R1 risk estimate. Accordingly, the study's findings ought to be translated into consumer-friendly language and shared with decision-makers within Reintegration Programs in order to determine the operational impacts of integrating the SDS classification within existing assessment processes.

Decision-makers at the operational and clinical levels comprise the third group. They are responsible for the direct delivery of program and services to the offender population. CSC has five regions, each headed by a Regional Deputy Commissioner. Five Regional Headquarters (RHQ) are responsible for the administration of the day-to-day operations with their respective regions. RHQs are also responsible for liaising between NHQ and the sites. Typically, members of the clinical services team and administrators at the site level communicate concerns or issues to their administrators at the regional level, who in turn inform officers of primary interest at the national level. Thus, field consultations between researchers, policy-makers/program administrators and clinical staff drive the research agenda. Accordingly, the study's findings should be translated into language that is appropriate to the clinical context and then formally integrated into the staff training/professional development agendas across all five

regions of CSC.

A fourth category of audience includes administrators and clinicians at the international, federal, provincial and territorial levels. These groups are also consumers of CSC's research. CSC disseminates the results to this audience through various means including research publications on its corporate website, subscriptions to the "Forum on Corrections" publication (reaching 6000 readers in 35 countries) and presentations at conferences and workshops. Translation of research results is also achieved through formal memoranda of understanding between CSC and non-governmental and governmental organizations within and outside of Canada, informal and formal partnerships with researchers within academia, and partnerships with other agencies and centres, such as researchers and policy analysts at the Canadian Centre on Substance Abuse, Justice Canada and Health Canada. It is recommended that the Addictions Research Centre, specifically, and the Research Branch, generally, assess the quality of the research, and if deemed appropriate, formulate a plan to disseminate the results within CSC and to a broader audience through conferences, forums and publications. Additionally, the establishment of formal partnerships with other government /non-governmental agencies and academic institutions may advance the study's methodologies and findings that can then be applied to other populations and contexts.

From the beginning, audiences at the legislative, administrative and clinical levels have expressed an active interest in this research. The goal, now, is to translate and disseminate the thesis research into language that specifically, concisely and clearly articulates the policy and clinical implications of it (Feldman, Nadash & Gursen, 2001).

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Appendix A: Drug Abuse Screening Test (DAST) and Severity of Dependence Scale (SDS) Items

Drug Abuse Screening Test (DAST) (Skinner, 1982)

Look back to the 12 months before your arrest for this current offence(s):

1. Did you use drugs other than those for medical reasons?
2. Did you abuse prescription drugs?
3. Did you abuse more than one drug at a time?
4. Could you get through the week without using drugs?
5. Were you always able to stop using drugs when you wanted to?
6. Did you have "blackouts" or "flashbacks" as a result of drug use?
7. Did you ever feel bad or guilty about your drug use?
8. Did your spouse (or parents) ever complain about your involvement with drugs?
9. Did your drug abuse create problems between you and your spouse or your parents?
10. Did you lose friends because of your use of drugs?
11. Did you neglect your family because of your use of drugs?
12. Were you in trouble at work because of drug abuse?
13. Did you lose a job because of drug abuse?
14. Did you get into fights when under the influence of drugs?
15. Did you engage in illegal activities in order to obtain drugs?
16. Were you ever arrested for possession of illegal drugs?
17. Did you ever experience withdrawal symptoms (felt sick) when you stopped taking drugs?
18. Did you have medical problems as a result of your drug use (e.g., memory loss, hepatitis, convulsions, bleeding, etc.)?
19. Did you go to anyone for help for a drug problem?
20. Have you been involved in a treatment program specifically related to drug use?

Severity of Dependence Scale- SDS (Gossop et al., 1995)

Look back to the 12 months before your arrest for this current offence(s):

1. Do you think your use of *(named drug)* was out of control?

    1. Never or almost never
    2. Sometimes
    3. Often
    4. Always or nearly always

2. Did the prospect of missing a fix (or dose) or not chasing make you anxious or worried?

    1. Never or almost never
    2. Sometimes
    3. Often
    4. Always or nearly always

3. Did you worry about your use of *(named drug)*?

    1. Never or almost never
    2. Sometimes
    3. Often
    4. Always or nearly always

4. Did you wish you could stop?

    1. Never or almost never
    2. Sometimes
    3. Often
    4. Always or nearly always

5. How difficult did you find it to stop or go without *(named drug)*?

    1. Not difficult
    2. Quite difficult
    3. Very difficult
    4. Impossible

Appendix B: Offender Intake Assessment (OIA) Indicators

Education/Employment Domain

1. Has less than grade 8?
2. Has less than grade 10?
3. Has no high school diploma?
4. Finds learning difficult?
5. Has learning disabilities?
6. Has physical problems which interfere with learning?
7. Has memory problems?
8. Has concentration problems?
9. Has problems with reading?
10. Has problems with writing?
11. Has problems with numeracy?
12. Has difficulty comprehending instructions?
13. Lacks a skill area/trade/profession?
14. Dissatisfied with skill area/trade/profession?
15. Has physical problems that interfere with work?
16. Has no employment history?
17. Unemployed at the time of arrest?
18. Unemployed 90% or more?
19. Unemployed 50% or more?
20. Has an unstable job history?
21. Often shows up late for work?
22. Has poor attendance record?
23. Has difficulty meeting workload requirements?
24. Lacks initiative?
25. Has quit a job without another?
26. Has been laid off from work?
27. Has been fired from a job?
28. Salary has been insufficient?
29. Lacks employment benefits?
30. Job lacks security?
31. Has difficulty with co-workers?
32. Has difficulties with superiors?
33. Prior vocational assessment(s)?
34. Has participated in employment programs?
35. Has completed an occupational development program?

Marital/Family Domain

1. Childhood lacked family ties?
2. Mother absent during childhood?
3. Maternal relations negative as a child?
4. Father absent during childhood?
5. Paternal relations negative as a child?
6. Parents' relationship dysfunctional during childhood?
7. Spousal abuse during childhood?
8. Sibling relations negative during childhood?
9. Other relative(s) relations negative during childhood?
10. Family members involved in crime?
11. Currently single?
12. Has been married/common-law in the past?
13. Dissatisfied with current relationship?
14. Money problems affect relationship(s) past/present?
15. Sexual problem affect relationship(s) past/present?
16. Communication problems affect the relationship(s)?
17. Has been a victim of spousal abuse?
18. Has been a perpetrator of spousal abuse?
19. Has no parenting responsibilities?
20. Unable to handle parenting responsibilities?
21. Unable to control the child's behaviour appropriately?
22. Perceives self as unable to control the child's behaviour?
23. Supervises child improperly?
24. Does not participate in activities with the child?
25. Lacks an understanding of child development?
26. Family is unable to get along as a unit?
27. Has been arrested for child abuse?
28. Has been arrested for incest?
29. Prior marital/family assessment(s)?
30. Has participated in marital/family therapy?
31. Has completed a marital/family intervention program?

Associates/Social Interactions Domain

1. Socially isolated?
2. Associates with substance abusers?
3. Has many criminal acquaintances?
4. Has mostly criminal friends?
5. Has been affiliated with a gang?
6. Resides in a criminogenic area?
7. Unattached to any community groups
8. Relations are described as predatory?
9. Often victimized in social relations?
10. Easily influenced by others?
11. Has difficulty communicating with others?

Substance Abuse Domain

1. Abuses alcohol?
2. Began drinking at an early age?
3. Drinks on a regular basis?
4. Has a history of drinking binges?
5. Has combined the use of alcohol and drugs?
6. Drinks to excess during leisure time?
7. Drinks to excess in social situations?
8. Drinks to relieve stress?
9. Drinking interferes with employment?
10. Drinking interferes with marital/family relations?
11. Drinking interferes with social relations?
12. Drinking has resulted in law violations?
13. Drinking interferes with health?
14. Abuses drugs (solvents, prescription drugs, etc.)?
15. Began using drugs at an early age?
16. Uses drugs on a regular basis?
17. Has gone on drug-taking sprees?
18. Has combined the use of different drugs?
19. Uses drugs during leisure time?
20. Uses drugs in social situations?
21. Uses drugs to relieve stress?
22. Drug use interferes with employment?
23. Drug use interferes with marital/family relations?
24. Drug use interferes with social relations?
25. Drug use has resulted in law violations?
26. Drug use interferes with health?
27. Prior substance abuse assessment(s)?
28. Has participated in substance abuse treatment?
29. Has completed substance abuse treatment?

Community Functioning Domain

1. Has unstable accommodation?
2. Residence is poorly maintained?
3. Has poor self-presentation?
4. Has poor hygiene?
5. Has physical problems?
6. Has dental problems?
7. Has dietary problems?
8. Difficulty meeting bills?
9. Has outstanding debts?
10. Has no bank accounts?
11. Has no credit?
12. Has no collateral?
13. Has problems writing?
14. Unable to express verbally?
15. Has no hobbies?
16. Does not participate in organized activities?
17. Unaware of social services?
18. Has used social assistance?
19. Prior assessment for community functioning?
20. Has participated in a community skills program?
21. Has completed a community skills program?

Personal/Emotional Orientation Domain

1. Feels especially self-important?
2. Physical prowess problematic?
3. Family ties are problematic?
4. Ethnicity is problematic?
5. Religion is problematic?
6. Gang member?
7. Unable to recognize problem areas?
8. Has difficulties solving interpersonal problems?
9. Unable to generate choices?
10. Unaware of consequences?
11. Goal setting is unrealistic?
12. Has disregard for others?
13. Socially unaware?
14. Impulsive?
15. Incapable of understanding the feelings of others?
16. Narrow and rigid thinking?
17. Aggressive?
18. Assertion problem?
19. Copes with stress poorly?
20. Poor conflict resolution?
21. Manages time poorly?
22. Gambling is problematic?
23. Has low frustration tolerance?
24. Hostile?
25. Worries unreasonably?
26. Takes risks inappropriately?
27. Thrill-seeking?
28. Non-reflective?
29. Is not conscientious?
30. Manipulative?
31. Has difficulty performing sexually?
32. Sexual identity problem?
33. Inappropriate sexual preferences?
34. Sexual attitudes are problematic?
35. Mentally deficient?
36. Diagnosed as disordered in the past?
37. Diagnosed as disordered currently?
38. Prior personal/emotional assessment(s)?
39. Prescribed medication in the past?
40. Prescribed medication currently?
41. Past hospitalization?
42. Current hospitalization?
43. Received outpatient services in the past?
44. Receiving outpatient services prior to admission?
45. Past programs participation?
46. Current program participation?

Attitude Domain

1. Negative towards law?
2. Negative towards police?
3. Negative towards courts?
4. Negative towards corrections?
5. Negative towards community supervision?
6. Negative towards rehabilitation?
7. Employment has no value?
8. Marital/family relations have no value?
9. Interpersonal relations have no value?
10. Values substance abuse?
11. Basic life skills have no value?
12. Personal/emotional stability has no value?
13. Elderly have no value?
14. Women/men roles are unequal?
15. Ethnically intolerant?
16. Intolerant of other religions?
17. Intolerant of disabled persons?
18. Disrespectful of personal belongings?
19. Disrespectful of public property?
20. Disrespectful of commercial property?
21. Supportive of domestic violence?
22. Supportive of instrumental violence?
23. Lacks direction?
24. Non-conforming?

Appendix C: Unconditional Associations between Indicators within each OIA Domain and Psychological Drug Dependence

Education/Employment Domain

Table C1. Significant, unconditional associations (*OR*) between Psychological Drug Dependence, the Education/Employment Domain Indicators, the Overall Rating on the Domain, and the SIR-R1 Risk Rating

		Psychological Drug Dependence			
	Unconditional	No		Yes	
Covariate	***OR*[a]**	***n***	**%**	***n***	**%**
Domain rating of need for intervention					
Asset		106	4.4	8	.8
None	5.58	1068	44.5	450	47.4
Some	5.26	1073	44.7	426	44.8
Considerable	5.72	153	6.4	66	7.0
Less than grade eight education					
No		1754	78.2	640	72.9
Yes	1.33	490	21.8	238	27.1
Less than grade 10 education					
No		1202	53.8	415	47.3
Yes	1.30	1033	46.2	462	52.7
No high school diploma					
No		593	26.6	183	20.9
Yes	1.37	1638	73.4	693	79.1
Finds learning difficult					
No		1548	70.8	554	65.3
Yes	1.30	638	29.2	295	34.7
Has learning disabilities					
No		1634	80.7	577	75.8
Yes	1.33	391	19.3	184	24.2
Has memory problems					
No		1917	80.2	698	73.8
Yes	1.44	474	19.8	248	26.2
Concentration problems					
No		1720	72.1	584	61.9
Yes	1.59	666	27.9	360	38.1
Lacks a skill area/trade/profession					
No		1081	45.1	356	37.6
Yes	1.37	1316	54.9	592	62.5
Dissatisfied with skill area/trade/profession					
No		1077	46.1	355	38.9
Yes	1.32	1259	53.9	557	61.1
Unemployed at arrest					
No		998	41.7	230	24.3
Yes	2.23	1398	58.4	718	75.7

Covariate	Unconditional *OR*[a]	Psychological Drug Dependence No *n*	No %	Yes *n*	Yes %
Unemployed 90% or more					
No		1661	69.3	568	60.0
Yes	1.51	736	30.7	379	40.0
Unemployed 50% or more					
No		1160	48.5	316	33.5
Yes	1.87	1230	51.5	628	66.5
Unstable job history					
No		1089	45.5	264	27.8
Yes	2.16	1306	54.5	685	72.2
Has no employment history					
No		2158	90.0	826	87.0
Yes	1.33	241	10.0	123	13.0
Often shows up late for work					
No		2181	92.7	756	82.2
Yes	2.75	172	7.3	164	17.8
Has poor attendance record					
No		2228	94.6	748	80.8
Yes	4.17	127	5.4	178	19.2
Difficulty meeting workload					
No		1965	82.9	684	73.4
Yes	1.76	405	17.1	248	26.6
Lacks initiative					
No		1843	79.7	613	68.5
Yes	1.80	470	20.3	282	31.5
Has quit a job without another					
No		1439	60.8	453	48.4
Yes	1.66	927	39.2	483	51.6
Has been laid off from work					
No		1068	45.9	374	39.9
Yes	1.28	1282	54.1	563	60.1
Has been fired from a job					
No		1800	76.5	599	65.2
Yes	1.74	552	23.5	320	34.8
Salary has been insufficient					
No		1504	63.1	552	58.4
Yes	1.22	880	36.9	394	41.7
Job lacks security					
No		1130	49.4	369	41.7
Yes	1.37	1157	50.6	516	58.3
Has difficulty with co-workers					
No		2291	96.9	886	95.3
Yes	1.56	73	3.10	44	4.7
Prior vocational assessment(s)					
No		1954	81.9	704	74.4
Yes	1.56	433	18.1	242	25.6
Has participated in employment programs					
No		1785	74.8	666	70.6
Yes	1.23	602	25.2	277	29.4

Covariate	Unconditional *OR*[a]	Psychological Drug Dependence: No *n*	No %	Yes *n*	Yes %
SIR-R1 risk estimate for recidivism:					
One out of three expected to succeed on release (poor risk)	5.86	451	18.8	355	37.4
Two out of five expected to succeed on release (fair/poor risk)	4.09	289	12.0	160	16.8
One out of two expected to succeed on release (fair risk)	2.57	400	16.7	139	14.6
Two out of three expected to succeed on release (good risk)	2.32	319	13.3	100	10.5
Four out of five expected to succeed on release (very good risk)		776	32.3	105	11.1
Not administered the SIR-R1[b]	4.08	165	6.9	91	9.6

Note. Only the "yes" and "no" indicator responses were included in the table. The "unknown" responses for all indicators were excluded. [a]Odds ratios compare the odds of psychology drug dependence when the problem is present versus when the problem is absent. The odds ratio estimates for the SIR-R1 ratings compare the odds of psychological drug dependence for each of the risk groups to the odds for the *very good risk* group. The odds ratios for the domain rating compare the odds of psychological drug dependence for each domain rating to the odds for the "asset" rating. [b]Of the 256 offenders who were not administered the SIR-R1, 235 are of Aboriginal ancestry (92%).

Marital/Family Domain

Table C2. Significant, unconditional associations (*OR*) between Psychological Drug Dependence, the Marital/Family Domain Indicators and the Overall Rating for the Domain

Covariate	Unconditional *OR*[a]	Psychologically Drug Dependent: No *n*	No %	Yes *n*	Yes %
Domain rating of need for intervention					
Asset		132	5.5	23	2.4
None	2.30	1508	62.8	603	63.5
Some	2.74	421	17.5	201	21.2
Considerable	2.10	339	14.1	123	13.0
Childhood lacked family ties					
No		1868	77.9	706	74.3
Yes	1.22	530	22.1	244	25.7
Maternal relations negative as a child					
No		1952	81.7	698	73.6
Yes	1.61	437	18.3	251	26.5
Father absent during childhood					
No		1532	63.9	563	59.4
Yes	1.21	865	36.1	385	40.6
Paternal relations negative as a child					
No		1548	65.3	479	51.1
Yes	1.81	821	34.7	459	48.9
Parents relationship dysfunctional during childhood					
No		1398	59.8	420	45.2
Yes	1.80	941	40.2	509	54.8
Spousal abuse during childhood					
No		1757	76.9	577	63.4
Yes	1.92	529	23.1	333	36.6
Sibling relations negative during childhood					
No		2192	92.6	847	90.3
Yes	1.34	176	7.4	91	9.7
Other relative(s) relations negative during childhood					
No		2137	90.6	817	87.6
Yes	1.37	222	9.4	116	12.4
Currently single					
No		951	39.7	281	29.6
Yes	1.56	1445	60.3	668	70.4
Money problems affect relationship(s) past/present					
No		1730	74.3	637	68.2
Yes	1.35	599	25.7	297	31.8

Covariate	Unconditional *OR*[a]	Psychologically Drug Dependent: No *n*	No %	Yes *n*	Yes %
Sexual problem affect relationship(s) past/present					
No		2031	91.7	841	95.4
Yes	0.54	183	8.3	41	4.7
Communication problems affect the relationship(s)					
No		1466	62.3	529	56.6
Yes	1.27	886	37.7	406	43.4
Has been a victim of spousal abuse					
No		2197	92.5	831	88.2
Yes	1.64	179	7.5	111	11.8
Has been a perpetrator of spousal abuse					
No		1689	71.9	585	62.9
Yes	1.51	659	28.1	345	37.1
Unable to handle parenting responsibilities					
No		2108	89.6	803	85.2
Yes	1.51	244	10.4	140	14.9
Unable to control the child's behaviour appropriately					
No		2235	96.0	873	94.0
Yes	1.53	94	4.0	56	6.0
Perceives self as unable to control the child's behaviour					
No		2329	98.6	909	97.3
Yes	1.94	33	1.4	25	2.7
Does not participate in activities with the child					
No		2201	92.9	827	87.9
Yes	1.80	169	7.1	114	12.1
Has been arrested for child abuse					
No		2323	97.0	935	98.6
Yes	0.44	73	3.0	13	1.4
Has been arrested for incest					
No		2305	96.2	938	98.8
Yes	0.29	92	3.8	11	1.2

Note. Only the "yes" and "no" indicator responses were included in the table. The "unknown" responses for all indicators were excluded. [a]Odds ratios compare the odds of psychological drug dependence when the problem is present versus when the problem is absent. The odds ratios for the domain rating compare the odds of psychological drug dependence for each domain rating to the odds for the "asset" rating.

Associates/Social Interactions Domain

Table C3. Significant, unconditional associations (*OR*) between Psychological Drug Dependence, the Associates/Social Interactions Indicators and the Overall Rating for the Domain

		Psychological Drug Dependence			
		No		Yes	
Covariate	**Unconditional *OR*[a]**	***n***	**%**	***n***	**%**
Domain rating of need for intervention					
Asset		81	3.4	1	.1
None	29.56	808	33.7	296	31.2
Some	34.15	938	39.1	397	41.8
Considerable	36.05	573	23.9	256	27.0
Socially isolated					
No		1986	82.9	726	76.4
Yes	1.49	410	17.1	224	23.6
Associates with substance abusers					
No		781	32.8	78	8.3
Yes	5.40	1598	67.2	864	91.7
Has many criminal acquaintances					
No		813	34.4	171	18.2
Yes	2.35	1551	65.6	767	81.8
Mostly criminal friends					
No		1392	59.9	380	40.8
Yes	2.16	933	40.1	551	59.2
Resides in a criminogenic area					
No		1751	76.7	599	66.8
Yes	1.64	531	23.8	298	33.2
Unattached to any community groups					
No		750	31.5	204	21.6
Yes	1.67	1628	68.5	741	78.4
Relations are described as predatory					
No		2031	85.6	779	82.5
Yes	1.26	342	14.4	165	17.5
Often victimized in social relations					
No		2172	91.2	824	87.1
Yes	1.53	210	8.8	122	12.9
Easily influenced by others					
No		1363	57.6	469	49.9
Yes	1.36	1004	42.4	471	50.1

Note. Only the "yes" and "no" indicator responses were included in the table. The "unknown" responses for all indicators were excluded. [a]Odds ratios compare the odds of psychological drug dependence when the problem is present versus when the problem is absent. The odds ratios for the domain rating compare the odds of psychological drug dependence for each domain rating to the odds for the "asset" rating.

Substance Abuse Domain

Table C4. Significant, unconditional associations (*OR*) between Psychological Drug Dependence, the Substance Abuse Domain Indicators and the Overall Domain Rating

Covariate	Unconditional *OR*[a]	Psychologically Drug Dependent No *n*	No %	Yes *n*	Yes %
Domain rating of need for intervention					
None		1008	42.0	15	1.6
Some	2.33	665	27.7	102	10.7
Considerable	4.34	727	30.3	833	87.7
Began drinking at an early age					
No		1526	64.2	508	53.6
Yes	1.55	850	35.8	439	46.4
Drinks on a regular basis					
No		1629	68.8	595	63.2
Yes	1.28	740	31.2	347	36.8
Has a history of drinking binges					
No		1620	68.5	518	55.3
Yes	1.76	744	31.5	419	44.7
Has combined the use of alcohol and drugs					
No		1673	70.7	467	49.3
Yes	2.49	692	29.3	481	50.7
Abuses alcohol					
No		1334	55.9	441	46.5
Yes	1.44	1053	44.1	508	53.5
Drinks to excess during leisure time					
No		1604	67.9	558	59.5
Yes	1.44	760	32.2	380	40.5
Drinks to excess in social situations					
No		1567	66.5	542	58.0
Yes	1.44	789	33.5	393	42.0
Drinks to relieve stress					
No		1836	77.8	627	66.4
Yes	1.77	523	22.2	317	33.6
Drinking interferes with employment					
No		1997	84.8	678	72.4
Yes	2.12	358	15.2	258	27.6
Drinking interferes with marital/family relations					
No		1810	76.5	623	66.1
Yes	1.67	557	23.5	320	33.9
Drinking interferes with social relations					
No		1897	80.1	659	69.8
Yes	1.74	471	19.9	285	30.2

Covariate	Unconditional OR^a	Psychologically Drug Dependent: No *n*	No %	Yes *n*	Yes %
Drinking has resulted in law violations					
No		1565	65.7	560	59.2
Yes	1.32	818	34.3	386	40.8
Drinking interferes with health					
No		2089	89.2	751	81.2
Yes	1.92	252	10.8	174	18.8
Began using drugs at an early age					
No		1470	62	197	20.8
Yes	6.19	903	38	749	79.2
Uses drugs on a regular basis					
No		1507	63.8	53	5.59
Yes	29.7	856	36.2	895	94.4
Has gone on drug-taking sprees					
No		1690	71.9	83	8.8
Yes	26.6	661	28.1	864	91.2
Has combined the use of different drugs					
No		1690	71.6	174	18.5
Yes	11.13	670	28.4	768	81.5
Abuses drugs					
No		1153	48.0	8	.84
Yes	108.87	1247	52.0	942	99.2
Uses drugs during leisure time					
No		1286	54.1	40	4.2
Yes	26.68	1093	45.9	907	95.8
Uses drugs in social situations					
No		1342	56.8	54	5.7
Yes	21.64	1022	43.2	890	94.3
Uses drugs to relieve stress					
No		1608	68.5	165	17.5
Yes	10.26	740	31.5	779	82.5
Drug use interferes with employment					
No		1897	81.3	210	22.5
Yes	14.96	436	18.7	722	77.5
Drug use interferes with marital/family relations					
No		1701	72.2	128	13.6
Yes	16.54	654	27.8	814	86.4
Drug use interferes with associates					
No		1870	79.2	191	20.2
Yes	15.10	491	20.8	756	79.8
Drug use resulted in law violations					
No		1519	63.9	44	4.6
Yes	36.4	858	36.1	904	95.4
Drug use interferes with health					
No		2016	86.2	357	39.0
Yes	9.81	323	13.8	561	61.1

Covariate	Unconditional *OR*[a]	Psychologically Drug Dependent: No *n*	No %	Yes *n*	Yes %
Prior substance abuse assessment					
No		1475	63.3	270	30.0
Yes	4.01	856	36.7	629	70.0
Has participated in substance abuse treatment					
No		1497	62.7	276	29.2
Yes	4.08	890	37.3	669	70.8
Has completed substance abuse treatment					
No		1674	71.5	413	45.5
Yes	3.00	667	28.5	494	54.5

Note. Only the "yes" and "no" indicator responses were included in the table. The "unknown" responses for all indicators were excluded because they comprised a very small proportion of responses. [a]Odds ratios are comparing the odds of psychological drug dependence when the problem is present versus when the problem is absent. The odds ratios for the domain rating compare the odds of psychological drug dependence for each domain rating to the odds for the "none" rating.

Community Functioning Domain

Table C5. Significant, unconditional associations (*OR*) between Psychological Drug Dependence, the Community Functioning Domain Indicators and the Overall Domain Rating

Covariate	Unconditional *OR*[a]	Psychologically Drug Dependent No *n*	No %	Yes *n*	Yes %
Domain rating of need for intervention					
Asset		103	4.3	8	.8
None	1.53	1912	79.7	687	72.3
Some	2.06	326	13.6	198	20.8
Considerable	2.52	59	2.5	57	6.0
Has unstable accommodation					
No		1694	71.3	457	48.7
Yes	2.61	683	28.7	481	51.3
Residence is poorly maintained					
No		1896	95.7	660	88.4
Yes	2.91	86	4.3	87	11.7
Has poor self-presentation					
No		2311	96.6	891	94.2
Yes	1.74	82	4.4	55	5.8
Has poor hygiene					
No		2325	98.2	897	96.6
Yes	1.93	43	1.8	32	3.4
Has dietary problems					
No		2227	94.8	860	92.5
Yes	1.49	122	5.2	70	7.5
Difficulty meeting bills					
No		1365	57.9	361	38.7
Yes	2.17	993	42.1	571	61.3
Has outstanding debts					
No		1353	59.7	477	54.8
Yes	1.22	913	40.3	394	45.2
Has no bank accounts					
No		1483	65.8	434	48.8
Yes	2.02	771	34.2	456	51.2
Has no credit					
No		1117	49.1	298	33.2
Yes	1.94	1157	50.9	599	66.8
Has no collateral					
No		929	40.2	253	27.7
Yes	1.76	1383	59.8	662	72.4
Has no hobbies					
No		1576	66.9	496	52.9
Yes	1.80	779	33.1	441	47.1

Covariate	Unconditional *OR*[a]	Psychologically Drug Dependent: No *n*	No %	Yes *n*	Yes %
Has problems writing					
No		2007	84.2	820	86.9
Yes	0.81	377	15.8	124	13.1
Does not participate in organized activities					
No		914	38.6	266	28.1
Yes	1.60	1455	61.4	677	71.8
Has used social assistance					
No		926	40.4	211	23.1
Yes	2.25	1366	59.6	701	76.9
Prior assessment for community functioning					
No		2077	87.2	755	80.2
Yes	1.67	306	12.8	186	19.8
Has participated in a community skills program					
No		2220	93.4	842	89.4
Yes	1.69	156	6.6	100	10.6
Has completed a community skills program					
No		2250	94.7	856	91.0
Yes	1.79	125	5.3	85	9.0

Note. Only the "yes" and "no" indicator responses were included in the table. The "unknown" responses for all indicators were excluded. [a]Odds ratios are comparing the odds of psychological drug dependence when the problem is present versus when the problem is absent. The odds ratios for the domain rating compare the odds of psychological drug dependence for each domain rating to the odds for the "asset" rating.

Personal/Emotional Orientation Domain

Table C6. Significant, unconditional associations (*OR*) between Psychological Drug Dependence, the Personal/Emotional Orientation Domain Indicators and the Overall Domain Rating

		Psychologically Drug Dependent			
	Unconditional	No		Yes	
Covariate	***OR*[a]**	***n***	**%**	***n***	**%**
Domain rating of need for intervention					
None		520	21.7	161	17.0
Some	1.33	712	29.7	292	30.7
Considerable	1.37	1168	48.7	497	52.3
Feels especially self-important					
No		2004	83.8	832	87.7
Yes	0.73	387	16.2	117	12.3
Family ties are problematic					
No		1488	62.4	487	51.4
Yes	1.57	898	37.6	460	48.6
Gang member					
No		2186	94.7	897	97.2
Yes	0.52	122	5.3	26	2.8
Unable to recognize problem areas					
No		1126	46.9	483	50.8
Yes	0.85	1274	53.1	467	49.2
Has difficulties solving interpersonal problems					
No		737	30.9	187	19.8
Yes	1.82	1650	69.1	760	80.3
Unable to generate choices					
No		941	39.3	262	27.6
Yes	1.69	1456	60.7	687	72.4
Goal setting is unrealistic					
No		1722	72.6	643	68.2
Yes	1.23	651	27.4	300	31.8
Socially unaware					
No		1787	75.0	672	70.7
Yes	1.24	595	25.0	278	29.3
Impulsive					
No		760	31.9	148	15.6
Yes	2.53	1623	68.1	799	85.4
Aggressive					
No		1435	60.3	516	54.5
Yes	1.27	946	39.7	431	45.5
Assertion problem					
No		1536	64.6	520	55.2
Yes	1.48	841	35.4	422	44.8
Copes with stress poorly					
No		891	37.4	153	16.2
Yes	3.08	1493	62.6	789	83.8

Covariate	Unconditional *OR*[a]	Psychologically Drug Dependent: No *n*	No %	Yes *n*	Yes %
Poor conflict resolution					
No		839	35.1	219	23.2
Yes	1.79	1553	64.9	725	76.8
Manages time poorly					
No		1465	62.8	429	46.8
Yes	1.92	868	37.2	487	53.2
Has low frustration tolerance					
No		1377	58.2	455	48.3
Yes	1.49	989	41.8	487	51.7
Worries unreasonably					
No		2011	85.3	745	79.6
Yes	1.48	348	14.7	191	20.4
Takes risks inappropriately					
No		733	30.6	227	23.9
Yes	1.40	1662	69.4	723	76.1
Thrill-seeking					
No		1713	72.8	620	66.7
Yes	1.34	641	27.2	310	33.3
Non-reflective					
No		1057	44.3	352	37.1
Yes	1.35	1330	55.7	597	62.9
Is not conscientious					
No		1382	58.2	480	51.0
Yes	1.34	993	41.8	462	49.0
Inappropriate sexual preferences					
No		2044	88.5	866	95.4
Yes	0.37	266	11.5	42	4.6
Sexual attitudes are problematic					
No		1972	85.3	836	90.8
Yes	0.59	341	14.7	85	9.2
Diagnosed as disordered in the past					
No		2047	86.7	771	82.0
Yes	1.42	315	13.3	169	18.0
Diagnosed as disordered currently					
No		2177	91.6	833	88.7
Yes	1.38	201	8.5	106	11.3
Prior personal/emotional assessments					
No		1646	69.4	595	63.2
Yes	1.32	726	30.6	347	36.8
Prescribed medication in the past					
No		1658	70.5	551	58.8
Yes	1.68	693	29.5	386	41.2
Currently prescribed medication for mental health problems					
No		1915	81.2	667	70.9
Yes	1.78	443	18.8	274	29.1

Covariate	Unconditional *OR*[a]	Psychologically Drug Dependent: No *n*	No %	Yes *n*	Yes %
Past hospitalization for mental health problems					
No		2057	87.3	749	79.7
Yes	1.75	299	12.7	191	20.3
Current hospitalization for mental health problems					
No		2375	99.2	913	96.7
Yes	4.03	20	.8	31	3.3
Received outpatient services in the past					
No		1869	79.3	700	75.2
Yes	1.26	488	20.7	231	24.8
Past programs participation					
No		1677	70.1	581	61.2
Yes	1.49	714	29.9	368	38.8

Note. Only the "yes" and "no" indicator responses were included in the table. The "unknown" responses for all indicators were excluded because they comprised a very small proportion of the responses. Descriptive information for the SIR-R1 risk ratings and age at assessment covariates are presented in the education /employment section of the results so this information will not be repeated here. [a]Odds ratios compare the odds of psychological drug dependence when the problem is present versus when the problem is absent. The odds ratios for the domain rating compare the odds of psychological drug dependence for each domain rating to the odds for the "none" rating.

Attitude Domain

Table C7. Significant, unconditional associations (*OR*) between Psychological Drug Dependence, the Attitude Domain Indicators and the Overall Domain Rating

		Psychologically Drug Dependent			
	Unconditional	No		Yes	
Covariate	***OR*[a]**	***n***	**%**	***n***	**%**
Domain Rating					
Asset		40	1.7	7	.7
None	2.36	898	37.4	371	39.1
Some	2.05	734	30.6	263	27.7
Considerable	2.43	728	30.3	309	32.5
Negative toward corrections					
No		1871	78.7	656	69.3
Yes	1.63	508	21.3	290	30.7
Negative towards community supervision					
No		1435	60.2	465	49.1
Yes	1.57	948	39.8	482	50.9
Negative toward rehabilitation					
No		1906	81	695	73.9
Yes	1.50	447	19	245	26.1
Employment has no value					
No		1925	80.8	688	72.7
Yes	1.58	458	19.2	258	27.3
Marital/family relations have no value					
No		2127	89.3	815	86.3
Yes	1.33	254	10.7	129	13.7
Interpersonal relations have no value					
No		2157	90.7	806	85.6
Yes	1.65	221	9.3	136	14.4
Values substance abuse					
No		1143	48.3	153	16.2
Yes	4.84	1223	51.7	792	83.8
Basic life skills have no value					
No		2156	90.1	800	84.4
Yes	1.68	237	9.9	148	15.6
Personal/emotional stability has no value					
No		2078	87.2	765	80.9
Yes	1.62	304	12.8	181	19.1
Elderly have no value					
No		2359	98.7	919	97.3
Yes	2.09	32	1.34	26	2.8
Disrespectful of personal belongings					
No		1359	56.8	347	36.6
Yes	2.28	1032	43.2	600	63.4
Disrespectful of public property					
No		1689	70.9	496	52.7
Yes	2.19	693	29.1	445	47.3

Disrespectful commercial property					
No		1526	64	363	38.5
Yes	2.84	858	36	580	61.5
Supportive of domestic violence					
No		1950	83.0	730	79.1
Yes	1.29	399	17.0	193	20.9
Supportive of instrumental violence					
No		1396	59.3	490	52.1
Yes	1.34	958	40.7	450	47.9
Lacks direction					
No		950	39.7	261	27.5
Yes	1.73	1446	60.3	687	72.5
Non-conforming					
No		850	35.6	241	25.4
Yes	1.63	1538	64.4	709	74.6

Note. Only the "yes" and "no" indicator responses were included in the table. The "unknown" responses for all indicators were excluded because they comprised a very small proportion of the total responses. Descriptive information for the SIR-R1 risk ratings and age at assessment covariates are presented in the education /employment section of the results so this information will not be repeated here. [a]Odds ratios compare the odds of psychological drug dependence when the problem is present versus when the problem is absent. The odds ratios for the domain rating compare the odds of psychological drug dependence for each domain rating to the odds for the "asset" rating.

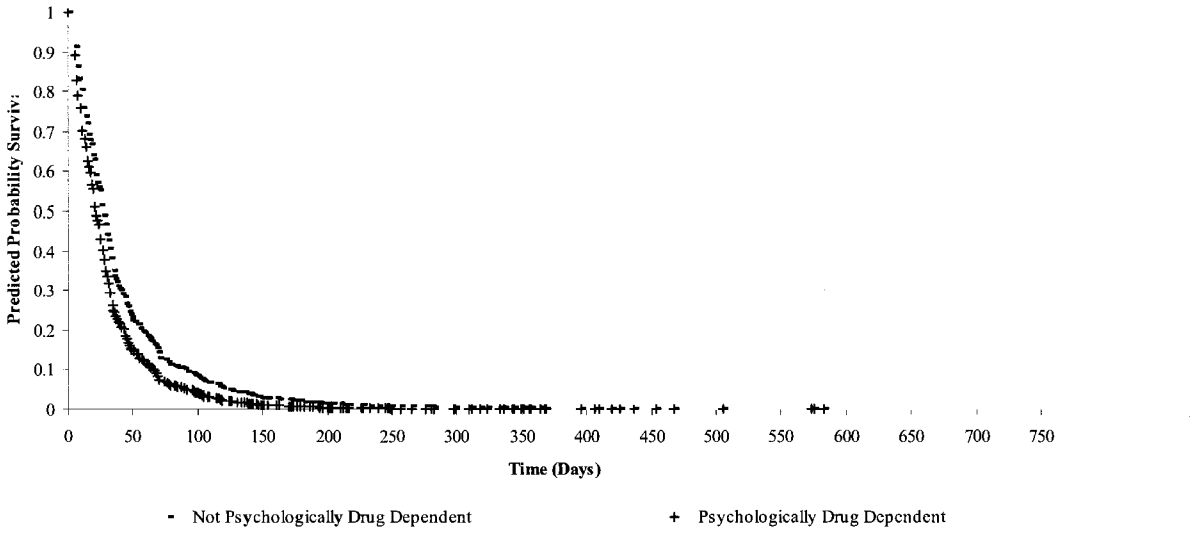
Appendix D: Unconditional Associations between the Triggers of Drug Use and Psychological Drug Dependence

Triggers of drug use	Unconditional *OR*[a]	Psychological Drug Dependence: No *n*	No %	Yes *n*	Yes %
Because of positive circumstances					
No		222	19.4	397	41.2
Yes	0.34	922	80.6	553	58.2
Because of negative affective states					
No		904	79.0	448	47.2
Yes	4.22	240	21.0	502	52.8
Because of external influence					
No		1040	90.9	724	76.2
Yes	3.12	104	9.1	226	23.8
To cope with physical pain					
No		955	83.5	561	59.0
Yes	3.50	189	16.5	389	41.0
To manage withdrawal symptoms					
No		1102	96.3	553	58.2
Yes	18.84	42	3.7	397	41.8
To test self-control					
No		1127	98.5	899	94.6
Yes	3.76	17	1.5	51	5.4
Because of boredom					
No		960	83.9	672	70.7
Yes	2.16	184	16.1	278	29.3
To lift courage					
No		1119	97.8	810	85.3
Yes	7.74	25	2.2	140	14.7

[a]Odds ratios compare the odds of psychological drug dependence when the trigger precipitated drug use during the 12 month period prior to arrest versus when the trigger was not identified as precipitating drug use.

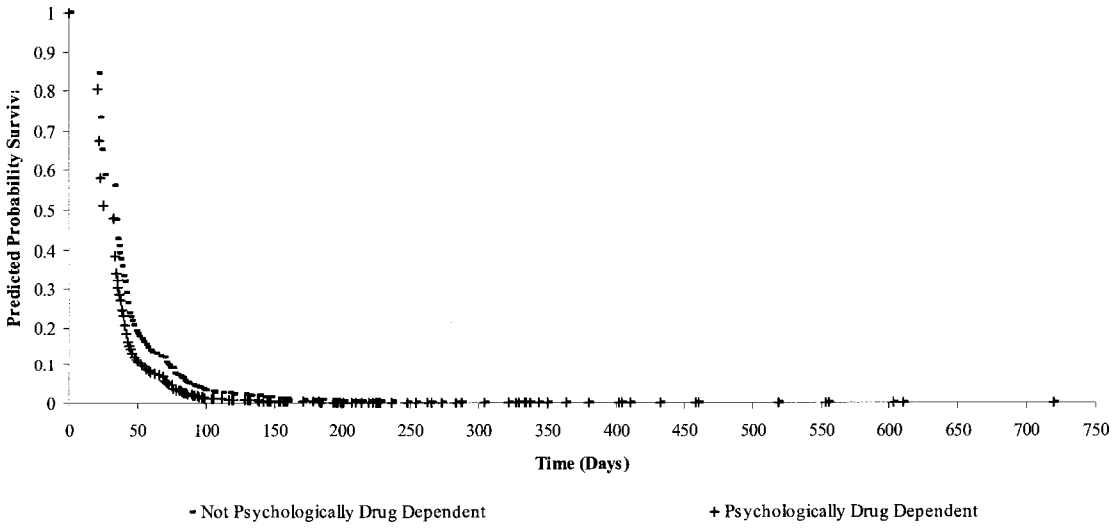
Appendix E: The Covariate-Adjusted Predicted Probabilities of Not Producing a Positive Urinalysis Result during Release

E1. The Covariate-Adjusted Predicted Probabilities of Not Producing a Positive Urinalysis Result During Release for the Psychologically Drug Dependent and the Non-Psychologically Drug Dependent Offenders (Time to event after second positive test result)



Note. All covariates in the model were set at median values. The offender was rated some need on the domains of associates/social interactions and attitude, with a fair risk rating on the SIR-R1 and no negative tests since last positive result. Observations were restricted to the second stratum (number of positives = 2).

E2. The Covariate-Adjusted Predicted Probabilities of Not Producing a Positive Urinalysis Result During Release for the Psychologically Drug Dependent and the Non-Psychologically Drug Dependent Offenders (Time to event after third positive test result)



Note. All covariates in the model were set at median values. The offender was rated some need on the domains of associates/social interactions and attitude, with a fair risk rating on the SIR-R1 and no negative tests since last positive result. . Observations were restricted to the second stratum (number of positives = 3).