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OVERDOSES, SUICIDAL BEHAVIOUR AND CLINICAL CHARACTERISTICS IN HEAVY DRUG USERS

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Anders Håkansson

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Abstract

Background: Substance use disorders and complications, such as drug overdose (OD) and suicide attempt (SA), are common among criminal justice clients.
Methods: Since 2001, the Swedish Prison and Probation Service has assessed substance-using clients with the Addiction Severity Index (ASI), a semi-structured instrument widely used to examine substance-related problems in different domains of life. This data material is based on 7,085 clients, interviewed mainly in prison (72 %) or while on probation (17 %). Compared to the entire criminal justice system, these subjects represent an oversampling of prisoners and drug users, and a slight oversampling of women (12 %). Logistic regression technique was used in the four studies for the analysis of factors associated with drug OD, SA and repeated SA, and for the analysis of primary amphetamine use compared to heroin and cocaine use.
Results: Primary and current amphetamine use was markedly more common (n=1,396) than heroin use (n=392) and cocaine use (n=119) in this population. Amphetamine users were markedly older, and more likely to be born in the Nordic countries. Compared to heroin users, amphetamine users were more likely to have heredity of alcohol problems, and more likely to report cognitive problems. The overlap in use of the three different drugs was limited. Among recent opioid users (n=1,096), OD history was reported by 55 percent. OD clients were more likely to report a history of injecting, heroin use, and use of tranquillisers, or to report SA or difficulty controlling violent behaviour. In the present data material (n=6,836), 21 percent reported a SA, which was associated with several variables: female gender, several different psychiatric symptoms, history of being abused, heredity, physical disease, alcohol misuse and severe drug use complications. 55 percent of attempters reported two or more SAs, and these clients were more likely to report physical disease, opioid (analgesic) use, delirium tremens, cognitive problems and violent behaviour, while gender and depression were not related to repeated SA.
Conclusions: Abuse of amphetamine, historically the predominating drug among heavy drug users in Sweden, is a substance use pattern relatively separated from other drugs. Drug OD, common in this setting, may possibly have a link to impulse control disturbances, in addition to known substance-related risk factors. SA, also common in this setting, appears to be associated with a large set of variables, including severe substance use complications and adverse life events.

Key words: amphetamine, heroin, cocaine, criminal justice, overdose, attempted suicide, substance use disorder, Addiction Severity Index

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To my daughter Nora

Papers in the thesis

I **Hakansson A, Schlyter F, Berglund M**
Characteristics of primary amphetamine users in Sweden: A criminal justice population examined with the Addiction Severity Index.
European Addiction Research 15, 10-18, 2009

II **Hakansson A, Schlyter F, Berglund M**
Factors associated with history of non-fatal overdose among opioid users in the Swedish criminal justice system.
Drug and Alcohol Dependence 94, 48-55, 2008

III **Hakansson A, Bradvik L, Schlyter F, Berglund M**
Factors associated with history of attempted suicide – a criminal justice population examined with the Addiction Severity Index (ASI).
Submitted.

IV **Hakansson A, Bradvik L, Schlyter F, Berglund M**
Variables associated with repeated suicide attempt in a criminal justice population. Submitted.

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1. Introduction

1.1 Substance use disorders

1.1.1 General aspects

The use of alcohol and other mood-altering substances has a long history, and many of the substances that today present major challenges to society have been used for thousands of years (for example alcohol, opiates, cannabis, and cocaine). Today, the use, abuse and dependence related to alcohol and other substances, and substance-related complications, affect large proportions of the general population worldwide (Schuckit, 1989; United Nations Office on Drugs and Crime, 2008). Substance abuse or dependence is highly prevalent in the general population, and affects a larger number of individuals than many other psychiatric disorders (Regier et al., 1990). The highest prevalence of use involves the two legal (in most countries) substances tobacco and alcohol, which induce dependence in relatively high proportions of users. Several illicit substances, and the misuse of legal pharmaceuticals such as analgesics and anxiolytics, are markedly less prevalent, but also induce dependence at relatively high rates. For alcohol and several drugs, men are generally more commonly affected by dependence than women (Anthony et al., 1994). For both nicotine dependence, alcohol abuse/dependence, and for the use of illicit substances, significant excess mortality has been demonstrated (Harris and Barraclough, 1998).

1.1.2 Definition of substance use disorders

The two dominating diagnostic systems in psychiatry are the DSM-IV-TR, from the American Psychiatric Association (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text revision, 2000), and the ICD-10 (World Health Organization, 1993). Both systems define substance dependence, whereas ‘abuse’ is defined only by DSM-IV-TR, while ICD-10 uses a definition of ‘harmful use’.

The DSM-IV-TR defines substance dependence as substance use associated with the occurrence, during one 12-month period, of any three or more of seven criteria (tolerance, withdrawal, larger intake than intended, a persistent desire to reduce intake, a large amount of time spent on activities related to the substance, giving up social, occupational or recreational activities because of substance use, and continued use despite the knowledge of physical or psychological problems caused by the substance). The ICD-10 uses principally the same criteria, listed as six items.

The DSM-IV-TR definition of substance abuse is related to the harmful consequences of substance use, and is defined as the use of a substance leading to one or more of four criteria during a 12-month period (failure to fulfil major obligations, substance use in hazardous situations such as operating a car or machinery, substance-related legal problems, or continued use despite social or interpersonal problems) in an individual who has never met the criteria of dependence. The ICD-10 defines 'harmful use' as a condition where substance use leads to physical or psychological harm, including impaired judgment or dysfunctional behaviour causing disabilities or adverse consequences for relationships, and which lasts for one month or relapses during the same year (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text revision, 2000; World Health Organization, 1993; Jaffe and Anthony, 2005).

1.1.3 Substance use internationally and in Sweden

A large variety of illicit substances, or legal substances that are misused and handled illicitly, can become subject to abuse or dependence. Misuse of legal drugs generally involves prescribed pharmaceuticals such as opioid analgesics, tranquillisers or sleeping pills that may be used by individuals without prescription, or in a non-prescribed way. Legal pharmaceuticals may be misused in clearly different settings, such as 'street abuse' of prescribed or diverted drugs, or in a 'medical' context, where patients or health care professionals with access to these pharmaceuticals may misuse them (Schuckit, 1989).

The main illicit substances used worldwide are cannabis, opiates and central nervous stimulants (mainly amphetamines and cocaine). Every year, almost 5 percent of the world's population between 15 and 64 years use an illicit substance. Around the world, cannabis is used by as many as 166 million people per year, i.e. slightly less than 4 percent of the world's population aged 15-64 years. Amphetamines are used by 0.6 percent or 25 million people (34 million including ecstasy, MDMA), cocaine by 0.4 percent or 16 million people, and heroin by 0.3 percent or 12 million people every year (16.5 million including other opiates). Despite being used by a small proportion of the population, these latter drugs are known to cause significant problems around the world (United Nations Office on Drugs and Crime, 2008).

Polydrug substance use, i.e. the use of more than one psychoactive substance, is a clinical problem attracting some attention as particularly problematic behaviour (Schuckit, 1989; Leri et al., 2003; Borges et al., 2000; Darke and Ross, 1997; Darke and Hall, 1995). During the course of a drug user's abuse history, it is common to subsequently add new substances (Kandel, 1975; Schuckit, 1989), and unless the drug user completely quits the use of his previous drugs of abuse, a

pattern of polydrug use develops. The use of two or more drugs concomitantly, or within a limited period of time, may have different explanations and purposes, including the enhancement of drug effect, or the intention of controlling the consequences of one substance (intoxication or withdrawal) by another substance (Schuckit, 1989; Leri et al., 2003). There are different theories about how polydrug use develops, and how the transfer from one substance to another occurs. It appears that nicotine and alcohol are generally the first substances used, and when a transition to illicit substances occurs, the next substance used is often cannabis, which may or may not be followed by other substances such as stimulants, hallucinogens or depressants. In this explanatory model, it would appear that heroin is considered to represent a late stage in the transition from one drug to another (Kandel, 1975; Schuckit, 1989).

Most central nervous stimulants abused can be classified as either cocaine or one of the substances referred to as amphetamine and its substituted derivates, the latter including methamphetamine, methylene-dioxy-methamphetamine (MDMA, 'ecstasy'), and methylphenidate, which share basic molecular structure (Sulzer et al., 2005), but also phenmetrazine, marketed as a slimming pill several decades ago (Bejerot, 1975). Amphetamine was first synthesized in 1887, and it was increasingly used during the twentieth century in order to keep people awake for longer periods, for example for the treatment of narcolepsy, and as a treatment for obesity due to its appetite-decreasing effect. Amphetamine intake produces euphoria, a general central nervous stimulation, an increase in locomotor activity (including stereotypies at higher doses), and decreased appetite (Seiden et al., 1993; Schuckit, 1989; Sulzer et al., 2005). Abuse of amphetamines occurred relatively early during the twentieth century, and the substance was used and propsed for a large variety of medical conditions, and it did not become a controlled drug in the United States until the 1960s (Jaffe et al., 2005).

Amphetamines have caused significant problems in many part of the world. In the United States, methamphetamine use has increased and has been spreading geographically, and methamphetamine is described as a cheaper and easily produced alternative to cocaine (Rawson et al., 2002; Meredith et al., 2005; Brecht et al., 2005). Post-war Japan has seen long-lasting epidemics of methamphetamine use (Sato, 1992), and increased methamphetamine-related problems have hit several other east-Asian countries, including for example Thailand (Farrell et al., 2002b). In recent years, Australia has seen major amphetamine- or methamphetamine-related problems (Topp et al., 2003; Baker et al., 2004). In Europe, a few countries have a large proportion of amphetamine users among treatment seeking drug users and, notably in Sweden and Finland (as described below), this drug has dominated the drugs scene (European Monitoring Centre of Drugs and Drug Addiction, 2006a; Kraus et al., 2003). MDMA ('ecstasy') is often

separated from the other substances mentioned here, but has a high prevalence of use in many parts of the world. Among other amphetamines, methamphetamine globally dominates the group in absolute numbers (United Nations Office on Drugs and Crime, 2008).

Cocaine produces principally the same effects as amphetamine (Schuckit, 1989). Although the chewing of coca leaves has a history of probably more than a thousand years, cocaine, derived from the leaves, was first isolated in the 1850s. After some attention to some real or assumed favourable pharmacological properties, the more widespread use and abuse of cocaine started in the late 19th century and the early decades of the twentieth century (Karch, 1999; Schuckit, 1989). The United States saw an important spread of cocaine abuse during the 1980s, along with the establishment of crack smoking as a new and potent route of administration (Karch, 1999), and a high frequency of co-abuse of cocaine has been seen in heroin users (Kreek, 1996; Leri et al., 2003). The use of cocaine in some European countries has been a large problem, for example in the United Kingdom and Spain (Haasen et al., 2004).

Misuse of opiates has a very long history, as opium, the natural origin of other opiates, has been known and used by man for thousands of years. Today, the category of opiates or opioids includes a large number of substances, and the misuse of these substances ranges from increasing doses of prescribed opioid analgesics to heavy compulsive street abuse of heroin. Opium addiction is well-known historically, but the abuse of opium still persists in some cultures. Morphine and codeine were isolated in the early nineteenth century, and diacetylmorphine, heroin, around 1900 (Jaffe and Strain, 2005; Schuckit, 1989). Heroin abuse constitutes a particularly severe problem in this category, and is associated with high excess mortality (Hulse et al., 1999). The United States saw a treatment-requiring heroin problem already in the 1930s, and heroin users with symptoms of addiction were found to display a very difficult clinical course with high rates of relapse after treatment (Kreek, 1996). Heroin addiction has continued to show a very severe long-term course in affected individuals, as a chronic and relapsing disorder with high mortality and other health consequences (Goldstein and Herrera, 1995; Hser et al., 2001). Subsequent to the growing problem in the United States, the first substitution treatment with opiate agonists, in this case methadone, was first documented and introduced in the mid-1960s (Dole and Nyswander, 1965).

Along with the substances cited above, usually classified as the drugs causing the most severe consequences for somatic and mental health, cannabis plays a very important role as the illicit substance most widely used in the general population. Cannabis, originating from the *cannabis sativa*, is likely to have a history of use dating back several thousand years. Its prevalence, as with other drugs, varies between countries but, in the United States, the 1970s and 1980s saw an increase in

cannabis use, with around 50 million Americans reporting having tried the substance, with very high lifetime prevalence reported by young people. The definition and establishment of a cannabis withdrawal syndrome has undergone some debate (Schuckit, 1989), and the state of withdrawal from cannabis is included as a diagnosis in the ICD-10 diagnostic system, but not in the DSM-IV-TR (World Health Organization, 1993; Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text revision, 2000).

An even more widely used substance, although legal, is of course alcohol. Alcohol is drunk on some occasion by a large majority of inhabitants in most countries in the Western world, and the number of individuals with alcohol dependence is higher than for any other substance, except tobacco. Alcohol is known to cause significant psychosocial and physical harm (Anthony et al., 1994; Schuckit, 1989).

1.1.4 History of substance use in Sweden

The Swedish drug use situation is somewhat different from that of other Western countries. Sweden saw an early introduction of amphetamine, first reported in the late 1930s, and with intravenous misuse being reported in the late 1940s. Amphetamine was classified as an illicit drug in 1944, and amphetamine continued to dominate during the post-war period, for some time along with other similar stimulant drugs such as phenmetrazine (which was introduced in the 1950s, and attracted many users), and methylphenidate. Opiates also had appeared as drugs of abuse, and morphine-type drugs were associated with significant problems in the 1950s (Bejerot, 1975).

During the 1960s, increasing attention was paid to illicit drug use in Sweden, and it was reported that stimulants presented a large problem, and that drug users admitted to inpatient rehabilitation were difficult to treat and relapsed in high numbers. A significant drug problem was also reported among criminals in Sweden during this period (Rylander, 1969). During the 1950s and 1960s, it was reported that a substantial minority of substance users were health care professionals with access to substances with abuse liability (Ettlinger and Rylander, 1965), and so the population of illicit drug users at that time may have been different from that of more recent years. One controversial chapter of the Swedish illicit drug history was the experimental permissive prescription practice introduced in 1965, where physicians freely prescribed opiates and stimulant drugs in order to replace the black market and to make addicts ‘tire’ of using drugs, an experiment that was abandoned as a failure in 1967 (Bejerot, 1975).

Opiates also caused significant problems during the 1960s, and the early 1970s saw an increase in customs seizures of opium and misuse of opiates. Morphine base replaced raw opium for a few years and, subsequently, heroin started spreading in

the country in 1974 and took the position as the main opiate abused (Bejerot, 1975; Frykholm and Gunne, 1980). Large samples of injecting opiate users were admitted for detoxification in the early 1970s along with amphetamine users (Frykholm, 1980; Frykholm and Gunne, 1980), and it was reported that the mortality rates among these opiate users were significantly higher than for amphetamine users (Frykholm, 1980). In the late 1970s, heroin was already an established drug of abuse and constituted a severe health problem (Gunne and Grönbladh, 1981), although it was reported that it was still markedly less prevalent than amphetamine in the Swedish drugs scene as a whole (Olsson et al., 1981).

While amphetamine has been dominating, the other major type of stimulant, cocaine, has been rare in the Swedish drugs scene (Haasen et al., 2004), with a past-year prevalence in the general population in the lower European range, and far below countries such as the United States, the United Kingdom, Australia, Italy and Spain (United Nations Office on Drugs and Crime, 2008). Cocaine is also rarely reported as the primary drug of treatment-seeking substance users in Sweden (European Monitoring Centre of Drugs and Drug Addiction, 2006a).

1.1.5 Amphetamine use – a unique Swedish misuse pattern

Consequently, before the introduction of heroin in Sweden, amphetamine was already an established drug of abuse. Although the use of heroin among problematic drug users has been gradually increasing (Olsson et al., 2001; Käll et al., 1996), amphetamine continued to play a major role in illicit drug use throughout the 1970s, 1980s and 1990s (Engström et al., 1991; Käll and Nilsonne, 1995; Tunving, 1988; Frykholm, 1979; Olsson et al., 1981; 2001). For example, among injecting drug users on remand in the late 1980s in Stockholm, 83 percent were classified as amphetamine injectors and 17 percent as heroin injectors (Käll and Olin, 1990). Even during recent years, amphetamine appears to be somewhat more common than opiates as a primary drug of abuse. Primary amphetamine abuse has been reported to be slightly more common than primary heroin use in out-of-treatment samples such as syringe exchange clients (Hakansson et al., 2007) and among clients entering treatment (European Monitoring Centre of Drugs and Drug Addiction, 2006a). The high proportion of primary amphetamine users in Sweden (and Finland) has been reported to stand out compared to other European countries (Kraus et al., 2003). Among treated drug users, the only European countries where the number of amphetamine users (excluding ecstasy) exceeds the number of opiate users are Sweden and the Czech Republic (and Iceland, where illicit opiates appear to be almost non-existent in the group), and Sweden is one of the countries reporting the highest amount of seizures of amphetamine in Europe (United Nations Office on Drugs and Crime, 2008). Also, the Swedish drugs scene

has been characterised not only by the high percentage of amphetamine users, but by the high percentage of injectors in the group, compared to many other countries (European Monitoring Centre of Drugs and Drug Addiction, 2006a; Tunving, 1988; National Drug Intelligence Center, 2004; Brecht et al., 2004).

At the same time, however, it must be noted that the lifetime prevalence of amphetamine use in the general population ranges between 1 and 2 percent in Sweden (European Monitoring Centre of Drugs and Drug Addiction, 2006b), far less than in a high-prevalence country such as the United Kingdom. Also, the past-year prevalence is in the order of 0.2 percent, which is in the lower range of European countries; this figure is far below countries such as the United Kingdom, the United States, Australia and New Zealand, but also lower than Norway, Denmark and Finland (United Nations Office on Drugs and Crime, 2008). Thus, while amphetamine use is not particularly common in the general population, it has played a major role among the population of heavy drug users.

The Swedish drug use pattern, with a high percentage of primary amphetamine users compared to heroin users, and notably with few cocaine users (Haasen et al., 2004; European Monitoring Centre of Drugs and Drug Addiction, 2006a; United Nations Office on Drugs and Crime, 2008), has seldom been described and discussed in the research literature, although it has been reported that primary amphetamine users have increased mortality (Tunving, 1988) and high rates of psychosocial and health problems (Hall et al., 1996; Kaye and Darke, 2000; Farrell et al., 2002a). It has, for example, been reported that amphetamine use increases the risk of several psychiatric symptoms, including hallucinations, paranoia and violent behaviour, especially associated with intravenous amphetamine use (Hall et al., 1996).

Withdrawal from amphetamine is often associated with increased appetite and sleepiness, along with dysphoria (McGregor et al., 2005). Despite the literature demonstrating significant harm associated with amphetamine abuse, specific treatment for amphetamine dependence is lacking, both for the amphetamine withdrawal syndrome (Srisurapanont et al., 2001a), and for the dependence syndrome (Srisurapanont et al., 2001b).

1.1.6 Comparative studies of clinical characteristics in substance use disorders

However, for the last few decades, opiate and stimulants have played an important role in the drugs scene of most countries for which data is available. These categories of drugs exert markedly different effects on the human body, and are therefore likely to display somewhat different clinical patterns. Despite this, in the literature there are relatively few comparisons of clinical characteristics between

users of these different drug types. Although rather limited, some research attempts to compare the course and possibilities for treatment and cure in drug users with different primary (main) drugs. In the analysis of five different studies, heroin, methamphetamine and cocaine users in California were monitored over ten years. Here, it was demonstrated that heroin users, in comparison to the other two groups, had more persistent abuse, and markedly fewer episodes of quitting or decreasing drug use (Hser et al., 2008). Other studies comparing heroin and amphetamine users have demonstrated more frequent use, higher level of dependence, psychosocial problems and criminal behaviour among heroin users, but high levels of polydrug use in both groups (although even more so among amphetamine users, Darke and Hall, 1995; Kaye and Darke, 2000). It has also been reported that the proportion of users who became dependent was higher for heroin than for cocaine and other stimulants (Anthony et al., 1994), and that heroin users spend more money on drugs than amphetamine users (Hall et al., 1993). On the other hand, the psychological and psychiatric harm associated with amphetamine use is described, and Australian data has shown that psychiatric symptoms are common among amphetamine users, and more specifically attributed to the use of the substance (Hall et al., 1996). In a comparison of the harm associated with heroin and amphetamine use respectively, Kaye and Darke found similar rates of harm in both groups, even though amphetamine users were younger and reported less frequent use. Based on this, they discussed whether amphetamine is at least as harmful, and possibly even more harmful, than heroin (Kaye and Darke, 2000).

1.1.7 Psychiatric co-morbidity in substance use disorders

There is a substantial amount of literature indicating a link between psychiatric disorders and substance use disorders. Often, this overlap of disorders is referred to as ‘co-morbidity’ or ‘dual diagnosis’ in the clinical or research assessment of substance users with a concurrent psychiatric problem.

Comorbid psychiatric problems are common among substance users (Regier et al., 1990; Schuckit, 2006; Kessler et al., 1997), and it is likely that substance-induced psychiatric symptoms account for one part of this comorbidity, while another proportion is likely to be due to primary psychiatric disorders (Schuckit, 2006). Epidemiological research has shown that the risk of substance use disorders is elevated in several psychiatric conditions, including schizophrenia, different anxiety disorders and affective disorders including depression and bipolar disorder, and antisocial personality disorder (Regier et al., 1990). More specifically, a correlation with substance use disorders has been demonstrated in several mood disorders, such as depression, dysthymia, mania, and anxiety disorders (Kushner et al., 2000) such as social phobia, simple phobia, generalised anxiety disorder, and

panic disorder with and without agoraphobia (Grant et al., 2004). Also, an association between substance use and conduct disorder has been demonstrated (Kessler et al., 1997), and antisocial personality disorder, known to be associated with substance use problems (Forrest, 1994; Regier et al., 1990), may also aggravate the prognosis in substance users (Fridell et al., 2006; 2008).

Another diagnosis frequently discussed in recent years in association with substance use disorders is Attention Deficit Hyperactivity Disorder (ADHD). ADHD is a disorder involving inattention, impulsive behaviour and hyperactivity in children, and in recent years it has been increasingly accepted that ADHD symptoms in some patients persist into adulthood (Biederman and Faraone, 2005). It has been shown that childhood ADHD is associated with subsequent alcohol and drug dependence (and several psychiatric and developmental disorders) in young adulthood (Biederman et al., 2006), and that alcohol and drug abuse is highly over-represented among patients with adult ADHD, even more so among men than among women (Rasmussen and Levander, 2008). The issue of causality between ADHD and subsequent substance use disorders has been debated, and it has been stated that the link between ADHD and substance use problems is mediated by conduct disorder (CD), and is not independent of this disorder (Disney et al., 1999). However, more recent reports have suggested an association independent of CD (Szobot et al., 2007), and this association appears to be attributed to the hyperactivity/impulsivity components of ADHD (Elkins et al., 2007).

The co-existence of a substance use disorder and a psychiatric disorder may have a complex interaction. It must be noted that, in a follow-up study of subjects diagnosed with substance-induced psychosis, a substantial proportion were found to suffer from a primary psychotic disorder after follow-up. Thus, a significant comorbidity between substance use and primary psychosis can be suspected, independent of suspected substance-induced episodes (Caton et al., 2007).

Regarding several psychiatric symptoms occurring in substance users, it can be suspected that the lifestyle during substance use, the substance in itself or substance-related problems affect their psychiatric status. Heroin users have been reported to have high rates of depressive symptoms and personal distress (Darke et al., 1994), and a higher prevalence of depression and suicidal behaviour than the general population (Darke and Ross, 2002). Increased risk of depression and suicidal behaviour has also been observed among cannabis-dependent subjects (Lynskey et al., 2004), although the literature on this association is not consistent (Moore et al., 2007). Among stimulant users, psychotic symptoms are commonly reported (Hall et al., 1996; Farrell et al., 2002a; Angrist et al., 1974), and mood disorder symptoms are commonly reported in this group (Kalechstein et al., 2000). Stimulants are highly mood-altering drugs, and the euphoria associated with drug intake has been shown to turn into dysphoria during early withdrawal (Uslaner et

al., 1999). There is substantial documentation of an association between alcohol abuse and secondary mood disorders and suicidal behaviour (Schuckit, 2006; Brady, 2006; Sher, 2006; Berglund and Öjehagen, 1998), and that alcohol use disorders can increase the risk of anxiety disorders (Kushner et al., 2000).

For some psychiatric symptoms among substance users, it is reasonable to believe that they are substance-specific and due to features of the substance itself. This is likely to be the case for psychotic symptoms related to amphetamine use (Schuckit, 2006; Angrist et al., 1974), and dysphoria during stimulant withdrawal (McGregor et al., 2005; Uslaner et al., 1999). A link between long-term cannabis use and psychosis has been much debated, as there is a correlation between the prevalence figures of these two conditions, and the literature suggests that cannabis is one risk factor of schizophrenic psychosis, although causality may be difficult to establish (Moore et al., 2007). Also, a 'depressogenic' effect of alcohol has been discussed in relation to its involvement in suicidal behaviour (Brady, 2006).

1.2 Mortality and life-threatening behaviour in drug addiction

1.2.1 General aspects

The use of illicit drugs is known to cause significant excess mortality and morbidity compared to the general population. Alcohol abuse and dependence, legal and illicit substance abuse, and nicotine use, are associated with significant excess mortality (Harris and Barraclough, 1998). Also, criminal behaviour is known to be markedly more common among substance users than in the general population (Gossop et al., 1998; 2005; Stewart et al., 2000).

There is a growing amount of scientific documentation on the diverse clinical picture and risk of disease and death for each specific type of substance. Opiates and central nervous system stimulants, for example, are substances with markedly different mental and physical effects, and causes of death are known to be different (Darke et al., 2007).

Parenteral drug use is known to cause more severe complications than other drug use, including bloodborne infections such as HIV and hepatitis C (Darke et al., 2007). The alarming spread of HIV among injecting drug users in the 1970s and 1980s added yet another aspect to the life-threatening behaviour of severe substance use (Kreek, 1996). Hepatitis C has received less attention than HIV, but constitutes a major problem due to its high prevalence among injecting drug users, and due to its long-term effect in terms of hepatic disease (Darke et al., 2007).

Intravenous injections also constitute the bulk of acute fatalities related to heroin intake (Thiblin et al., 2004).

Both heroin and stimulant abuse appear to be associated with excess mortality (Tunving, 1988; Engström et al., 1991; Fridell and Hesse, 2006; Gossop et al., 2002) and, according to the majority of studies, mortality is higher among heroin users (Bartu et al., 2004; Tunving, 1988; Engström et al., 1991; Fugelstad et al., 1997; Wahren et al., 1997). This has been shown both in studies assessing substances involved in the mechanism of acute death (Steentoft et al., 2006), and in studies assessing mortality in groups of drug users with different primary drug (Fugelstad et al., 1997; Bartu et al., 2004). For heroin users, a marked increase in mortality rates has been seen for patients discharged from substitution treatment (Fugelstad et al., 1995; Grönbladh et al., 1990).

1.2.2 Overdose in drug addiction

The difference in mortality rates between heroin users ans stimulant users is likely to be partly due to the heroin overdose syndrome, which appears to be the single most common cause of death in the group (Hulse et al., 1999; Grönbladh et al., 1990; Fugelstad et al., 1997; Goldstein and Herrera, 1995). Acute fatal intoxications with opioids are more common than with stimulants (Steentoft et al., 2006), and this is likely to be due to the respiratory depression associated with opioid (mainly heroin) intake at high doses (White and Irvine, 1999).

For non-fatal intoxications, the literature is much more extensive in addressing opiate (mainly heroin) overdoses, including their risk of respiratory depression (Darke et al., 2007), compared to other drug overdoses, although stimulant overdoses do occur (Kaye and Darke, 2004; Coffin et al., 2003). Relatively early during the history of heroin use in Sweden, a significant overdose problem was reported (Engström et al., 1982). Drug addicts commonly report a history of non-fatal overdose, with approximately 20 to 30 non-fatal overdoses for every fatal overdose among heroin users (Darke et al., 2003). The lifetime prevalence of non-fatal overdose ranges between 38 and 69 percent of opiate users in most studies (Darke et al., 2007), although lower prevalence, 23 percent (Gossop et al., 1996), and higher figures, 74 percent (Bradvik et al., 2007b), have been reported. The annual prevalence among heroin users has been reported to lie between 19 and 30 percent (Darke et al., 2003). The lifetime prevalence of non-fatal stimulant overdoses is less commonly described, but has been reported to range between 13 and 40 percent for cocaine users (Darke et al., 2007).

In recent years, a large number of studies (Brugal et al., 2002; Darke et al., 2000; 2005; Gossop et al., 1996; Dietze et al., 2005; Seal et al., 2001; McGregor et al., 1998; Bradvik et al., 2007b), including several reviews (Darke and Hall, 2003;

Darke and Zador, 1996; Darke et al., 2007; Warner-Smith et al., 2001), have documented the principal risk factors of overdose, generally among opiate (heroin) users: intravenous injection, polydrug use and concomitant intake of sedatives (mainly benzodiazepines and alcohol) along with opiates, and the lowered tolerance after a period of abstinence such as imprisonment or in opiate-free treatment. Also, it has been described that overdose is associated with previous overdose (Darke et al., 2005), and longer duration of dependence (Darke and Hall, 2003; Darke et al., 1996). Overdoses typically occur in heroin users who are not in maintenance treatment (Fugelstad et al., 1995; 1997; Brugal et al., 2005; Caplehorn et al., 1996), while sole detoxification does not decrease the risk of overdose (Darke et al., 2005). Typically, overdose patients are experienced heroin users, perhaps contrary to public belief (Warner-Smith et al., 2001). Also, social network factors have been shown to affect the risk of non-fatal overdose (Latkin et al., 2004; Tobin et al., 2007). Different studies have reported overdose patients to be either older (Tobin et al., 2007) or younger (Seal et al., 2001). Although the role of heroin purity in heroin overdose appears to be limited (Darke and Hall, 2003), it has been reported that the higher the quantity of heroin used, the greater the likelihood of overdose (Dietze et al., 2005).

1.2.3 Suicidal behaviour

In addition to psychiatric conditions appearing at greater frequency among substance users, an association between suicidal behaviour and substance use has also been demonstrated (Borges et al., 2000). Suicide is an important cause of death in the general population, accounting for an important proportion of premature deaths worldwide. Attempted suicide has been reported to occur about 10-20 times more frequently than death by suicide (Diekstra and Gulbinat, 1993), and the rates of lifetime attempted suicide, although differing significantly between countries, are reported to range from 0.5 to 5.9 percent (Bernal et al., 2007; Weissman et al., 1999; Kessler et al., 1999). Suicidal behaviour, including suicide attempts, presents a frequent and difficult challenge to clinicians in somatic and psychiatric emergency health care.

One important challenge in suicide research is the definition of suicidal behaviour, and notably the outlining of suicidal behaviour as opposed to deliberate self-inflicted harm without suicidal intent. This problem of definitions has been discussed in previous literature (Silverman et al, 2007). Here, the primary focus is on suicidal acts with the intention to die.

In general, risk factors predicting completed suicide and attempted suicide are essentially the same (Darke et al., 2007), except for gender, which demonstrates a clearly increased risk of suicide attempt in women but an increased risk of suicide

death among men (Diekstra and Gulbinat, 1993). Also, previous suicide attempt has been shown to predict subsequent completed suicide (Harris and Barraclough, 1997; Tidemalm et al., 2005). The association between suicidal behaviour and psychopathology has been demonstrated in a large number of studies. Several psychiatric disorders, such as mood disorders, psychotic disorders and substance use, have been shown to predict suicide attempt (Beautrais et al., 1996; Kessler et al., 1999). Also for completed suicide, several psychiatric disorders have been identified as predictors in a meta-analytical study: child and adolescent psychiatric disorders, eating disorders, substance use disorders, psychotic disorders, mood disorders (including depression, dysthymia and bipolar disorders), anxiety disorders such as panic disorder, adjustment disorders, personality disorder, and previous suicidal behaviour (Harris and Barraclough, 1997).

However, several other factors have been shown to affect suicidal behaviour. The stress-diathesis model stipulates that the combination of state and trait factors predict suicidal behaviour. This may include a combination of psychiatric diagnosis and such factors as aggression and impulsivity (Mann et al., 1999). Childhood abuse and history of other adverse childhood experiences have been shown to increase the risk of future suicide attempt, and this increased risk appears to be mediated partly by depression and substance use (Dube et al., 2001). In neurobiological research, the role of serotonergic dysfunction in suicidal behaviour has been suggested (Mann and Currier, 2007). It has also been suggested that, apart from the predictive value of psychiatric disorders, a “suicidal syndrome” may exist, predisposing for suicidal behaviour independent of these disorders (Ahrens and Linden, 1996). Also, genetic factors have been discussed due to the increased risk of suicidal behaviour and completed suicide in individuals with a family history of suicide (Roy et al., 1997; Runeson and Asberg, 2003).

Several studies have demonstrated a link between substance use disorders and suicidal behaviour (Harris and Barraclough, 1997; Wilcox et al., 2004; Borges et al., 2000; Petronis et al., 1990; Darke et al., 2004; Rossow and Lauritzen, 1999; 2001; Beautrais et al., 1996; Roy et al., 1990; Roy, 2003). More specifically, among heroin users, an association between recent overdose and recent suicide attempt has been demonstrated (Darke et al., 2004). The association between suicide death and drug-specific substance use problems has most frequently been demonstrated for alcohol and opioid use disorders, and a link between suicide and mixed drug use or intravenous drug use is also established. However, specific effects of cannabis or stimulants have not received the same attention in previous research (Harris and Barraclough, 1997; Wilcox et al., 2004).

In the assessment of suicidality in substance users, it is noteworthy that many of the known risk factors of suicidal behaviour are highly prevalent among groups of substance users, for example among heroin users. Although risk factors for

suicidality appear to be essentially the same in this group as in the general population, the rates of suicide and the rates of the risk factors predicting it are markedly higher in this group (Darke and Ross, 2002).

1.3 Substance use disorders and criminal justice populations

1.3.1 Rate and clinical characteristics

A large proportion of drug users commit crimes. This includes several categories of criminal acts, including property crimes, drug-related crimes and violence (Fridell et al., 2008). The most common category of criminal offences committed by drug users are acquisitive crimes (mainly shoplifting), consistent with public belief that many crimes are committed in order to obtain money for drugs, and heroin use has been demonstrated to be highly associated with high rates of crime (Stewart et al., 2000). Also, it has been shown that acquisitive crimes decrease markedly among drug users after treatment (Gossop et al., 2005), and a substantial proportion of offences committed by drug users are related to the actual handling of drugs, for example drug selling (Stewart et al., 2000). Violence is markedly less common than acquisitive crimes (Gossop et al., 2005) but, on the other hand, a substantial proportion of violent crimes are committed by individuals with a diagnosis of alcohol or drug misuse (Grann and Fazel, 2004), and symptoms of substance abuse significantly increase the risk of violent offending (Steadman et al., 1998). Also, earlier-onset substance abuse has been seen to predict worse outcome in violent offenders (Gustavson et al., 2007).

Substance use disorders are known to be highly prevalent in criminal justice populations and in studies assessing them (Teplin et al., 1996; Fazel et al., 2006; Gunter et al., 2008; Rotily et al., 2001; Boys et al., 2002). In a review of thirteen studies from four industrialised countries, alcohol abuse or dependence was diagnosed in between 18 and 30 percent of male prisoners and between 10 and 24 percent of female prisoners, while drug abuse/dependence was present in 10-48 percent of men and 30-60 percent of women. While alcohol and drug use disorders with this prevalence are obviously more common in prison populations than in the general population, it was also concluded that the overrepresentation is even stronger for drugs than for alcohol, and stronger for women (Fazel et al., 2006). Data from the prison system of Iowa showed substance use disorders in 90 percent of patients, with three-quarters of prisoners having a drug use disorder (Gunter et al., 2008). A substantial proportion of prisoners report a history of injection drug use (Rotily et al., 2001). The link between substance misuse and criminal

behaviour has been well documented in the literature and, in many settings (such as in Sweden), the use, possession or selling of illicit drugs are criminal activities *per se*, further increasing the proportion of substance misusers in prison samples. Given the high prevalence of substance use among criminals, the situation where clients are taken into custody has been described as a possible treatment opportunity for substance use disorders (Brooke et al., 1998).

Sweden is no exception to the close association between substance use and criminal justice populations. Among clients entering the Swedish criminal justice system, the use of illicit substances is common, and has been increasing. Among clients sentenced to prison during 2006, 61 percent were reported to abuse illicit drugs, while the proportion of illicit drug abusers was 47 percent among clients starting probation. In 38 percent of clients admitted to prison in 2006, the crime committed was a drug crime (Swedish Prison and Probation Service, 2007a; 2007b).

In-prison use of illicit substances is an important problem, which has been addressed in international literature, for example in studies from British prisons (Boys et al., 2002; Strang et al., 2006). It has been reported that a significant proportion of prisoners in many countries inject drugs in prison at some time, and that a substantial minority of clients in some settings even initiate injection drug use in prison, also in a small sample assessed in a Swedish prison (Rotily et al., 2001). More recent data from the Swedish Prison and Probation Service (2007b) reports relatively low frequencies of positive urinalysis during 2006. Every client was tested with urinalysis once every eighteenth day on average, and 75 percent of urinalyses taken were random tests. Among these random tests, 3.2 percent were positive (a slight decline since 2004, when 4.0 percent of tests were positive). Among tests taken on the grounds of suspicion, 31 percent were positive (compared to 39 percent in 2004). The drugs most commonly found in prisons are cannabis (55 percent), benzodiazepines (31 percent), stimulants (25 percent, mainly amphetamine) and opiates (9 percent). Cocaine was revealed in 1 percent of positive urinalyses.

Although a substantial amount of psychiatric research in Sweden has assessed prison populations or populations of offenders (Levander et al., 1997; Dalteg et al., 1998; Hiscoke et al., 2003; Gustavson et al., 2007), research literature contains little about substance use relating to Swedish inmates. There is, as expected, some data indicating that the proportion of substance abusers in the criminal justice population is high (Berman et al., 2004; Levander et al., 1997) and, in a sample of 103 clients, alcohol, cannabis and stimulants were the dominating substances (Levander et al., 1997). However, there appears to be a paucity of internationally published research reports on the prevalence of the use of different illicit drugs in the Swedish prison system (European Monitoring Centre of Drugs and Drug

Addiction, 2008). To the best of the author's knowledge, there is no internationally published literature describing the drugs scene of Swedish criminals in recent years, except for a European multicentre study that instead focused on HIV risk behaviour, including injection drug use, and where the substances misused were not specified (Rotily et al., 2001). This is somewhat surprising, given the assumingly high number of drug users in Swedish prisons, and the risk of withdrawal symptoms at intake, drug craving and clandestine substance use in custody, and the complications associated with substance use, including the risk of drugs-related death after a period of abstinence in prison (Binswanger et al., 2007; Farrell and Marsden, 2008; Seaman et al., 1998; Seymour et al., 2000; Bird and Hutchinson, 2003). Also, given the long history of amphetamine abuse in Sweden, it can be assumed that the misuse pattern of Swedish criminals displays characteristics deserving an international comparison. In recent years, and mostly since the late 1990s, the criminal justice system of Sweden has more strongly focused on substance use disorders of its clients (Andrén et al., 2001; Tengvald et al., 2004), including more thorough assessment of substance use-related problems (see the Methods section below).

1.3.2 Psychiatric co-morbidity

The recent decades have seen a growing amount of literature analysing psychiatric characteristics of criminal justice clients, and it is generally agreed that psychiatric disorders are considerably more prevalent among criminal justice clients than in the general population, and that there is need for psychiatric assessment and treatment among prisoners (Lamb and Weinberger, 1998; Fazel and Danesh, 2002; Andersen, 2004). Therefore, criminal justice populations are of great interest to research assessing psychiatric characteristics of substance use disorders.

Some psychiatric disorders have been repeatedly reported to be over-represented in criminal justice populations. These disorders include major depression, personality disorders (notably antisocial personality disorder), substance use disorders, anxiety disorders, ADHD, and even psychotic disorders may be over-represented in this type of populations (Fazel and Danesh, 2002; Andersen, 2004; Gunter et al., 2008; Teplin, 1990; Teplin et al., 1996; Forrest, 1994; Butler et al., 2005; 2006; Brugha et al., 2005).

However, it must also be taken into consideration that criminals with severe and obvious psychiatric disturbances are likely to become subject to forensic psychiatric assessment rather than regular custody, and some of these clients may therefore not appear in prison studies of convicted criminals. A review of 62 studies, involving a total of 23,000 prisoners, found a prevalence of psychotic disorders in four percent of male and female prisoners, major depression in 10

percent of men and 12 percent of women, personality disorder in 65 percent of men and 42 percent of women, and antisocial personality disorders specifically in 47 percent of men and 21 percent of women (Fazel and Danesh, 2002). In a study by Brugha and co-workers, history of psychosis was markedly more prevalent among prisoners than in the general population, and only a minority of these cases were attributed to substance use (Brugha et al., 2005).

Criminal justice populations are usually predominantly male, and so research assessments in these populations usually include a large majority of males. However, the high prevalence of psychiatric disorders is also true for women (Teplin et al., 1996), and there is data indicating that female prisoners may have more severe psychiatric characteristics than male prisoners (Gunn, 2000; Maden et al., 1994; Butler et al., 2005), higher drugs-related mortality, all-cause mortality and even mortality from suicide (Kariminia et al., 2007), higher excess mortality after release from prison (Farrell and Marsden, 2008), and possibly higher rates of substance misuse (Maden et al., 1994). This may reflect the assumption that women in general are less prone to commit crimes, and that women who do engage in criminal activity may therefore have a more severe psychological profile than their male counterparts (Andersen, 2004).

The personality disorder attracting the most attention in prison studies is the antisocial personality disorder, which includes the somewhat narrower concept of psychopathy (Hare et al., 1990; Forrest, 1994; Gunter et al., 2008). Antisocial personality disorder is reported to be more prevalent among men than among women. While the lifetime prevalence is reported to be around 2-3 percent in the general American population, it is consequently considerably higher in prison populations, and its overrepresentation among substance users is also well described (Forrest, 1994). It has been reported that as many as 50-75 percent of US inmates may be diagnosed with this disorder. These numbers appear to be lower in Europe, but still the prevalence is many times higher than in the general population (Andersen, 2004). This may not be surprising, as criminal behaviour is actually one of the diagnostic criteria of antisocial personality disorder. Data also suggests that symptoms of antisocial personality disorder in subjects with criminal behaviour increase the risk of criminal recidivism (Hiscoke et al., 2003) and incarceration in drug users (Fridell et al., 2006). However, it is also noteworthy that several psychological expressions during current severe substance abuse, such as impulsivity or aggression, may mimic the diagnostic criteria of personality disorders, including the antisocial personality disorder (Forrest, 1994).

The Swedish prison population does not appear to be an exception to the high rates of psychiatric morbidity reported above. Research from a sample of Swedish inmates reported high rates of anxiety and mood disorder symptoms, and high rates of several personality disorders. Fifty-one percent fulfilled criteria of a personality

disorder from cluster A, 58 percent from cluster B, and 42 percent from cluster C. The single most common personality disorders were borderline (39 percent), narcissistic (38 percent), paranoid (36 percent) and antisocial (33 percent) personality disorders (Levander et al., 1997).

Adult ADHD (Attention Deficit Hyperactivity Disorder) has also been found in high numbers in criminal justice populations. The prevalence of adult ADHD in the general population has been found to be 4.4 percent in a national household survey in the United States, with a somewhat higher prevalence among men than among women (5.4 vs 3.2 percent, Kessler et al., 2006). A cross-national study of ten countries found somewhat different rates in different countries, varying from 1.2 percent to 7.3 percent of the adult population, with a total prevalence of 3.4 percent, again higher among men (4.1 percent) than among women (2.7 percent, Fayyad et al., 2007). The ADHD prevalence reported from prison populations stands in sharp contrast to the general population (Rasmussen et al., 2001). A prevalence of 45 percent has been reported from young male inmates (Rösler et al., 2004), while the prevalence among their female counterparts may be lower but still higher than in the general population (Rösler et al., 2008). Consistent with this, recent data has shown that criminal behaviour is common in adult ADHD, and that it is markedly more common among male ADHD patients than among female patients (Rasmussen and Levander, 2008).

Here too, Sweden is no exception. A high frequency of ADHD was diagnosed in a Swedish sample, where more than half of the clients retrospectively met diagnostic criteria of ADHD (Dalteg et al., 1998).

1.3.3 Suicidal behaviour and drug overdoses

Criminal justice clients, including clients being discharged into the community, have been shown to be at risk of two of the major consequences of drug abuse and/or mental illness; fatal drug overdose and completed suicide. Inmates are more likely to die from suicide, either while still in custody or after release (Kariminia et al., 2007), or to have a history of suicidal ideation or attempted suicide (Jenkins et al., 2005). In-prison death from suicide is a common cause of death among prisoners (Fazel et al., 2005; Sattar, 2003), including prisoners in Denmark (Christiansen and Gregersen, 1999) and Finland (Joukamaa, 1997). In the Swedish criminal justice system, it has been reported that several completed or attempted suicides occur annually (Swedish Prison and Probation Service, 2008), and suicidal behaviour in custody has received much public attention in Sweden recently.

It has also been demonstrated that suicide rates are very high among recently released prisoners compared to the general population (Pratt et al., 2006), and total mortality rates are very high after prison release, with remarkable risk during the

first two weeks (Farrell and Marsden, 2008). The high prevalence of lifetime and in-custody suicidal behaviour, and the high rates of post-release suicide, enhances the need for suicide risk assessment, at intake into prison and prior to discharge into the community. In addition, prison clients are at markedly higher risk of future death by drug overdose in prospective follow-up (Kariminia et al., 2007). The first weeks following discharge from prison have been demonstrated as a risk situation for fatal overdose (Seaman et al., 1998; Seymour et al., 2000), indicating the importance of risk assessment and intervention in substance-dependent inmates prior to release.

2. Aim of the thesis

The substance abuse pattern of Swedish criminal justice clients is insufficiently understood. The Swedish pattern of amphetamine use is poorly described in research literature and needs further assessment, including comparison with other drugs of abuse. Clients in the criminal justice system, and substance users in particular, are known to have a high prevalence of life-threatening behaviour such as drug overdoses and suicide attempts. Knowing this, the criminal justice system constitutes an opportunity of intervention, and due to the chronic and relapsing nature of substance use disorders, and the high problem load associated with overdoses and suicidal behaviour, it appears to be crucial to identify and intervene in high-risk clients before discharge into the community. Especially among clients who already have a history of attempted suicide, the risk of subsequent repeated fatal or non-fatal suicidal behaviour is important to assess. Given these assumptions, the present thesis assessed a large population of criminal justice clients with the intention to:

- Examine the substance use situation in the Swedish criminal justice system, analyse clinical characteristics of primary amphetamine users, and compare these to clients reporting a primary abuse of heroin or cocaine;
- Examine the lifetime prevalence of overdose among clients with recent opioid use, and characteristics associated with a history of overdose;
- Examine the lifetime prevalence of attempted suicide in the whole sample of criminal justice clients, and factors associated with a history of suicide attempt; and to
- Analyse, among clients reporting a history of suicide attempt, factors associated with reporting repeated attempt.

3. Methods and material

3.1 The Swedish Prison and Probation Service: The ASI project

Along with social authorities and the health care system, the prison and probation system handles a large number of substance users and, due to the obvious involuntary nature of clients' involvement with criminal justice, the clients entering the system often may not be in treatment or actively seeking treatment. Recent years have seen increased expectations for the criminal justice system to carry out not only its correctional and controlling function, but also to provide treatment for substance use disorders.

During the 1990s, the Swedish Prison and Probation Service initiated the development of an evidence-based framework of assessment of treatment needs, treatment planning and follow-up. For the instrumental component of this work, the Addiction Severity Index (ASI) was chosen and further developed as an adaptation to this setting. The ASI is an interview instrument for the assessment of an individual's substance use and substance-related problems within several aspects of life (see next section). The ASI had previously been used in a similar setting in the mid-1990s for a treatment project assessing clients sentenced for driving under the influence of alcohol (the Kapubra Project, Andrén et al., 2001). In this criminal justice setting, for the assessment of illicit drug users, the ASI was now complemented with an assessment tool called MAPS (Monitoring Area and Phase System), aiming to assess a client's position regarding motivation for substance use treatment. In 2001, the Swedish Prison and Probation Service decided to implement the ASI/MAPS assessment in a large number of clients, and a statistical database was established for the documentation of assessment results. During the first years following the top-down implementation of this assessment method, until 2004, at least 500 interviewers were trained, and a large number of criminal justice clients were assessed with the ASI instrument (Tengvald et al., 2004). Until August 2006, when data from the database was coded, blinded and extracted from the database for the present research project, 7,085 individuals had been assessed in 7,493 interviews. The present studies on this data material were approved by the Ethics Committee, Lund University.

The ASI assessment is carried out in different types of correctional facilities and, in some cases, the assessment is carried out while the client is on remand. Since 2002, the Swedish Prison and Probation Service has designed special treatment units for the treatment of drug dependence, or for motivation-enhancing treatment (Swedish

Prison and Probation Service, 2007b). The procedure of assessing criminal justice clients with the ASI is spreading, with a growing number of facilities using this instrument. Overall, in the present database, clients admitted or referred to treatment units due to substance use problems are oversampled, and illicit drugs users are oversampled, compared to alcohol misusers.

In order to estimate the attrition rate, 85 interviewers, who had conducted at least 30 interviews, were contacted by mail with a short questionnaire about their number of ASI interviews and the number of clients who denied or refused the interview. Thirty-nine interviewers responded, and these interviewers had carried out a total of approximately 4,050 interviews (around 57 percent of the database), and estimated that approximately 225 clients had refused. This gives an attrition rate of around 5-6 percent. Common reasons for refusal were suspicion about how collected information would be used, denial of problems, unwillingness to admit or treat substance use and other problems, current psychiatric problems, already interviewed, tiredness of interviews and evaluations, or simply refusal without a reason. The low attrition rate may, of course, be affected by the fact that the clients assessed were in a controlled environment.

The total number of clients admitted to the criminal justice system during 2006 was 10,428 for custodial sentences (starting on remand or in prison), and 12,982 for probation. Among clients starting probation, 6,035 had been conditionally released from prison (Table 1). On average, the number of clients on remand was 1,928, most of who were on pre-trial remand or waiting for a prison sentence to be effected (Swedish Prison and Probation Service, 2007a).

Table 1
Number of clients in different types of correctional institutions (Swedish Prison and Probation Service, 2007a)

Total number of clients starting custodial sentences during 2006 (prison or remand)	10,428
Conditionally released from prison to probation	6,035
Started probation directly during 2006	6,947
Total number of clients starting probation during 2006	12,982
Clients in prison in October 2006	5,533

In 2006, 29 percent of probation clients were primarily drug abusers, another 18 percent were mixed alcohol and drug abusers, and 19 percent only alcohol abusers. Among prisoners in 2006, 36 percent were classified as drug abusers, 19 percent as mixed abusers, and 11 percent as alcohol abusers (Swedish Prison and Probation Service, 2007b). In the data material studied here, among prisoners, a primary drug problem was reported by 67 percent, a combined drug and alcohol problem by 6 percent, and a primary alcohol problem by 11 percent. In probation, these figures were 45 percent, 3 percent and 21 percent, respectively. In the entire data material, 62 percent reported drugs to be their main problem, whereas 5 percent reported a main problem of drugs and alcohol combined, and 13 percent reported a primary alcohol problem (Table 5). Thus, the present data material appears to be an oversampling of drug users.

In the studied data material, a clear majority of clients were assessed in prison (Table 2). Thus, the present data material is an oversampling of prisoners as opposed to non-custodial care or remand. This is likely to be reflected by the type of offences committed by the substance users for which the ASI project is intended.

Table 2
Type of correctional institution where clients were assessed with the ASI (ASI database, 2001-2006)

Number of clients interviewed	7,085
Interviewed	
In prison	5,122 (72%)
In probation	1,189 (17%)
On remand	386 (5%)
In institution treatment	142 (2%)
Other	246 (3%)

For the assessment of the representativity of the material, the main crimes reported by the clients in the ASI database were compared to the main crime of clients in the whole system. In this comparison, prison clients in the ASI material were compared to clients in prison in the whole system in 2006, and clients who were on some type of probation when interviewed (sentenced to probation or conditionally released from prison) have been compared to the total of clients entering probation in the criminal justice system during 2006. In the ASI crime, an additional domain used as a part of the ASI/MAPS interview, the main type of crime is coded with a letter from ‘a’ to ‘p’. Therefore, unfortunately, there is a risk of confusion between the crime coded ‘n’ (meaning ‘other violent crime’) and N (the common ASI code

meaning that a question is not applicable and cannot be answered). Because of this, in 12 percent of the clients assessed with the ASI, it cannot be established whether their answer is 'other violent crime' or if it is not applicable and therefore missing. In the present data material, the data on the main crime reported therefore varies depending on how the answer 'N' is interpreted. These percentages are compared to the main crime reported from the whole prison and probation service, for prisoners and probationers, respectively (Table 3).

Table 3
Main crime reported by clients in the ASI database.
A comparison with the main crime reported for the whole prison and probation system (Swedish Prison and Probation Service, 2007a).

The Swedish Prison and Probation Service 2006		**The ASI database 2001-2006**	
Clients serving prison sentence October 2006 (n = 5,533)		*Clients interviewed in prison ¤ (n = 5,122)*	
Drug crime	30%	Drug crime	37-44%
Violent crime	25%	Violent crime	8-22%
Acquisitive (incl robbery)	17%	Acquisitive (incl violence*)	24-28%
Fraud	5%	Fraud	4-5%
DUI**	3%	DUI**	4%
Clients entering probation during 2006 (n = 12,982)		*Clients interviewed on probation¤ (n = 1,189)*	
Drug crime	23%	Drug crime	27-31%
Violent crime	20%	Violent crime	6-18%
Acquisitive (incl robbery)	22%	Acquisitive (incl violence*)	29-34%
Fraud	7%	Fraud	4%
DUI**	10%	DUI**	12-13%

¤ Frequencies of crimes in the ASI material may vary depending on the interpretation of the item 'N' (see text)
* This includes property crime involving violence
** DUI = Driving under the influence of alcohol or drugs

Within the statistics of the whole criminal justice system, the proportions of drug crime and violent crime are somewhat higher in prison than in probation, while acquisitive crime and DUI (driving under the influence of alcohol or drugs) are more common in probation. The present material is an oversampling of prisoners compared with probation clients. Prison clients of the database were compared to prison clients of the whole criminal justice system, and probation clients of the database were compared to probation clients of the whole system. The rates of drug

crime and acquisitive crime among prisoners were higher in the study material. For probation clients, drug crime and acquisitive crime were also slightly more common in the present database, while fraud was less common. In both groups, violent crime was somewhat less common in the study material than in the whole criminal justice system (Table 3).

The bulk of clients are male. Twelve percent of clients starting probation and five percent of prisoners in the criminal justice system are women (Swedish Prison and Probation Service, 2007a). In the present study material, 17 percent of probation clients and 11 percent of prisoners were women (but, as prisoners were oversampled in this material, the total percentage of women was 12 percent). Thus, the present data material, primarily assessing substance users, oversamples female clients.

It appears that the study material is an oversampling of clients whose main type of crime is a drug crime or an acquisitive crime, which is reasonable given the intention to recruit drug users, who are likely to commit these types of crime. Also, the main type of crime registered by the Swedish Prison and Probation Service may not always be the same as the main problem reported by the client and registered by the ASI interviewer. Although the study sample may not be fully generalisable to the whole criminal justice population, it may still be representative of the population of substance users in the criminal justice setting.

3.2 The Addiction Severity Index (ASI)

The Addiction Severity Index (ASI) was developed as an instrument for the assessment of substance use and substance-related problems. The ASI is an interview instrument that comprises questions within several domains: substance use (alcohol and drugs respectively), physical status, psychiatric status, family and social relationships, employment, and legal status. The first version was developed in the United States as a research tool for use with substance users (McLellan et al., 1980), and a fifth version was published twelve years later (McLellan et al., 1992). Based on the fifth American version, a version was adapted to European conditions, the EuropASI (Kokkevi and Hartgers, 1995; Broekaert et al., 2002). The ASI is a semi-structured interview that takes approximately one hour, and a two-day training programme is generally required for interviewers.

The ASI has been translated into many languages, including a Swedish standard version (Andréasson et al., 2003). A version has also been developed for female clients, with some modifications, in order to better address issues particularly relevant to female misusers, who are generally a minority of substance users. The

female version, ASI-F, was developed in the United States (Friedman and Brown, 1997). In the preparation of ASI examinations in the criminal justice system, the need for a new version of the instrument was perceived, and the ASI-X was developed. The ASI-X ('X' for extended) is based on the EuropASI, but several variables have been added, many of them from the ASI-F. Among the variables added are homelessness during the past 30 days, data about the client's children and their situation (including alcohol and drug problems, psychiatric problems and criminality), tuberculosis, sexually transmitted diseases and other genital diseases, AIDS, current tobacco use, eating disorders, current emotional problems due to previous emotional, physical or sexual abuse, and family history of criminality. Also, clients are asked about whether they feel loved or cared about. Also, the question about hepatitis is more detailed, asking specifically about hepatitis B and C (Öberg et al., 1999; Sallmén and Öberg, 2002). With these additional variables, but with the base of previous versions, the ASI-X was considered relevant, both to the large majority of male criminal justice clients and to the smaller group of women in the population.

The composite scores are a construct that can be calculated from a number of chosen variables from each domain, and gives a severity assessment of the client's problem in the domain. For each domain, one composite score is calculated, and also enables a comparison at follow-up (McLellan et al., 1980; 1992). The ASI also contains an interviewer rating for each domain, where the interviewer estimates the client's need for help. The composite scores have received some criticism (Jansson, 2001), but have shown relatively stable inter-rater reliability, whereas this has been more variable for the more subjective severity rating. The test-retest variability of the composite score has also varied. Internal consistency of the composite scores has differed markedly between domains (Mäkelä, 2004). In the present studies, the composite scores and the severity ratings were not used, and instead, separate items from the ASI interview were analysed.

3.3 Statistical methods

The studies included in the present thesis all include a large number of variables from different domains of the ASI. Also, problem variables in different domains are likely to be interrelated within and between domains, and so multivariate statistics were used in all four studies in order to identify variables independently related to the dependent variable. Logistic regression is the technique used in each of the included studies. Logistic regression analysis is used for dichotomous dependent variables (overdose or not, suicide attempt or not, repeated suicide attempt or not, major repetition or minor repetition, amphetamine use compared to

heroin use or amphetamine use compared to cocaine use), whereas independent variables can take any form (Tabachnick and Fidell, 2007). Here, in the processing of data, stepwise forward logistic regression was used, a technique where one variable is entered into the model on each step, until no more independent variable adds to the explanatory value of the model, and including only variables significantly associated with the dependent variable.

Here, variables considered relevant to the analysis were compared in a binary model, comparing the two groups according to the dependent variable. Variables significantly separating the two groups in the binary analysis ($p<0.05$) were entered in the logistic regression analysis. In the binary analysis, variables were adjusted for age if they were expressed as a lifetime history (such as history of overdose, history of depression), or if they described physical illness (such as chronic medical condition, medication for physical illness, hepatitis). Significant variables from the binary analysis were then entered in one logistic regression analysis for each ASI domain, in order to examine which variables in each domain were independently associated with the dependent variable. Variables independently associated with the dependent variables were then entered in a general logistic regression model. All regression analyses were adjusted for age (and, in the second paper, also for country of birth). The result of a logistic regression analysis, the relationship between each analysed variable and the dependent variable, is expressed as an odds ratio (OR). An association was considered significant if the OR was significantly separated from 1, applying a 95 percent confidence interval.

In the logistic regression analyses, we calculated the contribution of each domain to the total variance between the two groups. Here, we used Nagelkerke's R Square (Nagelkerke, 1991). This measure enables a comparison between different groups of independent variables, expressing their relative contribution to the variance, for example between overdose clients and clients without overdose. The stepwise logistic regression (forward or backward) technique is particularly used for the generation of hypotheses based on data material. The method of comparing variables with a logistic regression analysis within each domain, a type of sequential logistic regression, aims to examine to what extent the model is improved when adding further variables from other domains (Tabachnick and Fidell, 2007). It has been used in previous research in the substance use area, in research with a number of independent variables in different categories (Bodin and Romelsjö, 2007).

Rates of missing data in the present four studies were generally low, with some exceptions. Previous criminal charges were missing in approximately five percent of cases in the second study. Heredity data, analysed in all four papers, was missing in about six percent for maternal heredity, and in about twice as many cases for paternal heredity. It can be assumed that this difference between maternal

and paternal heredity data is partly explained by the proportion of subjects who never knew their father, or who did not know him sufficiently to provide the information asked for.

For most variables where rates of missing data were low, it was assumed that data was missing because the question was not relevant or did not apply to the client, and it was therefore coded ‘0’ (absent). However, for tobacco use and being born in the Nordic countries, missing cases were coded ‘1’ (present), like the large majority, as these two variables were affirmed by a large majority of subjects. Sensitivity analyses were carried out for heredity variables in all four studies, and, in the second paper, for criminal charges (and there, also for country of birth), coding this missing data the opposite way (‘1’ instead of ‘0’, and for country of birth, ‘0’ instead of ‘1’). Consequently, in the sensitivity analysis, it was assumed that *all* cases with missing heredity variables had all types of heredity missing, that *all* had previous criminal charges, and that *none* of them were born in the Nordic countries.

3.4 Sample and measurements

Clients included in the present studies have been interviewed with the ASI within the Swedish Prison and Probation Service where, at intake into the system, a substance use problem was reported or suspected. The implementation of the ASI/MAPS assessment has been gradually extended over the study period, involving more and more correctional facilities in the prison or probation system. In general, ASI assessments have been systematically carried out for clients who enter specialised treatment units for substance use disorders, or who were subject to referral to such units. The ASI/MAPS project has put some priority on drug users, who may be somewhat more likely to have undergone the ASI assessment than alcohol abusers. In most cases, clients were assessed in prison or in other types of correctional institutions, i.e. after conviction. However, for a smaller number of subjects, the assessment was carried out on remand, in order to assess the client’s treatment needs and for referral. Many of the clients interviewed on remand may have been assessed prior to the trial and were therefore not convicted at that time.

The data on which the following studies are based was extracted from the ASI database of the Swedish Prison and Probation Service in August 2006. Name, date of birth, date of the interview and the client’s social security number were coded before the extraction of data, and thus blinded to the author. Between 2001 and August 2006, 7,493 interviews had been carried out, with 7,085 unique clients. In

cases where a client was assessed twice or more, this was generally because of relapse and re-incarceration during the study period. In these cases, the first interview was used in the present studies. Of the interviewees, 124 of the subjects were actually assessed with the ADAD (Adolescent Drug Abuse Diagnosis, Friedman and Utada, 1989), an instrument including several of the ASI variables, adapted for use with adolescent clients. Inclusion criteria differed between studies, as described below. In all four papers, clients were excluded from the analyses if the interviewer judged that the answers in any one of the ASI domains were severely distorted by the client's misrepresentation or inability to understand (this applied to 11 subjects in the entire study population, 0.2 percent). Also, subjects were excluded from the analysis if they were considered unable to go through it (five subjects), and if they refused the interview (18 subjects) or interrupted the interview (16 subjects) where a substantial part of the included variables were lacking. In the third and fourth papers, ADAD interviews were excluded (Table 4).

Table 4
Overview of data material - Criminal justice clients examined 2001-2006
Exclusion criteria

Interviewed		
Once	6,691	94%
More than once	394	6%
Type of interview		
ASI-X	6,961	98%
ADAD	124	2%
Special		
Terminated	16	0%
Refused	18	0%
Unable to respond	5	0%
Answers considered severely distorted		
by the client's misrepresentation	7	0%
by the client's inability to understand	4	0%

Compared to the statistics of the criminal justice system as a whole (Swedish Prison and Probation Service, 2007b), the present data material involves an oversampling of drug abusers as opposed to alcohol abusers (Table 5). Also, compared to the distribution of criminal justice clients in prison and non-custodial interventions (Swedish Prison and Probation Service, 2007a), prison clients are oversampled here (Tables 1 and 2).

Table 5
Overview of data material - Criminal justice clients examined 2001-2006

Gender		
Male	6,263	88%
Female	822	12%
Mean age	32.8 yrs	
Urban residence		
Large city (>100,000 inhabitants)	3,172	45%
Medium-size town (10,000-100,000 inhabitants)	2,768	39%
Minor town (<10,000 inhabitants)	996	14%
Missing	149	2%
Country of birth		
Sweden	5,322	75%
Denmark, Norway, Finland or Iceland	312	4%
Other countries	1,257	18%
Missing	194	3%
Dominant problem (primary drug)		
Alcohol	891	13%
Heroin	514	7%
Methadone	4	0%
Other opioids	49	1%
Tranquillisers	174	2%
Cocaine	158	2%
Amphetamine	1,711	24%
Cannabis	770	11%
Hallucinogenic drugs	21	0%
Solvents	8	0%
Other	92	1%
Alcohol and drugs combined	374	5%
Polydrug use	918	13%
No dominating problem	1,130	16%
Missing	271	4%
History of criminal charges		
Drug crime	4,607	65%
Property crime	4,666	66%
Violent crime	4,227	60%
History of inpatient psychiatric treatment	1,048	15%
History of being abused		
Emotionally	2,806	40%
Physically	3,069	43%
Sexually	547	8%
History of delirium tremens	475	7%

History of drug overdose	1,642	23%
History of suicidal ideation	2,342	33%
History of suicide attempt	1,475	21%
Bloodborne diseases		
Hepatitis B	1,070	15%
Hepatitis C	2,412	34%
HIV	33	0%

All papers included demographic data such as age, gender, country of birth (whether or not the client was born in Sweden or other Nordic countries), and town of residence (city/town of more or less than 100,000 inhabitants). The ASI domains included varied between studies (Table 6).

The variables included from each domain were the following:

Alcohol use	History of binge drinking (one year or more). History of delirium tremens (not in paper II).
Drug use	History of use (one year or more) of each substance included in the ASI, and history of injection drug use (one year or more). History of drug overdose. Treatment history (inpatient detoxification and institution treatment, only in paper I). Tobacco use (not in paper II).
Family/social	Maternal and paternal history of alcohol problems, drug problems, psychiatric problems and criminality. Difficulty getting along with others (papers III and IV). Married, living with alcohol abuser, living with drug abuser (papers III and IV). History of being abused: emotionally, physically, sexually (papers III and IV).
Physical illness	Hepatitis B, C and HIV. Chronic medical condition, medication for chronic medical condition (papers III and IV).
Psychiatric status	Lifetime history of psychiatric symptoms included in the ASI (and lasting for 'significant time'): history of depression, anxiety (not in paper II), hallucinations (not in paper II), suicidal ideation (not in papers III and IV), suicide attempt, eating disorders (not in paper II), difficulty controlling violent behaviour, and troubles understanding, remembering or concentrating (not in paper II).
Criminality	Previous criminal charges: drug crime, property crime, violent crime (only in paper II).

Table 6

Domains analysed in papers I-IV

	Alcohol use	Drug use	Family/ social	Physical illness	Psychiatric status	Crimina-lity	Employ-ment
Paper I	X [1]	X [1]	X [2]	X [3]	X		
Paper II	X	X	X [2]		X	X	
Paper III	X	X	X	X	X [4]		
Paper IV	X	X	X	X	X [4]		

[1] Past 30 days

[2] Heredity variables only

[3] Bloodborne diseases only

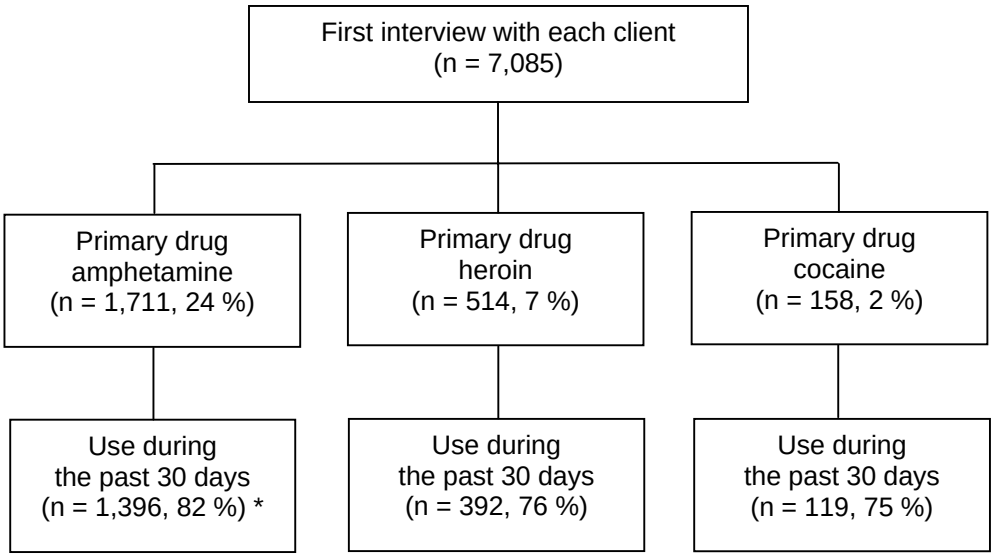
[4] Due to its close connection to the dependent variable, suicidal ideation was not included

Regarding substance use variables, the present ASI version does not separate prescribed substance use from non-prescribed use, which is applicable primarily to the use of tranquillisers and opiates, including methadone. In the case of methadone, opiate-dependent individuals are known to use this substance in order to manage withdrawal symptoms or for other purposes during opiate abuse (Roche et al., 2008), and its use is therefore likely to indicate opiate abuse or dependence, regardless of whether the substances is used illicitly or as a prescribed opiate substitution therapy. For substance use variables, a duration of at least six months is approximated to one year.

3.4.1 Paper I: Characteristics of primary amphetamine users in Sweden. A criminal justice population examined with the Addiction Severity Index (ASI)

The first paper compared primary (and recent) users of amphetamine, heroin and cocaine. Here, clients were included if they both reported either of these substances to be their primary (main) drug of abuse, and recent use (during the past 30 days) of their primary drug. Clients were excluded if they had been interviewed more than once and reported different primary drug in different interviews (i.e. if they belonged to different study groups in two different assessments). After applying exclusion criteria, the material comprised 1,396 amphetamine users, 392 heroin users, and 119 cocaine users (Figure 1).

Two separate logistic regression analyses were carried out, the first comparing amphetamine users with heroin users, and the other comparing amphetamine users to cocaine users, with respect to the independent variables included.

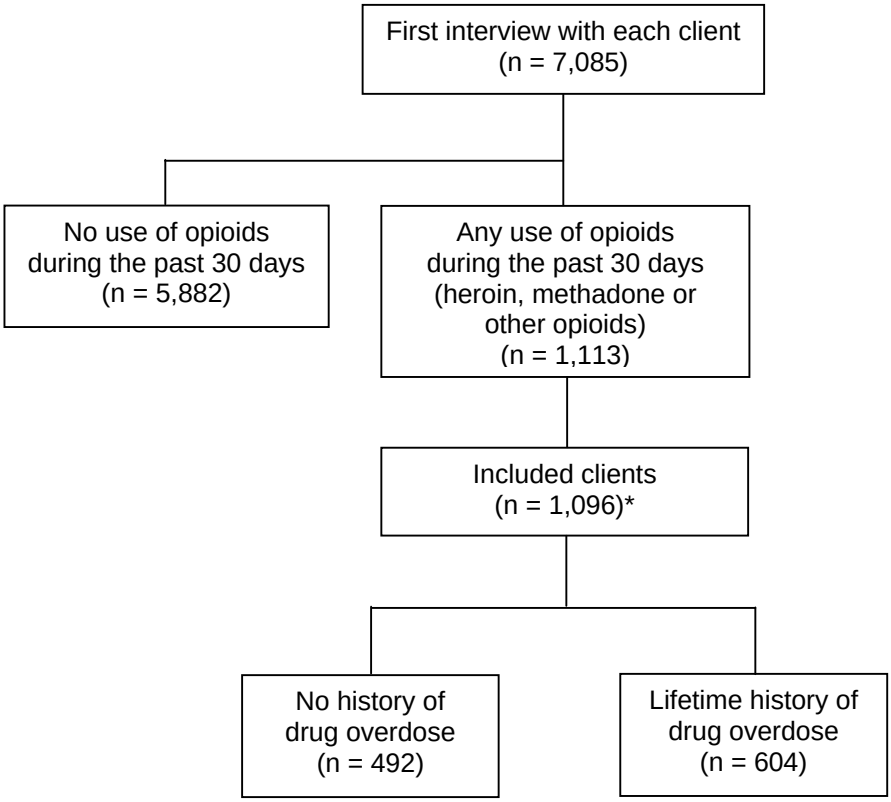


* Excluded: belonged to different study groups in different interviews, answers distorted by misrepresentation or inability to understand, unable to undergo interview, refused, or interrupted with significant loss of information (n = 4)

Figure 1. *Clients included in paper 1*

3.4.2 Paper II: Factors associated with history of non-fatal overdose among opioid users in the Swedish criminal justice system

The second paper aimed to analyse factors associated with overdose history among opioid users. Here, recent opioid users were included, i.e. clients reporting the use of heroin, methadone or other opioids during the past 30 days. This sample comprised 1,113 subjects.



* Excluded: Answer to overdose question missing (n = 16), or answers distorted by misrepresentation or inability to understand (n = 1)

Figure 2. *Clients included in paper 2*

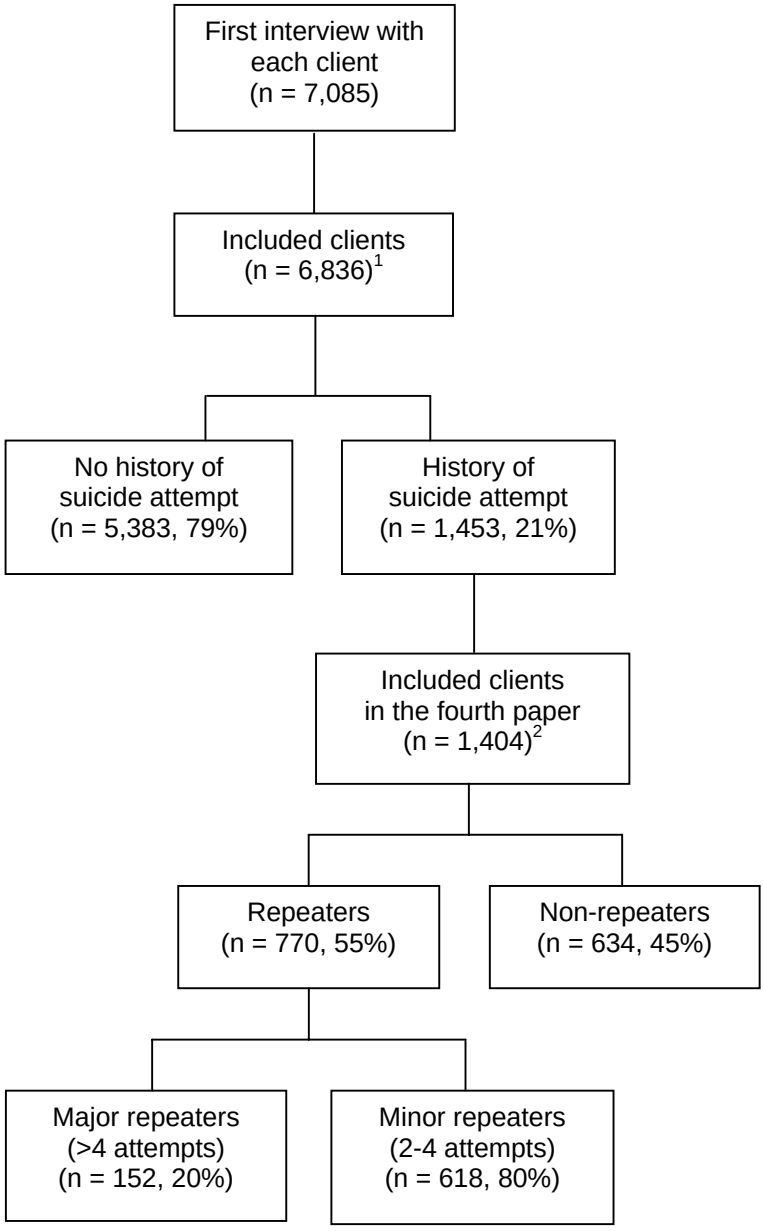
The ASI includes the question ‘How many times have you overdosed on drugs?’ Drug overdose is defined in the ASI-X as ‘life-threatening physical complications following drug intake” (Sallmén and Öberg, 2002). Here, this variable was dichotomised, coding each client as either ‘1’ (one or more overdoses) or ‘0’ (zero overdoses). Clients who failed to answer the overdose question were excluded from the analysis. After applying exclusion criteria, 1,096 subjects were included (Figure 2). The logistic regression analysis compared overdose clients with clients without a history of overdose.

3.4.3 Paper III: Factors associated with history of attempted suicide – a criminal justice population examined with the Addiction Severity Index (ASI)

The third paper compared subjects reporting suicide attempt history with clients without this history. In the psychiatry domain, clients are asked ‘Have you made a suicide attempt?’ both during lifetime and during the past 30 days, without any more detailed definition (Öberg et al., 1999; Sallmén and Öberg, 2002). In the present study, these two questions were combined. Consistent with the second paper, clients who failed to answer the questions about attempted suicide were excluded. Here, clients were also excluded if their interview was an ADAD interview, or if they answered ‘yes’ to the questions about suicide attempt, but inconsistently answered ‘zero’ to the question about the number of attempts. After application of exclusion criteria, 6,836 subjects were included in the third paper (Figure 3). The logistic regression analysis compared suicide attempters to non-attempters.

3.4.4 Paper IV: Variables associated with repeated suicide attempt in a criminal justice population

The fourth paper is based on the third, and included clients with a history of attempted suicide, including a total of 1,404 subjects (after excluding clients who failed to report their number of suicide attempts). Here, repetition of attempted suicide (as opposed to single suicide attempt) was the dependent variable in the first logistic regression analysis. In a second analysis, major repetition (defined as five or more suicide attempts as proposed by Kreitman and Casey, 1988) was compared to minor repetition (two, three or four attempts) as the dependent variable. This study included the same independent variables as the third paper (Figure 3).



[1] Excluded: ADAD interview (n = 124), refused, unable, broke off with loss of the psychiatry domain, answers distorted (n = 40), failed to answer questions about suicide attempts (n = 70), or inconsistent answers (affirming suicide attempt but answering 'zero' to the question about the number of attempts, n = 15).
[2] Excluded: number of attempts missing (n = 49)

Figure 3. *Clients included in papers 3 and 4*

4. Results

4.1 Paper I: Characteristics of primary amphetamine users in Sweden. A criminal justice population examined with the Addiction Severity Index (ASI)

The sample of primary amphetamine users was markedly larger than the groups of heroin and cocaine users, and the groups differed in several aspects. Amphetamine users were markedly older than the other groups (37.4 years, compared to heroin users, 31.6 years, $p<0.001$, and cocaine users, 29.8 years, $p<0.001$), they had been using their primary drug for longer (data not shown), and they were markedly less likely to be non-Nordic immigrants or to live in larger cities (Table 7).

Compared to amphetamine users, heroin users were more likely to report using other opioids, but also non-opioid drugs (tranquillisers, cannabis, cocaine) during the past 30 days, and they more commonly reported polydrug use. Injection drug use was somewhat more common in the amphetamine group than in the heroin group.

Although younger, heroin users were markedly more likely to report a history of inpatient detoxification. Compared to heroin users, amphetamine users considerably more often reported heredity of alcohol problems, and an independent association with amphetamine use was seen for both maternal and paternal alcohol problems. However, other family history variables did not differ between these two groups. History of psychiatric symptoms was comparable in the heroin and amphetamine users, with the exception of cognitive problems (troubles understanding, remembering or concentrating), which were more common in amphetamine users.

The final logistic regression model demonstrated several items independently associated with amphetamine use, as opposed to heroin use: older age, being born in the Nordic countries, cognitive problems and maternal and paternal alcohol heredity, and lower likelihood of overdose, inpatient detoxification, other opioid use and living in major cities (Table 8). This final model was estimated to explain 38 percent of the variance between amphetamine and heroin users. Differences in substance use accounted for most of the variance between heroin and amphetamine users (NRS 0.19), although significant explanatory value was seen for history of drug treatment (NRS 0.16), family history (NRS 0.13) and psychiatric symptoms (NRS 0.12, data not shown).

Table 7
Binary analysis – primary amphetamine users compared to heroin and cocaine users

	Heroin users (N=392) % (n)	Amphetamine users (N=1,396) % (n)	Cocaine users (N=119) % (n)
Female gender	11% (45)	15% (210)	0%
Residing in large city	61% (238)***	40% (554)	69% (82)***
Born in Nordic countries	69% (270)***	95% (1,327)	50% (59)***
Bloodborne infections			
Hepatitis B	23% (89)**	31% (433)	6% (7)***
Hepatitis C	62% (244)	67% (932)	4% (5)***
HIV	1% (5)	1% (9)	0% (0)
Substance use history[1]			
History of heroin use (≥1 yr)	97% (379)***	12% (174)	7% (8)*
History of amphetamine use (≥1 yr)	48% (190)***	97% (1,356)	27% (32)***
History of cocaine use (≥1 yr)	22% (86)***	7% (103)	91% (108)***
History of binge drinking (≥1 yr)	29% (113)***	46% (641)	18% (22)***
History of drug overdose	52% (205)***	27% (380)	16% (19)***
History delirium tremens	2% (9)**	7% (103)	1% (1)*
Daily tobacco use	96% (377)	94% (1,309)	79% (94)***

Co-occurring substance use past 30 days			
Heroin	100% (392)***	4% (52)	5% (6)
Methadone	9% (37)***	1% (7)	0% (0)
Other opioids	19% (76)***	6% (79)	3% (4)
Tranquillisers	40% (156)***	22% (301)	18% (22)
Cocaine	13% (51)***	4% (59)	100% (119)***
Amphetamine	23% (89)***	100% (1,396)	10% (12)***
Cannabis	45% (175)**	36% (507)	27% (32)*
Hallucinogenic drugs	2% (8)	3% (41)	3% (4)
Solvents	0% (1)	0% (3)	0% (0)
Polydrug use	56% (221)***	38% (525)	37% (44)
Injecting	63% (245)**	70% (980)	8% (10)***
Binge drinking	10% (39)	12% (164)	18% (22)*
Drug treatment history[1]			
Inpatient detoxification	43% (170)***	20% (280)	7% (8)***
Institution treatment	57% (222)	51% (717)	12% (14)***
Heredity			
Maternal alcohol problems	9% (37)***	18% (245)	3% (4)***
Maternal drug problems	5% (20)	7% (96)	2% (2)*
Maternal psychiatric problems	7% (29)	9% (131)	5% (6)
Maternal criminal problems	3% (10)	3% (44)	1% (1)
Paternal alcohol problems	28% (108)***	38% (533)	18% (21)***
Paternal drug problems	10% (38)	9% (131)	5% (6)
Paternal psychiatric problems	5% (18)	7% (94)	2% (2)*
Paternal criminal problems	14% (54)	13% (181)	7% (8)*

History of psychiatric symptoms[1]			
History of psychiatric inpatient treatment	16% (64)	16% (222)	10% (12)
Depression	49% (193)	49% (690)	54% (64)
Anxiety	57% (224)	52% (725)	52% (62)
Troubles understanding, concentrating, or remembering	48% (188)***	55% (764)	58% (69)
Hallucinations	15% (58)	14% (202)	17% (20)
Difficulty controlling violent behaviour	37% (145)*	38% (537)	46% (55)
Suicidal ideation	37% (144)	35% (489)	27% (32)
Suicide attempts	21% (84)	24% (339)	11% (13)**
Eating disorders	5% (19)	6% (89)	7% (8)

[1] Variables describing lifetime prevalence are adjusted for age

Significantly distinct from the amphetamine group

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Table 8
Variables associated with primary amphetamine use, compared to primary heroin use
Logistic regression analyses adjusted for age. Odds ratios with 95 percent confidence interval.

Substance use	
History of overdose	0.39 (0.30-0.50)
Other opioids past 30 days	0.36 (0.25-0.51)
Injecting past 30 days	1.55 (1.19-2.01)
Drug treatment history	
Inpatient detoxification	0.36 (0.28-0.46)
Heredity	
Maternal alcohol problems	2.05 (1.40-3.00)
Paternal alcohol problems	1.54 (1.19-2.00)
History of psychiatric symptoms	
Troubles understanding, concentrating, or remembering	1.53 (1.21-1.93)
General model	
Age	1.07 (1.05-1.09)
Born in Nordic countries	8.42 (5.76-12.31)
History of overdose	0.38 (0.28-0.50)
Residing in large city	0.39 (0.30-0.52)
Inpatient detoxification	0.38 (0.28-0.50)
Other opioids past 30 days	0.28 (0.19-0.43)
Troubles understanding, concentrating, or remembering	1.80 (1.37-2.38)
Maternal alcohol problems	1.72 (1.14-2.62)
Paternal alcohol problems	1.42 (1.06-1.91)

Cocaine users differed in several ways from the other two groups. Injection drug use was rare, and half of the cocaine users were non-Nordic immigrants. Treatment experience was also less common in the cocaine group. Several of the family history variables were less common, and cocaine users were less likely to report a history of attempting suicide (Table 9). This final regression model explained an estimated 52 percent of the variance between amphetamine and cocaine users, and showed that amphetamine use was associated with older age, injection drug use, tobacco use, institution treatment, being born in the Nordic countries, and not living in major cities. The substance use domain accounted for 35 percent of the variance between the groups, higher than for drug treatment (NRS 0.22), family history (NRS 0.16) and psychiatric symptoms (NRS 0.14, data not shown).

Table 9
Variables associated with primary amphetamine use, compared to primary cocaine use. Logistic regression analyses adjusted for age. Odds ratios with 95 percent confidence interval.

Substance use	
Injecting past 30 days	19.89 (10.23-38.69)
Daily tobacco use	3.02 (1.68-5.43)
Drug treatment history	
Institution treatment	7.40 (4.16-13.15)
Heredity	
Paternal alcohol problems	2.95 (1.80-4.84)
History of psychiatric symptoms	
Suicide attempt	2.60 (1.43-4.73)
General model	
Age	1.08 (1.05-1.11)
Injecting past 30 days	11.29 (5.58-22.84)
Born in Nordic countries	10.39 (6.09-17.72)
Residing in large city	0.29 (0.18-0.49)
Daily tobacco use	2.87 (1.45-5.67)
Institution treatment	3.61 (1.87-6.99)

4.2 Paper II: Factors associated with history of non-fatal overdose among opioid users in the Swedish criminal justice system

Among recent opioid users, 69 percent reported recent use of heroin, 10 percent reported methadone use, and 48 percent reported using other opioids. A majority of clients, 55 percent, reported a history of drug overdose. Overdose clients were significantly more likely to report a history of using heroin, methadone, other opioids, tranquillisers, amphetamine, cannabis, hallucinogenic drugs, and to report binge drinking and injection drug use. Also, overdose clients were more likely to be born in the Nordic countries, and to report criminal charges, maternal drug problems or maternal psychiatric problems, all paternal heredity variables, and psychiatric symptoms including suicide attempts. Also, overdose clients were significantly younger (31.3 vs 32.4 years, p=0.026, Table 10).

Table 10

Binary analysis of factors associated with history of non-fatal overdose (OD) in a sample of 1,096 clients in the Swedish prison and probation system

	OD history (N = 604) % (*n*)	No OD history (N = 492) % (*n*)	OR (95% CI)	*P* value
Mean age (years)	31.3	32.4		*
Born in Nordic countries	87% (523)	71% (349)	2.65 (1.95–3.59)	***
Female gender	12% (73)	11% (56)	1.07 (0.74–1.55)	NS
History of substance use, ≥1 year				
Heroin	80% (484)	58% (287)	2.88 (2.20–3.77)	***
Methadone	17% (101)	11% (53)	1.66 (1.16–2.37)	**
Other opioids	52% (317)	46% (228)	1.28 (1.01–1.62)	*
Tranquillisers	69% (415)	45% (223)	2.65 (2.07–3.39)	***
Cocaine	20% (119)	21% (103)	0.93 (0.69–1.25)	NS
Amphetamine	73% (441)	52% (256)	2.49 (1.94–3.21)	***
Cannabis	79% (479)	68% (333)	1.83 (1.39–2.40)	***
Hallucinogenic drugs	23% (138)	15% (74)	1.67 (1.22–2.28)	**
Injection drug use	84% (508)	52% (257)	4.84 (3.65–6.41)	***
Binge drinking	46% (276)	37% (184)	1.41 (1.10–1.80)	**
History of criminal charges				
Drug crime	85% (514)	79% (391)	1.48 (1.08–2.02)	*
Crime involving property	86% (519)	75% (369)	2.04 (1.50–2.77)	***
Crime of violence	68% (408)	58% (283)	1.54 (1.20–1.97)	***

Heredity				
Maternal alcohol problems	15% (91)	11% (56)	1.38 (0.97–1.97)	NS
Maternal drug problems	10% (60)	5% (26)	1.98 (1.23–3.18)	**
Maternal psychiatric problems	13% (77)	8% (38)	1.75 (1.16–2.63)	**
Maternal criminality	5% (28)	3% (15)	1.55 (0.82–2.93)	NS
Paternal alcohol problems	41% (247)	26% (127)	1.99 (1.53–2.58)	***
Paternal drug problems	17% (102)	9% (43)	2.12 (1.45–3.10)	***
Paternal psychiatric problems	8% (50)	4% (22)	1.93 (1.15–3.23)	*
Paternal criminality	19% (116)	13% (64)	1.59 (1.14–2.21)	**
History of psychiatric symptoms				
Depression	61% (370)	54% (266)	1.34 (1.06–1.71)	*
Difficulty in controlling violent behaviour	52% (316)	37% (183)	1.85 (1.45–2.36)	***
Suicidal ideation	50% (300)	35% (173)	1.82 (1.43–2.32)	***
Suicide attempts	36% (215)	19% (95)	2.31 (1.75–3.05)	***

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

After logistic regression analysis, overdose history was independently associated with heroin use, injection drug use, tranquilliser use, being born in Sweden or the Nordic countries, paternal alcohol problems, attempted suicide, and difficulty in controlling violent behaviour (Table 11). No independent association was seen with depression and suicidal ideation. Also, in the present study, there was no significant gender difference with respect to drug overdose history.

Table 11
Logistic regression analysis of factors associated with history of non-fatal overdose (OD), adjusted for age and country of birth

	OR (95% CI)	Estimated contribution to the variance (Nagelkerke's R Square, NRS)
History of substance use, ≥1 year		0.25
Injection drug use	3.16 (2.30–4.36)	
Heroin	2.46 (1.81–3.36)	
Tranquillisers	2.03 (1.53–2.69)	
Amphetamine	1.60 (1.18–2.17)	
History of criminal charges		0.08
Crime involving property	1.71 (1.24–2.37)	
Crime of violence	1.30 (1.00–1.69)	
Heredity		0.08
Paternal alcohol problems	1.62 (1.23–2.13)	
Paternal drug problems	1.52 (1.02–2.27)	
History of psychiatric symptoms		0.10
Suicide attempts	2.01 (1.51–2.69)	
Difficulty in controlling violent behaviour	1.55 (1.20–2.01)	
General model		0.29
Injection drug use	3.28 (2.39–4.52)	
Heroin use	2.87 (2.08–3.96)	
Suicide attempts	1.92 (1.40–2.63)	
Tranquilliser use	1.91 (1.44–2.54)	
Born in Sweden/Nordic countries	1.74 (1.22–2.49)	
Difficulty in controlling violent behaviour	1.68 (1.26–2.23)	
Paternal alcohol problems	1.57 (1.16–2.12)	

The final model contributed to an estimated 29 percent of the variance between clients with overdose and clients without overdose history. The substance use domain explained the largest proportion of the variation (NRS 0.25) between overdose clients and non-overdose clients.

4.3 Paper III: Factors associated with history of attempted suicide – a criminal justice population examined with the Addiction Severity Index (ASI)

In the material analysed, a history of at least one suicide attempt was reported by 21 percent of the clients. Suicide attempters were older (34.1 vs 32.7 years, $p<0.001$), more likely to be female, and more likely to report most of the problem variables included. These include

- Most of the substance use variables (heroin, methadone, other opioids, tranquillisers, amphetamine, cannabis, solvents, hallucinogenic drugs, tobacco, injection drug use, binge drinking, delirium tremens, drug overdose, and a higher total number of substances used)
- Somatic disorders (current physical illness, medication for physical illness, hepatitis B and C)
- All family history variables included (maternal and paternal alcohol problems, drug problems, psychiatric problems and criminality)
- Family/social variables (living with alcohol or drug abuser, difficulty getting along with others, history of being emotionally, physically or sexually abused)
- All psychiatric items analysed (depression, anxiety, hallucinations, eating disorders, difficulty controlling violent behaviour, and troubles remembering, understanding or concentrating, Table 12)

Table 12

Factors analysed in association with history of suicide attempt – binary analysis (odds ratio [OR] with 95 percent confidence interval)

	History of suicide attempt (n=1,453) % (n)	No history of suicide attempt (n=5,383) % (n)	OR (95 % confidence interval)
Background information			
Age (yrs)	34.1	32.7	1.01 (1.01-1.02)
Female gender	19% (282)	9% (508)	2.31 (1.97-2.71)
Born in Sweden or the Nordic countries	84% (1,224)	81% (4,384)	1.22 (1.04-1.42)
Resident in large city (>100,000 inhabitants)	38% (557)	47% (2,540)	0.70 (0.62-0.78)

History of substance use			
Binge alcohol drinking	56% (809)	38% (2,066)	1.98 (1.76-2.23)
Heroin	23% (329)	17% (901)	1.46 (1.26-1.68)
Methadone	4% (59)	3% (157)	1.40 (1.03-1.90)
Other opioids/analgesics	19% (280)	12% (620)	1.84 (1.58-2.15)
Tranquillisers	38% (559)	27% (1,447)	1.81 (1.60-2.05)
Amphetamine	63% (912)	49% (2,647)	1.69 (1.49-1.90)
Cocaine	13% (183)	13% (707)	1.00 (0.84-1.19)
Cannabis	56% (813)	52% (2,799)	1.21 (1.08-1.37)
Solvents	13% (195)	7% (375)	1.96 (1.63-2.36)
Hallucinogenic drugs	13% (186)	10% (515)	1.49 (1.25-1.79)
Injection drug use	53% (777)	39% (2,104)	1.73 (1.53-1.95)
Delirium tremens	13% (182)	5% (290)	2.39 (1.96-2.91)
Drug overdose	37% (533)	20% (1,083)	2.36 (2.08-2.68)
Daily tobacco use	89% (1,296)	84% (4,509)	1.60 (1.34-1.92)
Number of drugs used (except tobacco, methadone)	2.94	2.24	1.21 (1.18-1.25)
Medical status			
Chronic medical problem interfering with daily life	59% (853)	44% (2,363)	1.77 (1.56-1.99)
Current prescribed medication for physical problem	28% (414)	21% (1,121)	1.44 (1.26-1.65)
Hepatitis B	20% (284)	14% (771)	1.36 (1.16-1.59)
Hepatitis C	46% (666)	32% (1,716)	1.74 (1.54-1.97)
HIV positive	1% (11)	0% (22)	1.65 (0.79-3.41)
Family history (heredity)			
Maternal alcohol problems	19% (276)	10% (549)	2.06 (1.76-2.42)
Maternal drug problems	8% (122)	5% (243)	1.94 (1.55-2.43)
Maternal psychiatric problems	16% (235)	7% (386)	2.50 (2.10-2.97)
Maternal criminality	4% (63)	2% (121)	1.97 (1.45-2.69)
Paternal alcohol problems	42% (606)	27% (1,447)	1.95 (1.73-2.20)
Paternal drug problems	12% (168)	7% (401)	1.62 (1.34-1.96)
Paternal psychiatric problems	10% (142)	5% (260)	2.13 (1.72-2.64)
Paternal criminality	16% (235)	10% (515)	1.82 (1.54-2.15)

Family/social relationships			
Married	34% (494)	35% (1,866)	0.97 (0.86-1.10)
Currently living with alcohol abuser	7% (98)	4% (208)	1.80 (1.41-2.30)
Currently living with drug abuser	14% (202)	10% (554)	1.41 (1.18-1.67)
Difficulty getting along with others (any category, significant period)	86% (1,248)	71% (3,839)	2.56 (2.18-3.00)
Emotionally abused	63% (912)	34% (1,853)	3.18 (2.82-3.59)
Physically abused	61% (890)	40% (2,148)	2.36 (2.10-2.66)
Sexually abused	18% (264)	5% (279)	3.96 (3.31-4.75)
Psychiatric status			
Depression	80% (1,165)	44% (2,382)	5.23 (4.54-6.02)
Anxiety	80% (1,169)	47% (2,535)	4.67 (4.06-5.38)
Troubles understanding, concentrating, or remembering	69% (1,009)	48% (2,608)	2.53 (2.23-2.86)
Hallucinations	24% (348)	10% (541)	2.91 (2.50-3.38)
Difficulty controlling violent behaviour	57% (826)	37% (2,017)	2.42 (2.15-2.74)
Eating disorders	15% (212)	5% (288)	3.09 (2.56-3.73)

After logistic regression analyses, history of suicide attempt was still independently associated with a large number of variables. Suicide attempters remained older and more likely to be female. Depression was the item most strongly related to attempted suicide, while an association was also seen with anxiety, hallucinations, eating disorders and difficulty controlling violent behaviour. Furthermore, even in this model where adjustments were made for psychiatric symptoms, all three abuse variables (emotional, physical and sexual abuse) remained associated with suicide attempt. An association was also seen with binge drinking, injection drug use, delirium tremens, drug overdose, physical illness, maternal and paternal alcohol problems, and maternal psychiatric problems. On the other hand, attempted suicide was negatively associated with cannabis use and urban residence (Table 13). The final model explained an estimated 27 percent of the variance between attempters and non-attempters. The domain of psychiatric status contributed most strongly to the variance (NRS 0.20), whereas the family/social domain, including emotional, physical and sexual abuse (NRS 0.12), accounted for a larger proportion of the variance than the substance use domain (NRS 0.08, data not shown).

Table 13

Variables associated with history of suicide attempt - Logistic regression analyses adjusted for age. Odds ratios with 95 percent confidence interval

Background information	
Female gender	2.19 (1.86-2.57)
Resident in large city	0.72 (0.64-0.81)
Substance use	
Binge drinking	1.64 (1.44-1.86)
Other opioids/analgesics	1.25 (1.05-1.49)
Tranquillisers	1.23 (1.06-1.42)
Solvents	1.28 (1.05-1.57)
Injection drug use	1.23 (1.07-1.42)
Delirium tremens	1.67 (1.35-2.06)
Drug overdose	1.82 (1.58-2.11)
Daily tobacco use	1.24 (1.02-1.50)
Cannabis	0.81 (0.70-0.92)
Medical status	
Chronic medical problem interfering with daily life	1.56 (1.37-1.77)
Prescribed medication for physical problem	1.22 (1.05-1.41)
Hepatitis C	1.62 (1.43-1.84)
Heredity	
Maternal alcohol problems	1.46 (1.23-1.74)
Maternal psychiatric problems	1.92 (1.59-2.32)
Paternal alcohol problems	1.57 (1.37-1.79)
Paternal psychiatric problems	1.39 (1.10-1.76)
Paternal criminality	1.28 (1.06-1.54)
Family/social relationships	
Emotionally abused	2.16 (1.88-2.48)
Physically abused	1.43 (1.25-1.64)
Sexually abused	2.35 (1.94-2.85)
Difficulty getting along with others	1.74 (1.47-2.06)
Psychiatric status	
Depression	2.76 (2.34-3.26)
Anxiety	2.06 (1.74-2.43)
Troubles understanding, concentrating, or remembering	1.26 (1.10-1.46)
Hallucinations	1.59 (1.35-1.88)
Difficulty controlling violent behaviour	1.62 (1.42-1.85)
Eating disorders	1.86 (1.52-2.28)

General model	
Age	1.01 (1.00-1.02)
Female gender	1.35 (1.10-1.65)
Binge drinking	1.29 (1.12-1.48)
Injection drug use	1.29 (1.11-1.49)
Delirium tremens	1.32 (1.05-1.66)
Drug overdose	1.62 (1.39-1.89)
Chronic medical problem interfering with daily life	1.26 (1.10-1.45)
Maternal alcohol problems	1.26 (1.04-1.52)
Maternal psychiatric problems	1.27 (1.03-1.56)
Paternal alcohol problems	1.19 (1.03-1.36)
Emotionally abused	1.48 (1.28-1.72)
Physically abused	1.23 (1.06-1.42)
Sexually abused	1.60 (1.28-2.00)
Depression	2.53 (2.13-2.99)
Anxiety	1.79 (1.51-2.13)
Hallucinations	1.47 (1.24-1.75)
Difficulty controlling violent behaviour	1.47 (1.28-1.69)
Eating disorders	1.41 (1.14-1.75)
Cannabis	0.83 (0.72-0.96)
Resident in large city	0.80 (0.70-0.91)

4.4 Paper IV: Variables associated with repeated suicide attempt in a criminal justice population

Among 1,453 clients reporting a history of attempting suicide, 1,404 individuals reported the number of attempts. Of these, 45 percent (634 clients) reported only one attempt while the rest, 770 clients, were classified as repeaters (two or more attempts). In the sample of attempters, 44 percent were classified as ‘minor repeaters’ (two, three or four attempts), while 11 percent were regarded as ‘major repeaters’ (five or more attempts).

Repeaters turned out to be somewhat younger than non-repeaters (33.5 vs 34.6 years, p=0.028). No gender difference was seen between these groups. Although no domain explained most of the variance between the groups, the contribution of substance use variables was stronger than that of the psychiatric symptom domain. The substance use variables most strongly associated with suicide attempt repetition were the use of opioid analgesics, drug overdose, solvents use, binge drinking, and delirium tremens. In the psychiatry domain, troubles remembering, understanding or concentrating were most strongly associated with repetition, while the association with anxiety, hallucinations and violent behaviour was weaker (Table 14).

Table 14

Factors associated with repeated suicide attempt

Binary analysis (odds ratio [OR] with 95 percent confidence interval)

	Repeaters (n=770) % (n)	Non-repeaters (n=634) % (n)	OR (95 % confidence interval)
Background information			
Age (yrs)	33.5	34.6	0.99 (0.98-1.00)
Female gender	19% (149)	19% (123)	1.00 (0.76-1.30)
Born in Sweden or the Nordic countries	85% (652)	84% (530)	1.08 (0.81-1.45)
Resident in large city (>100,000 inhabitants)	37% (286)	41% (261)	0.84 (0.68-1.05)
Substance use			
History of alcohol binge drinking*	60% (459)	51% (326)	1.44 (1.17-1.79)
Heroin*	25% (192)	20% (127)	1.31 (1.02-1.70)
Methadone*	4% (30)	4% (27)	0.91 (0.53-1.55)
Other opioids (analgesics)*	24% (182)	14% (89)	1.91 (1.44-2.53)
Tranquillisers*	40% (309)	36% (230)	1.15 (0.93-1.44)
Amphetamine*	64% (490)	62% (392)	1.12 (0.90-1.39)
Cocaine*	13% (100)	13% (81)	0.99 (0.72-1.36)
Cannabis*	56% (431)	56% (358)	0.95 (0.77-1.18)
Solvents*	16% (122)	10% (63)	1.74 (1.25-2.42)
Hallucinogenic drugs*	15% (112)	11% (71)	1.30 (0.94-1.80)
Injection drug use*	54% (419)	53% (334)	1.13 (0.91-1.40)
Delirium tremens*	15% (113)	9% (60)	1.78 (1.27-2.50)
Drug overdose*	43% (332)	29% (185)	1.82 (1.46-2.28)
Daily tobacco use	90% (691)	89% (563)	1.10 (0.79-1.55)
Number of drugs used (except tobacco, methadone)*	3.11	2.74	1.10 (1.04-1.16)
Medical status			
Chronic medical problem interfering with daily life*	62% (476)	55% (346)	1.43 (1.15-1.77)
Current prescribed medication for physical problem*	32% (243)	24% (149)	1.63 (1.27-2.08)
Hepatitis B*	20% (157)	18% (117)	1.19 (0.91-1.56)
Hepatitis C*	46% (357)	46% (289)	1.11 (0.89-1.38)
HIV positive*	1% (6)	0% (3)	1.76 (0.44-7.08)
Family history (heredity)			
Maternal alcohol problems	21% (158)	17% (106)	1.29 (0.98-1.69)
Maternal drug problems	10% (80)	6% (35)	1.98 (1.31-3.00)
Maternal psychiatric problems	19% (150)	12% (76)	1.78 (1.32-2.39)
Maternal criminality	5% (38)	3% (20)	1.59 (0.92-2.77)
Paternal alcohol problems	45% (346)	38% (238)	1.36 (1.10-1.68)
Paternal drug problems	14% (106)	9% (56)	1.65 (1.17-2.32)
Paternal psychiatric problems	12% (91)	8% (48)	1.64 (1.13-2.36)
Paternal criminality	19% (146)	13% (81)	1.60 (1.19-2.14)

Family/social relationships			
Married	34% (259)	34% (217)	0.97 (0.78-1.22)
Currently living with alcohol abuser	8% (59)	6% (35)	1.42 (0.92-2.19)
Currently living with drug abuser	15% (112)	13% (83)	1.13 (0.83-1.53)
Difficulty getting along with others (any category, significant period)*	89% (682)	83% (529)	1.50 (1.11-2.05)
Emotionally abused*	67% (513)	58% (369)	1.43 (1.15-1.78)
Physically abused*	64% (494)	57% (364)	1.33 (1.07-1.65)
Sexually abused*	20% (156)	16% (101)	1.37 (1.04-1.80)
Psychiatric status			
Depression*	82% (632)	78% (493)	1.32 (1.01-1.72)
Anxiety*	84% (643)	76% (481)	1.63 (1.25-2.13)
Troubles understanding, concentrating, or remembering*	76% (582)	61% (389)	1.93 (1.53-2.43)
Hallucinations*	28% (212)	19% (121)	1.59 (1.23-2.05)
Difficulty controlling violent behaviour*	62% (479)	50% (320)	1.57 (1.26-1.95)
Eating disorders*	17% (128)	12% (76)	1.46 (1.08-1.99)

* OR is adjusted for age

In the final logistic regression analysis, comparing significantly associated variables from all domains studied, repetition of suicide attempt was associated with younger age, delirium tremens, drug overdose and opioid analgesics, medication for physical illness, maternal psychiatric problems, violent behaviour, and troubles remembering, understanding or concentrating. Among abuse variables, history of emotional abuse was most strongly related to repeated attempt, but no independent association remained in logistic regression analysis (Table 15).

Table 15
Variables associated with history of repeated suicide attempt
Logistic regression analyses adjusted for age. Odds ratios with 95 percent confidence interval

Substance use	
Binge drinking	1.55 (1.20-2.00)
Other opioids/analgesics	2.11 (1.49-3.00)
Solvents	1.62 (1.12-2.36)
Delirium tremens	1.57 (1.10-2.24)
Drug overdose	1.89 (1.45-2.45)
Number of drugs used	0.87 (0.79-0.95)
Medical status	
Chronic medical problem interfering with daily life	1.27 (1.01-1.60)
Prescribed medication for physical problem	1.49 (1.16-1.93)
Heredity	
Maternal psychiatric problems	1.71 (1.26-2.31)
Paternal alcohol problems	1.34 (1.08-1.67)
Family/social relationships	
Emotionally abused	1.43 (1.15-1.78)
Psychiatric status	
Anxiety	1.32 (1.00-1.74)
Troubles understanding, concentrating, or remembering	1.62 (1.27-2.07)
Difficulty controlling violent behaviour	1.37 (1.09-1.71)
Hallucinations	1.32 (1.01-1.72)
General model	
Age	0.99 (0.98-1.00)
Other opioids (analgesics)	1.52 (1.13-2.05)
Current prescribed medication for physical problem	1.49 (1.16-1.92)
Drug overdose	1.53 (1.21-1.94)
Maternal psychiatric problems	1.58 (1.16-2.16)
Troubles understanding, concentrating, or remembering	1.65 (1.30-2.10)
Difficulty controlling violent behaviour	1.31 (1.04-1.64)
Delirium tremens	1.58 (1.11-2.24)

In the analysis comparing major repeaters (five or more attempts) with minor repeaters (two to four attempts), major repetition was associated with the use of methadone, hallucinogenic drugs, and troubles remembering, understanding or concentrating (Table 16, 17). The age difference between major repeaters (32.4 years) and minor repeaters (33.8 years) was not significant (p=0.091, data not shown).

Table 16
Factors significantly associated with major repetition
*Binary analysis (odds ratio [OR] with 95 percent confidence interval) **

	Major repeaters (n=152) % (n)	Minor repeaters (n=618) % (n)	OR (95 % confidence interval)
Substance use			
Heroin**	32% (49)	23% (143)	1.56 (1.06-2.30)
Methadone**	8% (12)	3% (18)	2.79 (1.31-5.94)
Tranquillisers**	49% (74)	38% (235)	1.52 (1.06-2.18)
Hallucinogenic drugs**	24% (36)	12% (76)	2.08 (1.32-3.28)
Drug overdose**	51% (78)	41% (254)	1.51 (1.06-2.16)
Number of drugs used (except tobacco, methadone)**	3.59	3.00	1.15 (1.06-1.26)
Medical status			
Current prescribed medication for physical problem**	38% (58)	30% (185)	1.55 (1.06-2.26)
Family history (heredity)			
Paternal drug problems	20% (31)	12% (75)	1.85 (1.17-2.95)
Family/social relationships			
Difficulty getting along with others (any category, significant period)**	93% (142)	87% (540)	2.01 (1.01-3.98)
Physically abused**	70% (107)	63% (387)	1.48 (1.01-2.18)
Sexually abused**	26% (40)	19% (116)	1.60 (1.05-2.43)
Psychiatric status			
Troubles understanding, concentrating, or remembering**	84% (127)	74% (455)	1.78 (1.12-2.84)
Hallucinations**	34% (52)	26% (160)	1.47 (1.00-2.15)

* Only variables differing significantly between major and minor repeaters are shown
** OR is adjusted for age

Table 17
Variables associated with major repetition of suicide attempt (five attempts or more)
Logistic regression analyses adjusted for age. Odds ratios with 95 percent confidence interval

Substance use	
Methadone	2.48 (1.15-5.35)
Hallucinogenic drugs	2.08 (1.32-3.26)
Medical status	
Prescribed medication for physical illness	1.55 (1.06-2.26)
Heredity	
Paternal drug problems	1.76 (1.10-2.80)
Family/social relationships	
Difficulty getting along with others	2.04 (1.03-4.04)
Psychiatric status	
Troubles understanding, concentrating, or remembering	1.81 (1.14-2.88)
General model	
Methadone	2.55 (1.18-5.55)
Hallucinogenic drugs	1.99 (1.27-3.14)
Troubles understanding, concentrating or remembering	1.75 (1.10-2.80)

5. General discussion

5.1 The sample

The present studies were conducted in a particularly large sample of Swedish criminal justice clients who were in prison, on remand, or subject to other correctional interventions such as probation. Clients assessed were interviewed because they had a documented, reported or suspected substance use problem. The ASI assessment was carried out systematically in units of the prison system aimed specifically at the assessment and treatment of illicit drug use disorders, so there is an overrepresentation of illicit drugs users in the material, in relation to individuals who primarily have an alcohol use disorder. Furthermore, there was a clear overrepresentation of prison clients in relation to clients in non-custodial care, and some overrepresentation of women. Also, drug crimes and acquisitive crimes appear to be more common as the main types of crime in this population compared with the entire prison and probation system. These differences may be due to features related to the substance use problem of the clients assessed. The population studied here cannot be expected to be representative of all the clients in the Swedish Prison and Probation Service, including clients without substance use problems, but it may still be representative of the population with drug-related problems in the criminal justice system. Also, the present studies benefit from a low attrition rate, and from the fact that this is a high-prevalence population with respect to substance use-related problems and psychiatric problems. Also, the present analyses benefit from a particularly large population assessed.

Comparative studies of criminal justice populations may be subject to certain variability, for example due to different national legislation and forensic traditions. Also, psychiatric characteristics in criminal justice populations are likely to vary, depending on the extent to which mentally ill clients are treated in forensic psychiatric institutions. Also, convicted clients in prison, clients on remand before trial, or arrestees in police custody may show different levels of psychiatric problems – for example, clients with severe psychiatric disorders may be treated in forensic psychiatry instead of prison – but they may still be present in samples of remanded clients. Finally, the prevalence of psychiatric disorders is likely to vary depending on the type of crime committed by clients in the sample assessed (Andersen, 2004).

5.2 Measurements

This research is based on the ASI/MAPS project of the Swedish Prison and Probation Service, and it has used data from a non-identifiable database of ASI interviews with prison and probation clients. While the large size of population, low attrition and high prevalence rates have been beneficial to the present studies, the ASI is not a tool for structured diagnostic evaluation. Also, it is based on self-reported data, and the risk of recall bias or other bias in substance users has been discussed in the literature (Del Boca and Darkes, 2003; Johnson and Fendrich, 2005). Also, the interviews of this data material were carried out by a large number of interviewers. Although interviewers underwent formal ASI training (Tengvald et al., 2004), the large number of interviewers may be associated with a certain inter-rater variability in the assessment of variables included in the ASI, and is therefore a limitation to be considered in the present analyses.

The ASI includes a large number of variables in seven domains of life. Many of the variables assessed were dichotomised in order to diminish problems of recall bias (e.g. the exact number of overdoses, suicide attempts or years of substance use), and instead separate clients with any history of the variable concerned from those without such a history. The authors of the present papers considered this to be sufficiently reliable as an indicator of important client characteristics (e.g. defining heroin use as the reporting of at least one year of use, as opposed to a client reporting zero years of use). This reporting of a persistent problem for one year or more (in reality six months or more, as this is approximated to one year in the ASI) may be more likely to have an impact on substance-related problems than ever using a drug (for example only a few times), the latter not being included in the ASI version used here. Psychiatric symptoms reported in the ASI should have lasted for significant time, and reported symptoms (except for suicidal ideation and suicide attempts) do not include symptoms experienced under the influence of alcohol or drugs or during withdrawal.

5.3 Statistics

The present four papers were based on analyses applying the logistic regression technique. Substance use-related problems and psychiatric problems, like other health sciences, are likely to be multi-factorial, involving a variety of variables. Multivariate statistics are therefore used for the identification of independent associations when other variables are controlled for. The present research used a straightforward approach to the dependent variables analysed, using dichotomised variables (comparing two groups, e.g. overdose vs no overdose or amphetamine vs heroin). Logistic regression was chosen as this method analyses dichotomised dependent variables but allows a mix of different independent variables, including

dichotomised variables (such as depression vs no depression), continuous variables (such as age) or categorical variables (such as gender).

The strategy of analysing each domain separately was applied, with the aim of identifying, for each ASI domain, variables showing an independent association with the dependent variable when controlling for other items in the domain, and these independent variables from different domains then form the basis of analysis in a final logistic regression model. This type of domain-wise analysis also allows the comparison of each domain's contribution to the total group variance, measured here with one type of the coefficient of determination, Nagelkerke's R Square (Nagelkerke, 1991).

The choice of a stepwise forward logistic regression has the advantage of testing one variable at each step, but also has the limitation that a variable of relevance may not fit into the model because it is weaker than other variables in the model. An alternative strategy is to use a backward logistic regression, or any of the techniques with a more generous level of significance, such as a confidence interval on 80 or 85 percent level (Tabachnick and Fidell, 2007). Although the present analyses provided a rather large number of variables, backward logistic regression may be somewhat more inclusive, as the backward stepwise model starts with all variables, and excludes variables on each step instead of the opposite. In the present four studies, an alternative backward logistic regression was carried out as a control. In papers I and II, this made no difference to the results. In the third paper, only the negative association between cannabis use and suicide attempt disappeared. In the fourth paper, however, the alternative backward regression added two variables positively associated with suicide attempt repetition (binge drinking and use of solvents) and one negatively associated variable (number of substances used), whereas the association with delirium tremens disappeared. Here, a non-stepwise logistic regression gave results similar to the backward regression. In the analysis of major repetition, one variable (medication of physical illness) was added. Thus, the expected increase in variables with a backward model occurred only in the fourth paper, although the main findings of the paper were not changed. In the other three papers, the choice of forward or backward logistic regression technique had little impact. Although the forward logistic regression technique chosen in the present four studies may be a more conservative model, as shown also here in the fourth paper, to the authors of the present work, this forward model appears to present a reasonable model with a number of variables which show plausible associations with the dependent variable.

The present four studies examined large amounts of data, and most variables had missing data, although in most cases in a low percentage of clients. For the dependent variables, missing data was not analysed, i.e. the inclusion in the groups studied was based only on reported data and clients failing to answer questions about

the dependent variable were excluded from analysis. The strategy applied for managing missing data was to assume missing data to be ‘zero’ (this is likely to be appropriate for a large number of clients regarding variables where an answer is left out because the question is not applicable to the client). The exceptions were tobacco use and being born in Sweden or other Nordic countries, variables that were affirmed by a large majority, and where missing data was therefore coded ‘one’.

Sensitivity analyses were carried out for variables with the highest rates of missing data: criminal charges in the second paper, and heredity variables in all analyses. Also, a sensitivity analysis was done for country of birth in the second paper despite a low rate of missing data, because this variable was controlled for in logistic regression. However, the sensitivity analyses had a relatively limited influence on the results of the final logistic regression analysis, and affected mainly items from the heredity domain. In the second paper, the sensitivity analysis did not alter the variables in the final model. In the first paper, the variable ‘maternal alcohol problems’ was added to the model associated with amphetamine use compared to cocaine use. In the sensitivity analysis of the third paper, maternal alcohol problems was the only heredity variable associated with attempted suicide, whereas paternal alcohol problems and maternal psychiatric problems disappeared from the model. In the fourth paper, two new variables were added in the final result (use of solvents and a negative association with number of substances used).

It can be argued that older substance users are more likely to have a history of a particular event, due to a longer period at risk. Also, many substance use-related variables may also be subject to other age effects, such as changes in drug use pattern in society over time, and may lead to a different pattern in substance users initiating their use in recent years compared to older users. Here, all variables reporting a lifetime history of an event (substance use, overdoses etc) were adjusted for age, in order to address this problem and, because of the greater likelihood of health problems with age, physical health variables included in the analyses were also controlled for age. Accordingly, all logistic regression analyses also included age in the model. In the second paper, all regression analyses were also adjusted for country of birth.

5.4 Primary amphetamine use as an independent type of addiction

5.4.1 Misuse pattern of amphetamine users

The paper focusing on primary amphetamine users is, to the best of the author's knowledge, the largest detailed description of the pattern of illicit substance use among Swedish criminal justice clients. The comparison of primary amphetamine, heroin and cocaine users benefits from a particularly large sample, and indicates several important differences in characteristics in abuse pattern and the career of drug users. Firstly, the group of primary amphetamine users was considerably larger than the other two groups in the present population. Amphetamine users were, on average, almost six years older than heroin users, and more than seven years older than cocaine users. They were more likely than the other two groups to report heredity of alcohol problems and to report their own history of binge drinking and delirium tremens, and the overlap of drug use with the other two primary drug user groups was limited. Amphetamine users had high rates of psychiatric symptoms, comparable to the other two groups, while they were markedly less likely than heroin users to have undergone inpatient detoxification. The amphetamine group also differed from heroin and cocaine users in demographic characteristics; not only were they older, but also they were markedly less likely to be non-Nordic immigrants and they appeared to be a more rural population than the other two groups.

The age structure for these three groups of drug users is actually the opposite to the nationwide population of treatment-seeking heroin, cocaine and methamphetamine users in the United States (Substance Abuse and Mental Health Services Administration, 2008) and, in the comparison between heroin and amphetamine users, the older age of amphetamine users conflicts with the age structure described in studies from Australia (Darke and Hall, 1995; Hall et al., 1993; Kaye and Darke, 2000).

The overlap in recent use of the substances studied here was strikingly low, indicating that these three groups of primary drug users are relatively separated from each other in this setting. Although percentages were low, it was more common for heroin users to report co-occurring amphetamine use (23 percent) than for amphetamine users to report heroin use (4 percent). Co-occurring substance use in Swedish drugs users is sparsely assessed in the literature, but some data has shown that opiate users in another setting were more likely to report amphetamine use than the opposite (Tsuang et al., 1998). Despite amphetamine users being older, they were unlikely to report a previous history of heroin use (reported by 12 percent), whereas 48 percent of heroin users reported previous use of amphetamine. There is a notion

that the drug using ‘career’ involves the transition from one drug to another, and that amphetamine use precedes the first use of heroin (Schuckit, 1989; Kandel, 1975). Heroin use may represent a final stage of a drug using career, but data does not provide convincing support to this model (Darke et al., 1999). Although the present data indicates that a large proportion of heroin users have had a substantial history of amphetamine use, it must be noted that half of them did not report this. Also, amphetamine users in this sample are markedly older. This indicates that primary amphetamine users in this Swedish setting, compared to the other two groups assessed here, are a group with a long history of amphetamine use, and limited history of heroin or cocaine use, and this may simply be reflected by the long history of amphetamine use in Sweden (Bejerot, 1975; Engström et al., 1991; Käll and Nilsonne, 1995; Tunving, 1988; Frykholm, 1979; 1980; Käll and Olin, 1990). Consequently, amphetamine users may have established a stable pattern of use several years ago in a drugs scene dominated by that drug, and amphetamine addiction appears to be somewhat separated from heroin and cocaine addiction in this setting.

In addition, the development of a substance abuse pattern may not necessarily follow a simple pattern of transition from cannabis to stimulants and then on to heroin, especially because half of heroin users did not report a history of amphetamine use. Instead, the development of an individual’s misuse pattern is likely to be affected by regional cultural features of the drugs scene. As shown in data on the drug use in different countries, these patterns vary considerably (European Monitoring Centre of Drugs and Drug Addiction, 2006a; United Nations Office on Drugs and Crime, 2008). Also, in the present material, amphetamine users were less likely than heroin or cocaine users to live in larger cities. This also indicates that patterns of substance use may vary depending on the client’s setting, and the type of drugs available may be different in rural and urban settings.

The higher prevalence of alcohol problems in amphetamine users was seen as a higher prevalence of previous binge drinking, history of delirium tremens, and even family history of alcohol problems. In a later analysis of the group of clients reporting a primary problem of ‘alcohol and drugs combined’, amphetamine use was also markedly more common (49 percent) than heroin use (6 percent). Heavier drinking among amphetamine users, compared to heroin, has been described previously in Sweden (Tunving, 1988), and the present analyses appear to confirm and extend this finding. Although recent binge drinking was low among both heroin and amphetamine users, it appears that there is a stronger relationship between amphetamine and alcohol than between heroin and alcohol.

5.4.2 Somatic and psychiatric complications of substance use

Although rates of overdose were, as expected, higher in the heroin group, there were strikingly high rates of overdose also among stimulant users in the present material. Also, injection drug use, another item related to elevated risk of death, was common among amphetamine users, even somewhat more common than among heroin users (and strikingly rare among cocaine users). Along with this, self-reported hepatitis B and C infections were more common among amphetamine users. In a later analysis, the prevalence of somatic disease was somewhat higher in the amphetamine group (56 percent) than in the heroin group (45 percent), and markedly higher than in the cocaine group (29 percent), but amphetamine users were markedly older and, after adjustment for age, there was no significant difference between amphetamine and heroin users. Considering the high rates of injection drug use and history of binge drinking, and a high percentage of tobacco users, amphetamine users are likely to have health problems and treatment needs at least comparable to those of heroin users.

Regarding psychiatric symptoms, cognitive problems, represented in the ASI by the variable ‘troubles understanding, remembering or concentrating’, were common in all groups, but somewhat more prevalent in the amphetamine and cocaine groups than in the heroin group, and also when controlling for age. Furthermore, in the logistic regression analysis, these problems remained independently associated with being an amphetamine user rather than a heroin user. Previous research on amphetamine users has observed a deterioration of cognitive performance (memory and attention/concentration tasks) in severely dependent amphetamine users, compared to non-drug using controls, but not in less severely dependent users (McKetin and Mattick, 1997; 1998). This may be consistent with the high rates of cognitive dysfunction in our material.

A lifetime history of hallucinations was reported by a substantial minority in all three groups (between 14 and 17 percent), with no significant differences between stimulant users and heroin users. Amphetamine- and other stimulant-induced psychoses, including hallucinations, are well described in the literature (Angrist et al., 1974; Farrell et al., 2002a; Schuckit, 2006), and it has been reported that methamphetamine-related psychosis in chronic methamphetamine abusers may be likely to relapse (Sato, 1992). Despite this, hallucinations were no more common among stimulant users than among heroin users. However, the ASI-X explicitly addresses hallucinations in drug-free periods, and the more pronounced acute stimulant-induced psychosis (including symptoms such as hallucinations, paranoid delusions, and ideas of reference) is likely to disappear within days or weeks (Schuckit, 2006), which may explain why rates of hallucinations were not more prevalent among stimulant users. However, a lifetime prevalence of 14-17 percent for hallucinations is noteworthy as such, and likely to be consistent with previous

reports on elevated numbers of psychotic disorders in prison, and the figures in this substance-using sample may be relatively high in comparison (Fazel and Danesh, 2002). Although a large proportion of criminals with severe psychotic manifestations are likely to be assessed in forensic psychiatric institutions instead of in the criminal justice system, a substantial proportion of criminal justice clients appear to have psychotic symptoms requiring assessment.

It must also be noted that all three groups of drug users showed strikingly similar rates of psychiatric symptoms. Although cocaine users differed from the other two groups in several ways, with a younger age, lower rates of injection drug use, lower frequency of use, and relatively low rates of problematic family history, they had rates of psychiatric symptoms comparable to those of heroin and amphetamine users, except for suicidal behaviour. Psychiatric treatment needs of cocaine users may need further research. In contrast to the low rates of attempted suicide among cocaine users in this material, cocaine has previously been demonstrated to be a risk factor for suicide attempt in the general population (Petronis et al., 1990), and data indicates that suicide attempt is no less common among cocaine users than among opiate users (Roy, 2003). The relatively lower risk among cocaine abusers in the present criminal justice sample may be due to differences in other characteristics, compared to heroin and amphetamine users in the same setting, but may justify further research.

5.4.3 Amphetamine and criminal behaviour

Amphetamine use was considerably more common in this criminal justice population than heroin and cocaine use, both when analysing recent drug use, history of drug use, and primary drug reported by the clients. Clients were 3.4 times more likely to report recent use of amphetamine than recent use of heroin, and the group of primary (and recent) amphetamine users was 3.6 times larger than the corresponding heroin group.

Is there a real overrepresentation of amphetamine users in the criminal justice system? There is, unfortunately, a paucity of recent data describing the prevalence of different drugs in the current total Swedish drugs scene for comparison. The most recent national estimate of illicit drug use dates back to 1998. Compared to this estimate, although amphetamine has a long history of abuse in Sweden, the difference in prevalence in the present criminal justice material is larger than that expected from the national estimate, where 73 percent reported using amphetamine and 47 percent used heroin, whereas 32 percent were primary amphetamine users and 28 percent primary heroin users (Kraus et al., 2003; Olsson et al., 2001). In a sample of syringe exchange clients in Malmö, in 2004, amphetamine was the

primary drug of slightly more than 50 percent, while the rest reported heroin to be their primary drug (Hakansson et al., 2007).

The description of the pattern of drug use in the Swedish criminal justice system is a relatively recent research topic, and research data is limited. In the launch of the DUDIT instrument (originally introduced as AUDRUG), it was reported that among criminal justice clients, repeated use of stimulants (mainly amphetamine) was more than twice as common as for heroin, and amphetamine as a primary drug was almost three times more common than heroin (Schlyter, 1997). In an assessment of psychiatric diagnoses among 103 inmates in a Malmö prison in the 1990s, 70 percent of the clients were identified as substance misusers, and stimulants were reported by 28 percent of the sample and opiates by 11 percent, representing proportions consistent with the present findings (Levander et al., 1997). In an assessment of substance users included in an acupuncture treatment study, the number of criminal justice clients reporting amphetamine as their primary drug was between four and five times higher than for heroin (Berman et al., 2004) and, according to older data on prisoners on remand in the 1980s, heroin injectors were by far outnumbered by the amphetamine injectors (Käll and Olin, 1990). To the best of the author's knowledge, the present paper is the first scientific paper to report a more extensive analysis of illicit substance use in Swedish criminal justice clients, and the present study describes a particularly large sample. It appears that amphetamine has played a large and important role in the Swedish criminal justice setting for many years, and although there is currently no updated information about primary amphetamine use in the general population of drug users, it appears that amphetamine abuse is relatively more common than heroin abuse in the criminal justice system than in the drugs scene as a whole.

The high proportion of amphetamine users in the criminal justice system is somewhat surprising, given the fact that heroin use is increasing and common among heavy drug users (Olsson et al., 2001). One mechanism contributing to the criminal behaviour among drug users is the criminal activity intending to generate money for drugs. It can be argued that the abuse of heroin is likely to be more expensive than the use of amphetamine (Hall et al., 1993; CAN, 2005), and a more costly misuse pattern may induce a greater 'need' for criminal activities aimed at financing the substance use (Stewart et al., 2000). However, it must be said that even among heroin users with a necessity to obtain money, the first act of delinquency may very well occur before the initiation of drug use or heroin use specifically (Kraus, 1981; Kaye et al., 1998), possibly due to antisocial features in these individuals.

Another possible mechanism of drug-related crime is the commission of criminal acts under the influence of drugs. Regarding the effects of amphetamine itself, or other stimulant substances, a link with violent behaviour has been suspected, but the literature on this topic has been inconsistent (Hoaken and Stewart, 2003; Haggard-

Grann et al., 2006). In the present study, difficulty controlling violent behaviour was approximately as prevalent among heroin users as among amphetamine users, and no difference was seen when controlling for cognitive problems. One difference between heroin and amphetamine users was the history of binge alcohol drinking and delirium tremens, which were significantly more common among amphetamine users, also when adjusted for age. Although rates of recent binge drinking were low in both groups, their previous history of alcohol drinking may contribute to their criminal involvement, as alcohol is known to be involved in criminal behaviour (Poldrugo, 1998; Haggard-Grann et al., 2006). Another difference was the higher prevalence of both maternal and paternal alcohol problems in the amphetamine group. This may possibly have implications for a criminal lifestyle among amphetamine users, and one may speculate about an association with type-2 alcoholism (Cloninger et al., 1981) in the fathers of these drug-using criminals who are predominantly male.

A recent study considers the likelihood of criminal behaviour among users of a specific drug (Fridell et al., 2008). The article discussed possible different patterns of crime between heroin and amphetamine users, with heroin users being likely to finance their drug abuse through crime, while the criminal acts committed by amphetamine users may be related to intoxication with the substance. For comparison, a later analysis of self-reported criminal behaviour (lifetime history of committing crimes, assessed in ASI crime, an added ASI domain in the present setting), showed some differences between the groups of the present data material (data not shown). While some criminal behaviour was more common among amphetamine users than among heroin users (driving under influence of alcohol or drugs, other severe traffic offences, burglary, and family-related violence), shoplifting was common in both amphetamine and heroin users (but significantly less common in cocaine users). Self-reported data on committed offences may be hard to interpret, and the issue of reliability must be considered, but these figures do not show any clear association between acquisitive offences and primary heroin use in the present material.

In summary, it appears to be difficult to fully outline the causes of criminal behaviour in amphetamine users, and more research is needed. Amphetamine users, the oldest of the groups studied here, appear to be a sub-sample of drug users with a long-lasting career of drug use, and there may be features of their lifestyle which make them particularly prone to commit criminal offences resulting in prison or probation sentences. These mechanisms may be somewhat different in Sweden compared to other countries with different abuse patterns, and they are insufficiently studied and understood.

5.4.4 Heavy amphetamine use – a Swedish abuse pattern?

Does the Swedish pattern of amphetamine use differ from the drugs scene in other comparable countries? In fact, the literature on amphetamine abuse and dependence has not been as comprehensive as for heroin, and most literature regarding amphetamine (or methamphetamine) has been published in Australia, the United Kingdom, and the United States. We know that amphetamine has played a larger role as a primary drug among illicit drug users in Sweden and Finland (and the Czech Republic) than in other European countries (Kraus et al., 2003; European Monitoring Centre of Drugs and Drug Addiction, 2006a; United Nations Office on Drugs and Crime, 2008), and although the proportion of amphetamine users is low in the general Swedish population, and lower than in many comparable countries (United Nations Office on Drugs and Crime, 2008), the predomination of amphetamine among problem drug users stands out in an international comparison.

Methamphetamine users in the United States appear to differ from the Swedish amphetamine-using population, notably in the age structure of users, and with intravenous use being more common in the Swedish population assessed here (Substance Abuse and Mental Health Services Administration, 2008; Brecht et al., 2004). Australia, a nation with a significant heroin problem in the 1990s, saw a marked decrease in heroin availability around 2000-2001 (the 'heroin drought'), and an increase in the injection of amphetamine/methamphetamine and cocaine (Topp et al., 2003). Although older studies of amphetamine users in Australia were carried out in a setting where heroin was still dominating (Hall et al., 1993), it appears that the Australian misuse pattern of recent years has similarities with the Swedish pattern of illicit drug use, with a high prevalence of injected amphetamine or methamphetamine (Baker et al., 2004).

One important finding in the present material was the high intensity of amphetamine use, with 23 consumption days during the past 30 days (almost similar to the frequency of heroin use of primary heroin users), and 61 percent of amphetamine users reported daily use during the past 30 days. In Australian studies assessing amphetamine use in different samples, the frequency of use has usually been markedly lower than in the present material (Darke and Hall, 1995; Kaye and Darke, 2000; Hando et al., 1997; Hall et al., 1996). Primary stimulant use has been described to occur typically in 'binges' or 'runs' (Schuckit, 1989). The amounts of amphetamine consumed cannot be established in the interview used here, but with 23 days of use during the past 30 days, and a large proportion using daily, there are few or no days of recovery between assumingly intense periods of stimulant use. Besides a very frequent use of amphetamine, amphetamine users also displayed very high rates of intravenous use in the present material. The whole group of amphetamine users reported an average of 16.5 days of injecting during the past 30 days, compared to 14.2 days for heroin users ($p=0.003$). In the subgroup of recent

amphetamine and heroin injectors, injection was reported on 23.5 and 22.7 days respectively (p=0.26). Among recent injectors, amphetamine users reported 24.5 days of amphetamine use (compared to 23.5 days of injection). Thus, amphetamine use in Swedish drug users with criminal behaviour may be particularly intense, with a high percentage of injectors, and a pattern of injecting on a virtually daily basis, despite the consequences commonly associated with heavy amphetamine use (Schuckit, 2006; Angrist et al., 1974; Hall et al., 1996; Kaye and Darke, 2000), and despite the pattern of 'binges' traditionally described (Schuckit, 1989).

It has been described that polydrug use in stimulant addiction may be used to 'come down' from intense stimulant arousal or to 'smooth out' and treat withdrawal symptoms (Kreek, 1996; Leri et al., 2003), but substances possibly used for the management of amphetamine-related symptoms, such as concurrent opiate, tranquilliser or alcohol use, were relatively uncommon among the primary amphetamine users described here. It may be speculated that Swedish primary amphetamine users use the substance in sufficiently small daily doses to keep up a highly frequent use.

In some countries, including the United States, the polydrug use of heroin and stimulants (such as cocaine) has been reported to be highly prevalent and, in some settings, subjects addicted to heroin use cocaine regularly, also inducing a significant stimulant problem in methadone maintenance programmes (Leri et al., 2003). The overlap of heroin, amphetamine and cocaine use between the three groups studied here was, however, relatively limited. It is possible that these groups of substance users are more separated from each other in the Swedish setting. When studying all individuals reporting heroin or amphetamine use during the past 30 days (regardless of primary drug), among amphetamine users (n = 2,593), 23 percent use alcohol and 34 percent use tranquillisers, but only 12 percent use heroin. On the other hand, among all recent heroin users (n = 765), 41 percent use amphetamine. Cocaine was reported by 16 percent of recent heroin users and 8 percent of recent amphetamine users. As in the results of the first paper of this thesis, these figures indicate that primary amphetamine use may be somewhat separated from heroin and cocaine addiction in Sweden with regard to co-occurring substance use, in addition to differences in demographic characteristics such as age, country of birth and place of residence.

5.5 Overdoses in opioid addiction

5.5.1 Factors related to a history of non-fatal drug overdose

The overdose paper displays an overall more severe problem situation among overdose clients than among opioid-using clients without a history of overdose. As expected from previous literature (Gossop et al., 1996; Darke et al., 2000; Brugal et al., 2002; Thiblin et al., 2004), injection drug use was strongly associated with overdose, and a stronger predictor than any other item. Also, it is important to note that overdose history was more strongly related to heroin use than to methadone or other opioid use, and overdose did not have any independent relationship with the latter two substance types.

It is known, however, that opioids other than heroin do have the potential to cause overdoses, including fatal overdose cases. Other opioids, such as propoxyphene, methadone and codeine are also known to cause fatalities (Steentoft et al., 2006), and fentanyl intake also has been associated with acute overdose death (Kronstrand et al., 1997). Methadone, being a full opiate agonist, is implicated in a significant number of opioid overdoses (Steentoft et al., 2006). However, large international differences are seen, for example within the Nordic countries where, in 2002, methadone accounted for 41 percent of fatal intoxications among drug users in Denmark (a figure close to that of heroin, 44 percent), 15 percent in Norway and 4 percent in Sweden, possibly reflecting differences in methadone availability or features of the drug using culture in different countries (Steentoft et al., 2006). Fatal (Kintz, 2001) and non-fatal overdoses related to the misuse of buprenorphine have been described, but appear to be considerably less common than heroin overdoses (Boyd et al., 2003). In the present study, overdose was clearly associated with heroin use, whereas no independent association was seen with methadone and other opioids.

As expected, misuse pattern most strongly contributed to the difference between overdose clients and non-overdose clients. Also, overdose in the present material was associated with externalising psychiatric symptoms including suicide attempt and difficulty in controlling violent behaviour. Impulse control disturbances may therefore be involved in overdose risk behaviour. On the other hand, depressive characteristics were not independently associated with drug overdose. The association between suicide attempt and drug overdose has previously been reported (Darke et al., 2004; Bradvik et al., 2007a; Vingoe et al., 1999), and the connection between these two variables justifies a special discussion (see below).

Paternal history of alcohol problems also had some influence, and overdose was also associated with being born in the Nordic countries. The significance and implications of this finding are unclear. Although controlling for important substance

use-related risk factors in the present analysis, there may be such differences in the misuse pattern between ethnic groups, that overdoses are more likely to occur among individuals born in Sweden and neighbouring countries. The group of non-Nordic immigrants is heterogeneous, with clients born in several countries that are likely to differ from one another with respect to substance abuse, so that the interpretation of this finding is difficult.

No gender difference was seen between clients with and without overdose. The literature has been inconsistent regarding the influence of gender on drug overdose. Some articles, like the present study, did not show any gender difference (Darke et al., 1996; Bradvik et al., 2007b; McGregor et al., 1998; Gossop et al., 1996), while some studies have revealed an increased risk in either men (Latkin et al., 2004; Wines et al., 2007) or women (Powis et al., 1999).

5.5.2 Polydrug use and overdose

The literature on overdoses among opioid users has identified concomitant use of alcohol or benzodiazepines as major risk factors for overdose. Swedish heroin users in this setting appear to be several times more likely to report tranquillisers than alcohol binge drinking. In the first paper, co-occurring use of tranquillisers was four times more common than binge drinking among current heroin users. The pattern was confirmed when analysing specifically all individuals describing heroin to be their primary problem (34 and 10 percent reporting recent tranquillisers or binge drinking respectively), and among all recent users of heroin (53 and 15 percent respectively, data not shown). Use of sedative and anxiolytic tablets appears to be more common as risk behaviour among Swedish heroin users than alcohol binge drinking. The link between opiate overdose and polydrug use, including alcohol or benzodiazepines, is well-documented (Warner-Smith et al., 2001; Darke et al., 1996; 2007; McGregor et al., 1998; Powis et al., 1999; Darke and Zador, 1996) and, in the second paper of this thesis, history of using tranquillisers was both more common and more strongly related to overdose than binge drinking, and the latter had no independent association with overdose in the logistic regression.

5.5.3 Drug overdose among opioid users – the issue of definition

The interview instrument used here does not provide information about drugs involved in the overdoses reported. Overdose was associated with heroin use but, as described in the first paper, overdoses are not only reported by opiate users. In the second paper, 52 percent of heroin users, 27 percent of amphetamine users, and 16 percent of cocaine users reported a history of overdose. Although less common, overdoses are reported to occur among non-heroin using drug injectors (Taylor et al.,

1996), and overdose syndromes are documented in the literature for other drugs than opiates, including fatal and non-fatal toxicity of stimulants such as cocaine and amphetamine (Karch et al., 1999; 2005; Coffin et al., 2003), often due to the cardiovascular toxicity of stimulants (Karch, 2005). Furthermore, the ASI definition of drug overdose does not exclude overdose syndromes caused by stimulants. On the basis of previous literature (Karch et al., 1999; Coffin et al., 2003), it may be assumed that stimulant overdoses contribute to the number of overdoses among amphetamine and cocaine users, but that a high proportion are actually opiate overdoses. In Fugelstad's study on causes of death among heroin users, amphetamine users and 'other drug users', heroin overdose was the most common cause of death in all three groups (Fugelstad et al., 1997), and so it may be suspected that some overdoses reported by primary stimulant users are actually opiate overdoses.

The drug overdose reported in this ASI assessment must be seen as a variable representing an acute life-threatening event related to drug intake, where opiates are likely to cause a large proportion of events, while stimulants can be suspected to cause another proportion of these events. The literature has dealt with the definition problem for overdose in different ways. Some studies, based on mixed drug users, have not used any overdose definition, with no specification of the drugs involved (Powis et al., 1999; Kerr et al., 2007), and others used very broad and non-substance-specific definitions, such as the need for medical attention (Wines et al., 2007) or hospitalisation (Ravndal and Vaglum, 1999). Another study of a population of 'drug addicts' used no definition, but assumed that overdoses were predominantly attributed to opiates (Rossow and Lauritzen, 1999). Other studies have included heroin users and attempted to define opiate overdoses specifically (McGregor et al., 1998; Bradvik et al., 2007a; 2007b; Brugal et al., 2002).

In conclusion, drug overdose, even when using a broad definition that is not specific for opiate overdose, is most strongly associated with the use of heroin, and especially with injection as the route of administration, although other substances, including non-opiate drugs, may be involved in a certain percentage of self-reported overdoses. There are several risk factors for overdose, including polydrug use and factors related to impulse control disturbances. The term 'overdose', as concluded in previous literature (Darke and Zador, 1996), is likely to be misleading and over-simplified, and several different risk factors may contribute to the overdose event. Instead, the overdose term is probably more appropriate for the description of a severe life-threatening condition associated with acute drug intake.

5.6 Correlates of attempted suicide in the criminal justice population

5.6.1 General aspects

The present study demonstrated a lifetime prevalence of 21 percent for suicide attempt (19 percent of men and 36 percent of women) in this population of criminal justice clients assessed for alcohol or drug misuse and with high prevalence rates of depression and other psychiatric symptoms. This is comparable to the criminal justice population assessed by Jenkins and co-workers (2005), where 20 and 37 percent of sentenced men and women respectively, and 27 and 44 percent of remanded men and women respectively, reported suicide attempt. The prevalence of attempted suicide in the present study population is several times higher than in the general population (Bernal et al., 2007; Kessler et al., 1999; Weissman et al., 1999; Borges et al., 2000). However, the lifetime prevalence of the present study is within the range of rates reported from different study samples of substance users, i.e. between 17 and 43 percent (Darke et al., 2007). In the present data material, suicide attempt was reported by 33 percent of clients reporting a lifetime history of depression. This is markedly higher than among subjects reporting a history of depression in the European general population (8 percent, Bernal et al., 2007), and more comparable to the prevalence of suicide attempt in a sample of depressed subjects in Sweden (Bradvik and Berglund, 2002). Markedly higher rates of attempted suicide have been shown in patients with comorbid substance use and different types of severe mental illness (61 percent, Schaar and Öjehagen, 2001), or in hospitalised patients with alcoholism and depression (70 percent, Cornelius et al., 1996).

5.6.2 The multi-factorial nature of suicidal behaviour

The present work on factors related to suicide attempt in a criminal justice population confirm that several different types of problems are independently associated with a history of suicide attempt, and also when adjusting for one another and for known risk factors. Consequently, suicidal behaviour is likely to be a highly multi-factorial process. The population studied here differs from certain other study populations in that the prevalence of both the outcome variable (attempted suicide) and several potential predictors are high. For example, risk factors such as substance use, psychiatric symptoms, problematic family history and traumatic personal history (being emotionally, physically or sexually abused) are highly prevalent.

On the one hand, attempted suicide may be seen as one stage of a depressive symptomatology, which may propagate into suicidal thinking, and which may

possibly result in an attempt by the patient to kill himself. The completed suicide can be seen as the ultimate step on this ladder. However, there is reason to believe that the process of suicidal behaviour is more complex (van Heeringen et al., 2000). It has been discussed that a 'suicidal syndrome' may exist, with psychological and/or neurobiological factors increasing the risk of suicidal behaviour independently of psychiatric disorders (Ahrens and Linden, 1996; Asberg et al., 1986).

The multi-factorial nature of suicidal behaviour has also been described as a stress-diathesis model, where a combination of state and trait risk factors may influence suicidal behaviour (Mann et al., 1999). Closely related to the stress-diathesis model, Blumenthal and Kupfer suggested that predictors of suicidal behaviour can be described as the overlap of possible risk factors from five different areas: psychiatric disorders, family history and genetics, personality traits, biological factors, and psychosocially distressing life events including chronic medical illness and lack of social support (Blumenthal and Kupfer, 1986). Several of the factors relating to attempted suicide in the present studies can be classified among the five categories discussed by Blumenthal and Kupfer. Symptoms related to psychiatric diagnoses, including depression and substance use disorder, appeared to be associated with suicide attempt in the present study, and difficulty controlling violent behaviour may be seen as a personality trait possibly involved in suicidal behaviour. Regarding adverse life events, Blumenthal and Kupfer (1986) discuss the role of 'humiliating life experiences', consistent with the association with history of being emotionally, physically or sexually abused. Family history variables such as parental psychiatric problems or alcohol problems were also found in the present study, whereas biological factors are not studied here.

In the present material, suicide attempters were significantly older than non-attempters. This is the opposite of observations in several other studies assessing suicide attempt among substance users, such as in patients with alcoholism (Roy et al., 1990) or drug dependence (Roy, 2003; Darke et al., 2004; Darke et al., 2007). The older age of suicide attempters in this sample of criminal justice clients assessed for substance misuse may indicate that suicidal behaviour in this sample is associated with accumulating distress and adverse events during a life course including criminal behaviour and substance use.

5.6.3 The role of psychiatric symptoms

The domain of psychiatric symptoms had the strongest explanatory value in the logistic regression analysis of factors related to suicide attempt. Depression was the strongest psychiatric variable and also the strongest independent variable overall but, despite controlling for this variable (traditionally associated with suicidal behaviour), there were also independent connections between attempted suicide and other

psychiatric symptoms of anxiety, hallucinations, difficulty controlling violent behaviour, and eating disorders. Consequently, other types of psychiatric suffering than depression appear to be related to attempted suicide.

The role of impulsive behaviour in suicide attempt has previously been discussed (Mann et al., 1999; Mann and Currier, 2007) and there is, for example, data indicating a link between alcohol-related aggression and impulsive suicide attempt (attempts without persistent suicidal ideation, Conner et al., 2006), and an association between reactive aggression and suicide has been discussed (Conner et al., 2003). The link between 'difficulty controlling violent behaviour' and suicide attempt in the present study, and in previous literature (Tiet et al., 2006), may be mediated through impulse control disturbances. The association between eating disorders and suicide attempt remained, despite controlling for gender. The instrument used here does not separate different types of eating disorders but, in the literature, anorexia-type eating disorder, rather than bulimia-type disorder, has previously been shown to be a risk factor for suicidal behaviour (Berkman et al., 2007; Harris and Barraclough, 1997).

5.6.4 Substance use in suicidal behaviour

Several substance use variables contributed to the association between substance use and attempted suicide, even when controlling for one another within the domain, but alcohol binge drinking and delirium tremens (along with overdose) were more strongly associated with suicide attempt than any of the other separate substances. In the final logistic regression model, alcohol was the only single substance positively related to attempted suicide (binge drinking and delirium tremens), whereas no separate and positive association was seen with each of the illicit substances assessed. A link between alcohol misuse and suicidal behaviour is also a robust finding (Sher, 2006; Brady, 2006). The lack of substance-specific association for other substances than alcohol is in contrast with some previous reports. Borges and co-workers (2000) showed an association between suicide attempt and current substance use for several substances, with the association being stronger for heroin, sedatives and inhalants than for alcohol. Harris and Barraclough (1997) and Wilcox and co-workers (2004) have presented data on the risk of completed suicide in substance-specific substance use disorders, and found a higher risk of completed suicide in opioid users, mixed drug users and among injectors, than in subjects with heavy drinking or alcohol use disorders. In contrast to these reports on attempted and completed suicide respectively, the present analysis indicated a somewhat different pattern where, in the substance use domain, binge drinking and delirium tremens had a stronger link to suicide attempt than any other substance.

An association between substance use and suicidal behaviour is well documented and, for example, it has been shown that substance use may increase the risk of an unplanned suicide attempt among patients with suicidal ideation (Borges et al., 2000). Here, attempted suicide was associated with a history of injection drug use and overdose, which can be regarded as indicators of severe drug abuse. Thus, severe substance use was one of several factors increasing the likelihood of a suicide attempt history.

In contrast, a negative association was seen with cannabis use. This finding is somewhat hard to interpret, and is to be viewed in the perspective that a large proportion of the population studied here have severe illicit drug use with substances generally considered to be more 'problematic' than cannabis. Therefore, the negative association between cannabis and suicide attempt may be a relative risk decrease attributed to the population as such, although other explanations cannot be ruled out. The link between specific cannabis use and suicidal behaviour may need more research in order to better outline this relationship.

5.6.5 The role of adverse life events in attempted suicide

History of being abused (emotionally, physically or sexually), again analysed with depression and other risk factors included in the model, showed independent associations with attempted suicide. The relationship between attempted suicide and a history of being abused is consistent with previous literature (Davidson et al., 1996; Brodsky et al., 2001; Dube et al., 2001; Rossow and Lauritzen, 2001). A link between suicide attempts and a higher number of problematic childhood adversities has been shown, including variables such as emotional, sexual and violent assaults, parental divorce and other parental or family-related problems (Dube et al., 2001; Rossow and Lauritzen, 2001). In this study, this association applied to all three variables describing abuse history, even after logistic regression analysis. The link between this type of adverse life event and attempted suicide appears to be a robust finding. Also, the traumatic events described by these variables may deserve some further attention is this context. All three abuse variables were markedly more common among suicide attempters. Importantly, history of being abused sexually was between three and four times more common in the suicide attempt group than among non-attempters, and it must be noted that the connection between suicide attempt and sexual abuse remained when incorporating gender into the model. Consequently, the greater prevalence of sexual abuse in the suicide attempt group is not accounted for by the larger number of women (and also not conversely). These abuse variables and female gender respectively appear to have their own individual connections with suicide attempt history. The association between female gender and attempted suicide indicated in previous literature (Diekstra and Gulbinat, 1993),

including among substance users (Darke and Ross, 2001; Darke et al., 2004; Darke et al., 2007), was confirmed here. Also, in this population with a low proportion of women, it should be noted the sexual abuse variable obviously also applies also to a non-negligible proportion of male clients.

Chronic somatic disease, previously discussed in the literature in association with suicidal behaviour (Stenager and Stenager, 2000; Nielsen et al., 1990), was another type of life event associated with suicide attempt in the present study. Also, all family history problems were more common among suicide attempters and, even when comparing them in the logistic regression within the family history domain, five of them remained associated with suicide attempt. The link between parental psychopathology and offspring suicidal behaviour has been previously described (Glowinski et al., 2004).

5.7 Suicide attempt – the issue of repetition

Repetition of suicide attempt has received some attention in research over the past two decades (Kotila and Lönnqvist, 1987; Kreitman and Casey, 1988; Rudd et al., 1996; Laget et al., 2006), although generally not in criminal justice populations. Repeaters appear to have a lower global psychological functioning (Laget et al., 2006; Kotila and Lönnqvist, 1987), a more severe picture of axis I and II disorders (Hawton et al, 2003; Rudd et al., 1996), and more often a history of sexual abuse (Ystgaard et al., 2004).

Repetition was common in the present data material of suicide attempters, and 55 percent of attempters reported more than one attempt. This is within the range of data presented in previous articles (Laget et al., 2006; Mechri et al., 2005; Ystgaard et al., 2004; Kreitman and Casey, 1988). The classification of minor repeaters and major repeaters was chosen from the work of Kreitman and Casey (1988), and the proportions of first-timers, minor repeaters and major repeaters were roughly similar to those reported in that article.

The findings of factors related to repetition, and to major repetition, were consistent with the notion that variables related to repetition are not necessarily the same as variables related to suicide attempt in general (Kreitman and Casey, 1988). Interestingly, depression, hallucinations, anxiety and eating disorders were related to suicide attempt but not to repetition, while the opposite was true for cognitive problems, which were related to both repetition and major repetition, but not to the overall history of suicide attempt. The lack of association between repetition and depression, hallucinations, anxiety and eating disorders may be inconsistent with previous data describing that repeaters present more severe axis I and II disorder

symptoms (Rudd et al., 1996), and that repeaters are more likely to have personality disorder combined with an axis I diagnosis such as depression (Hawton et al, 2003). Also, history of being emotionally, physically or sexually abused was related to suicide attempt but not to repetition, thereby conflicting with the findings of Ystgaard and co-workers (2004). There was no gender difference between repeaters and non-repeaters. Previous literature has been inconsistent regarding gender: Gibb and co-workers showed an association between repetition and female gender (Gibb et al., 2005), while the data of Kreitman and Casey (1988) pointed in the opposite direction.

Instead, violent behaviour was associated with both suicide attempt in general and with repetition. Delirium tremens and drug overdose were also related to both suicide attempt and attempt repetition, thereby indicating a link to severe substance use complications. In conclusion, factors related to suicide attempt differ from those related to the repetition of suicide attempt, and mood disorders and psychotic symptoms, described as risk factors of suicidal behaviour, may not show an independent link to repetition.

Major repetition was associated with methadone use, hallucinogenic drugs, and with cognitive problems, with methadone being the strongest variable related to major repetition. It must be noted that methadone use in the present ASI examination may be prescribed or illicit. However, whether or not the methadone is prescribed, it is likely that the association with this variable indicates an association with severe opiate (such as heroin) abuse or dependence, as this group is either legally treated with methadone or likely to use the substance for withdrawal treatment and other purposes during active substance abuse (Roche et al., 2008).

5.8 The interface between illicit drug overdose and suicidal behaviour

Due to the self-inflicted nature of illicit drug overdose, it has been discussed whether such overdoses may represent an expression of suicidal behaviour. Heroin is the drug responsible of the highest number of fatal or non-fatal illicit drug overdoses (Darke et al., 2007). It has also been reported that both depression and attempted suicide are markedly more common among heroin users than in the general population (Darke and Ross, 2002), and a link between depressive symptoms and non-fatal overdose has been reported (Tobin and Latkin, 2003). In addition to this, the rationale behind this discussion is the knowledge that heroin users with suicidal behaviour have access to a highly potent drug as a potentially lethal method of suicide. Also, among heroin users, a history of overdose appears to be associated with a history of suicide

attempt (Bradvik et al., 2007a; Darke et al., 2004; Rossow and Lauritzen, 1999). Together, these facts have led to the discussion about whether some heroin overdoses may in fact be deliberate suicide attempts, and that certain fatal overdose cases may be misclassified suicides. Also, post-mortem classifications of opiate overdose versus suicide have been described as difficult (Cantor et al., 2001), and different procedures for classification of fatalities may affect these statistics (Farrell et al., 1996).

There is, however, literature supporting the hypothesis that illicit drug overdose and attempted suicide are mostly different phenomena with different background. It has been reported from a sample of heroin users, that only 10 percent had experienced a deliberate overdose, and that among subjects with overdose history, 92 percent reported their most recent overdose to be accidental, while seven percent reported it to be deliberate (Darke and Ross, 2001). It was also reported that only five percent of heroin-related fatalities in New South Wales were suicides (Darke et al., 2000). Also, among manifest suicide attempts among heroin users, opioid overdose is only used in a minority of cases (Darke and Ross, 2001). In Heale's report from Australia, four percent of heroin overdose survivors reported that the index overdose was intentional, while 17 percent reported they had at least once taken an intentional overdose (Heale et al., 2003). Tobin and Latkin (2003) reported that, although depressive symptoms were a risk factor of overdose, 91 percent of overdose subjects did not intend to die when taking the overdose.

It has also been reported that risk factors of overdose and attempted suicide differ among drug users. Ravndal and Vaglum (1999) found in a heterogeneous population of 'drug abusers' that overdose was associated with frequency of opiate use and inpatient treatment, while attempted suicide was associated with depression or borderline symptoms. Another study, also based on a population of 'drug addicts', found that HIV risk behaviour, polydrug abuse and lower social functioning were risk factors of having both suicide attempts and overdoses, while psychiatric problems were associated with suicide attempts, rather than with overdoses (Rossow and Lauritzen, 1999). A paper assessed opiate dependent subjects and interpersonal characteristics in relation to suicide attempt and unintentional overdose, and showed that low scores for 'belonging' were related to suicide attempt but not to overdose, and indicated that suicide attempt and overdose may have different correlates (Conner et al., 2007).

Contrary to the relatively low numbers of intentional overdoses, a study from Scotland interviewed a heterogeneous sample of users of different illicit drugs within a few hours after a non-fatal overdose, and as many as 49 percent reported suicidal thinking before the overdose. However, clients who reported intentional overdoses were not significantly more likely to be alone at drug intake. Overdoses involving heroin were also significantly more likely to be accidental than other drug overdoses.

Also, in qualitative interviews penetrating the overdoses reported to be intentional, many of the patients did not report ‘a clear and unambiguous desire to die’. This article also reported precipitating factors prior to overdosing, such as different types of adverse events or problems (Neale, 2000). Heale and co-workers (2003) also described events and emotions associated with intentional overdose. Qualitative work in Swedish heroin users has failed to demonstrate a clear suicidal intent among most clients with a history of non-fatal heroin overdose, whereas several other risk factors were mentioned, for example calculated risk-taking behaviour and hopeless and indifferent thinking (Richert and Svensson, 2008).

Suicidal behaviour and illicit drug overdose are statistically associated with one another among drug users and, although some overdoses are likely to represent suicidal acts, it appears that these two events represent different concepts with somewhat different risk factors. However, the interplay between these two phenomena is of great importance and relevance to the clinical assessment of drug users in the emergency setting, and adds new aspects to the complexity of self-harm and suicidal behaviour.

6. Clinical implications

6.1 Substance use among criminal justice clients

The high prevalence of substance use disorders in criminal justice populations is likely to present several important problems to prisons and other penal institutions, such as withdrawal symptoms at intake, drug craving, the risk of drug use in prison, and the risk of relapse and overdose after release. Two potentially life-threatening complications of substance use are discussed in the present work, suicide attempt and drug overdose, both of which are highly prevalent among substance users in the criminal justice system.

The presence of psychiatric symptoms was highly prevalent in all groups studied. This, for example, included high rates of suicidal behaviour and hallucinations, and demonstrates the need for psychiatric assessment and treatment among criminal justice clients. Also, history of trauma, such as being emotionally, physically or sexually abused, is strikingly common in the present population. In many of these individuals, such traumatic history is likely to require special assessment and psychosocial treatment efforts.

In the present setting, amphetamine users were clearly the largest group of drug users. Stimulant dependence is likely to continue to present a major challenge to the motivation work and treatment strategies for these clients. It is reasonable to believe that amphetamine users meet authorities in other contexts than addiction medicine, such as in criminal justice institutions, social authorities and syringe exchange programmes, and it will be crucial for these institutions to establish methods for referral to psychiatric care and addiction treatment. The present study indicates a connection between amphetamine use and alcohol problems and heredity of alcohol problems. A similar association has been seen in previous literature (Tunving, 1988), and high alcohol consumption is likely to affect the physical health status of this group of drug users. Also, the present study found a highly intense amphetamine use, with almost daily use of the substance.

Treatment opportunities for amphetamine addiction are likely to differ from those arising in heroin addiction. Several research reports discussing the treatment setting in amphetamine addiction come from Australia. It was reported that opiate users were more likely than amphetamine users to be in treatment (Hall et al., 1993), and that the treatment offered to a majority of amphetamine users has been outpatient treatment or even sole counselling or assessment, with low completion rates (McKetin et al., 2005). Many amphetamine users did not apply for treatment or underwent non-specialised treatment, and attempts to cut down or quit using

amphetamine were generally not successful (Hando et al., 1997). Self-detoxification attempts in this group also have been reported from the United Kingdom, often involving an increase in the consumption of other drugs of abuse, such as benzodiazepines, cannabis, alcohol and opiates, again with high relapse rates (Cantwell and McBride, 1998).

The amphetamine withdrawal syndrome, most commonly including increased sleepiness, appetite and depressive symptoms (McGregor et al., 2005) may not require inpatient detoxification, and there are no specific pharmacological agents for the treatment of withdrawal (Srisurapanont et al., 2001a). Also, the development of evidence-based treatment for stimulant dependence has been problematic (Srisurapanont et al., 2001b; Castells et al., 2007; Grabowski et al., 2004). Therefore, treatment options for amphetamine users may be fewer than, for example, for heroin users, and amphetamine users may remain outside treatment to a greater extent.

The findings of the present study indicate, consistent with the clinical characteristics of the amphetamine withdrawal syndrome (McGregor et al., 2005), that amphetamine users are far less likely to have undergone inpatient detoxification, while institution treatment was almost as common as for heroin users. Furthermore, the present study described that the group of amphetamine users in this setting is markedly larger than other groups of primary drug users. It may be assumed that some of the treatment needs for amphetamine users have been met with imprisonment following criminal charges, rather than in addiction treatment facilities. In clinical work, amphetamine users appear to be less likely to seek inpatient detoxification or other treatment and, although the field is not very extensively described, some data supports this assumption. Although not documented in research, inpatient detoxification is today dominated by heroin users. In the detoxification unit in Malmö, Sweden, the proportion of primary heroin users has increased since the 1990s (Tops and Silow, 1997), and in recent years, primary heroin use has been reported by more than 80 percent of the patients, while only a few percent report amphetamine (personal communication, the detoxification unit, Addiction Centre Malmö).

Today, however, there are promising reports favouring the use of either naltrexone (Jayaram-Lindström et al., 2008) or an agonist-like therapy (Grabowski et al., 2004) such as methylphenidate (Tiihonen et al., 2007) in amphetamine dependence. There is a strongly perceived need for implementation of an evidence-based treatment structure adapted to amphetamine-dependent patients, possibly including pharmacological treatment such as naltrexone or agonist therapy. As amphetamine users appear more likely to be assessed in the criminal justice system than in inpatient detoxification or other medical settings, strategies for motivation and treatment referral to evidence-based treatment appear to be crucial. The practical implementation of such treatment may need further efforts.

6.2 Life-threatening events in criminal justice clients – drug overdose

The high prevalence of overdose and attempted suicide in the Swedish criminal justice system in the present studies illustrates the importance of risk assessment at intake into the criminal justice system, during time served in prison, and prior to release into the community.

The high prevalence of overdose history in the criminal justice setting, and the high prevalence of known risk factors in this population, clearly highlight the need for prevention and treatment strategies addressing the overdose in criminal justice clients. Also, the risk situation for overdose and drugs-related death after release from prison (Farrell and Marsden, 2008; Binswanger et al., 2007; Bird and Hutchinson, 2003; Seaman et al., 1998; Seymour et al., 2000) clearly makes the criminal justice setting an opportunity for treatment and prevention.

From this study and others, it is clear that the overdose problem is most strongly linked to the specific abuse of heroin, and treatment addressing heroin addiction specifically may lower the risk of overdose. Methadone or buprenorphine substitution treatment is well documented for the treatment of heroin dependent patients (Mattick et al., 2008; Kreek, 1996; Caplehorn et al., 1996), including in the Swedish setting (Gunne and Grönbladh, 1981; Kakko et al., 2007; Fugelstad et al., 1997), and substitution treatment has also been introduced in criminal justice settings in several countries (Stallwitz and Stöver, 2007). Notably, methadone or buprenorphine maintenance treatment has been associated with a reduced risk of opiate overdose (Brugal et al., 2005; Fugelstad et al., 1995; 1997; Caplehorn et al., 1996; Auriacombe et al., 2004). Several other strategies have been discussed for the prevention of overdose, such as education about risk factors for overdose and about appropriate intervention for the resuscitation of overdose victims, the distribution of naloxone, and counselling aiming at the transition from intravenous injection to other routes of administration (Darke and Hall, 2003).

One important finding in the overdose paper was the association with variables that may be associated with impulse control disturbances, with externalising psychiatric manifestations rather than depressive characteristics. Although depression has been described as one risk factor for overdose (Tobin and Latkin, 2003), drug users with acting out behaviour such as suicide attempts and uncontrolled violent behaviour may be at higher risk of overdosing. Also, it appears that non-Nordic immigrants had lower risk of overdosing.

6.3 Life-threatening events in criminal justice clients – attempted suicide

The high prevalence of attempted suicide, and the high prevalence of risk factors in this population, has important implications for the assessment of criminal justice clients entering the prison or probation system, or before release into the open community. Several of the risk factors mentioned above are likely to be well-known, or revealed, by prison staff. The present studies indicate that clients with a history of psychiatric symptoms, and especially clients with severe substance use problems, traumatic background or a problematic family history, may be at greater risk of suicidal behaviour and should be thoroughly assessed with respect to this risk. This applies to the period before release in terms of the risk assessment of future suicidal behaviour, but suicidal behaviour within prison walls is not uncommon, and presents a major challenge to criminal justice staff, and highlights the importance of a risk assessment at intake into the prison system. Attempted suicide in the present population is likely to be preceded by a highly multi-factorial process, and characteristics discussed here, in relation to attempted suicide, may help prison staff pay attention to individuals at risk. Also, it appears that the risk factors associated with the repetition of suicidal behaviour may differ from factors associated with a first-ever attempt. Consistent with the findings of the present studies, several factors should be taken into account in the assessment of repetition risk among suicide attempters. These include somatic disease, impulsive/aggressive behaviour, cognitive problems and severe substance use.

The implications mentioned above apply not only to the criminal justice system, but are highly relevant to health care professionals. Suicidal behaviour in substance users with criminal background is a problem commonly encountered in somatic and psychiatric emergency units, and it is crucial to respond to known risk behaviours.

7. Directions for future research

In the field of amphetamine use, more research is needed to identify mediators of the connection between amphetamine use and criminal behaviour. In addition, future research may need to address more specifically the misuse pattern of primary amphetamine users, including the association between amphetamine use and alcohol drinking. In addition, given the older age of amphetamine users compared to heroin and cocaine users, future descriptions of the drugs scene should examine whether amphetamine remains a dominating illicit drug, or whether younger problematic drug users are recruited to other substances, such as heroin or cocaine instead. This will also require further follow-up studies in the setting assessed here. Also, there is a need for updated research in order to better understand underlying factors behind the abuse of amphetamine and its clinical course.

Regarding treatment for amphetamine addiction, further research is needed regarding both pharmacological and psychosocial treatment strategies, but there is also a need for research addressing the issues of evidence-based structures for motivational work, treatment entry and treatment retention strategies in amphetamine addiction.

Strategies for the prevention of drug overdose will need further scientific assessment, including studies addressing the treatment initiation and referral of opiate-dependent clients from the criminal justice system. Also, in line with the findings described above, future research should aim to examine the possible connection between drug overdose, attempted suicide and impulse control disturbances. Future research needs to further address the complexity of suicidal behaviour in substance users and, in the present setting of clients with criminal records and substance use, the prospective course of these clients should be assessed, including the risk of subsequent suicide death and fatal drug overdose.

8. General conclusions

Heavy illicit drug use among Swedish criminals displays a particular pattern, with a very high proportion of primary amphetamine use. Amphetamine users, sparsely addressed in previous literature in this setting, differ from heroin and cocaine users with respect to demographic characteristics, but also display high rates of intravenous abuse and low overlap with heroin and cocaine use, indicating a somewhat unique Swedish misuse pattern of amphetamine use. Amphetamine is more common than heroin and cocaine in this criminal justice population, and the link between amphetamine and criminal involvement justifies further research.

Overdose history is highly prevalent among current opioid users, and overdose is not only associated with heroin and injection drug use, but also with the use of tranquillisers, consistent with previous literature. As expected, severity of substance use was most strongly associated with overdose. Externalising psychiatric characteristics (suicide attempt and violent behaviour) were also associated with overdose. Here, an association with impulse control disturbances may be suspected. Also, a paternal heredity of alcohol problems may be associated with overdose risk, and overdose was more common among clients born in Sweden and other Nordic countries.

Lifetime history of attempted suicide is highly prevalent among substance users in the criminal justice system. History of suicide attempt has a large number of correlates in this population, and is likely to represent a multi-factorial process. Suicide attempt history was associated with female gender and with depression and several other psychiatric manifestations. There also appears to be an association with family history of alcohol problems, and a robust connection to history of being abused (physically, sexually or emotionally), even independent of one another and independent of gender and psychiatric symptoms. Binge alcohol drinking, but no other specific substance, was positively associated with suicide attempt, whereas severe substance use complications such as injecting, drug overdose and delirium tremens were associated with suicide attempt.

Factors associated with repeated attempt are not the same as factors predicting a first attempt. Suicide attempters were significantly older than never-attempters, whereas clients reporting repeated attempts were younger than non-repeaters. Female clients were more likely to report attempted suicide, but no more likely to report repetition. Repetition was associated with having a prescribed medication for a physical illness, and with a history of using opioid analgesics. Drug overdose and severe complicated alcohol abuse (indicated by a history of delirium tremens) were associated with repetition (and with first-time attempt). Cognitive problems were associated with suicide attempt repetition and with repeating several times.

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10. Populärvetenskaplig sammanfattning

Överdoser, självmordsförsök och kliniska karakteristika hos tunga missbrukare. Studier i svensk kriminalvård.

Det aktuella avhandlingsarbetet innehåller fyra studier som är gjorda på ett stort intervjumaterial från svensk kriminalvård. Kriminalvården bedömer sedan några år tillbaka klienter med missbruksproblem, bland annat i syfte att kartlägga och följa upp klientens hjälpbehov och för att kunna utvärdera myndighetens arbete med missbruk. Detta görs med hjälp av Addiction Severity Index (ASI), ett intervjuinstrument som sedan 80-talet har använts i kliniskt arbete och forskning, och som syftar till att bedöma problemtyngden hos en person med missbruksproblem. Intervjuinstrumentet berör både missbruk och andra missbruksrelaterade problem, med frågor om alkohol- och narkotikaanvändning, fysisk hälsa, psykiska symptom, arbete och försörjning, familj och sociala relationer, samt kriminalitet.

Ett ökande antal enheter i svensk kriminalvård har använt instrumentet, och det aktuella materialet innehåller klientintervjuer från år 2001 fram till augusti 2006, då materialet avidentifierades och överlämnades till forskargruppen för analys. Materialet innehöll då intervjuer med totalt 7085 klienter. I materialet har 72 procent intervjuats på anstalt, sjutton procent i någon typ av frivård, fem procent i häkte, och övriga i annan typ av behandling. Tolv procent av de intervjuade är kvinnor. Jämfört med hela kriminalvården har det aktuella datamaterialet en överrepresentation av klienter på anstalt jämfört med frivård, men också en överrepresentation av narkotikamissbrukare, kvinnor, och klienter dömda för narkotikabrott eller tillgreppsbrott (stölder och liknande). Den aktuella forskningen har genomgått forskningsetisk prövning vid Lunds universitet.

Artikel 1: Kliniska karakteristika hos amfetaminmissbrukare i kriminalvården

Avhandlingens första arbete fokuserar på de kriminalvårdsklienter som missbrukar amfetamin som sin huvuddrog (och som har ett aktuellt missbruk av den drogen), och jämför den gruppen med grupperna av heroin- respektive kokainmissbrukare. I den intervjuade populationen är amfetaminmissbrukarna betydligt fler (1396 personer) än heroin- (392 personer) och kokainmissbrukarna (119 personer). Flera betydande skillnader kunde ses mellan amfetamingruppen och de övriga. Amfetaministerna var betydligt äldre, betydligt oftare födda i Norden, mer sällan boende i storstäderna, och rapporterade berusningsdrickande i högre utsträckning.

Amfetamingruppen hade också i högre utsträckning föräldrar med alkoholproblem. Jämfört med heroingruppen rapporterade amfetaministerna i högre grad kognitiva svårigheter (svårigheter att minnas, förstå eller koncentrera sig), medan heroinisterna i högre grad hade varit i avgiftningsbehandling i slutenvård. Injektionsmissbruk var vanligt i heroin- och amfetamingruppen, och alla tre grupperna rapporterade hög förekomst av olika psykiatriska problem.

Artikel 2: Faktorer associerade med narkotikaöverdos bland användare av opioider

I nästa studie analyseras vilka faktorer som har en koppling till narkotikaöverdos bland klienter med aktuellt användande av opioider (heroin, metadon eller andra opioider såsom tunga smärtstillande preparat). I denna grupp, 1096 personer, rapporterade 55 procent att de hade haft minst en överdos i livet. Detta var starkast kopplat till att ha haft ett heroin- och injektionsmissbruk, men det fanns också ett samband med att ha använt lugnande medel, att ha gjort självmordsförsök, och att rapportera svårigheter att kontrollera våldsamt beteende. Dessutom var klienter med överdos mer sällan utomnordiska invandrare, och hade oftare ärftlighet för alkoholproblem hos fadern. Utöver kända missbruksvariabler med koppling till överdos, kan en koppling till impulskontrollstörningar diskuteras, med ett tänkbart samband mellan överdos, självmordsförsök och utåtriktad aggression.

Arbete 3: Faktorer associerade med självmordsförsök

Övriga två arbeten handlar om självmordsförsök, analyserade i större delen av det befintliga datamaterialet (6836 personer efter tillämpande av exklusionskriterier). Bland de studerade klienterna rapporterar 21 procent att de har gjort minst ett självmordsförsök, vilket är en mycket hög siffra jämfört med hela befolkningen, men lägre än i vissa material av svårt psykiska sjuka inklusive svårt deprimerade. Ett stort antal faktorer hade samband med självmordsförsök, även då man jämför potentiella riskfaktorer med varandra i den statistiska analysen. Självmordsförsök var kopplat till depression, men också till flera andra psykiatriska symptom, såsom ångest, hallucinationer, våldsamt beteende och ätstörningar. Dessutom fanns en koppling till att ha varit utsatt för misshandel, både för variablerna psykisk, fysisk och sexuell misshandel var och en för sig, samt en koppling till kroppslig sjukdom och ärftlighet för alkoholproblem och psykiska problem. Dessutom fanns samband mellan självmordsförsök och en historia av berusningsdrickande och delirium tremens, en svår abstinenskomplikation vid alkoholberoende, samt ett samband med injektionsmissbruk och narkotikaöverdoser. Ingen annan enskild drog än alkohol hade ett positivt samband med att ha gjort självmordsförsök. Liksom i många tidigare studier var risken för självmordsförsök klart högre hos kvinnor.

Artikel 4: Faktorer associerade med upprepat självmordsförsök

I det sista arbetet jämförs de klienter som har gjort upprepade självmordsförsök (770 klienter) med dem som har gjort ett försök (634 klienter). Upprepat självmordsförsök hade samband med fysisk sjukdom och att ha använt övriga opioider (såsom smärtstillande), och med narkotikaöverdos, kognitiva problem, våldsamt beteende, delirium tremens, och med psykiska problem hos modern. Att ha gjort fem försök eller fler (152 klienter) hade en koppling till att ha haft ett användande av metadon (legalt eller illegalt), hallucinogena droger eller att ha haft kognitiva problem.

Sammanfattning och slutsatser

Sammanfattningsvis studeras här en stor population av klienter i svensk kriminalvård som har intervjuats med avseende på missbruksproblem. Här finns en hög förekomst av svåra missbrukskomplikationer, hög förekomst av narkotikaöverdoser och självmordsförsök, samt av psykiska symptom och övergrepp. Gruppen amfetaminmissbrukare är påfallande stor i denna grupp av kriminella med missbruk, och vi ser att amfetamingruppen har hög förekomst av psykiatriska symptom, alkoholmissbruk och somatisk sjukdom. Trots detta har utvecklingen av evidensbaserad behandling för amfetaminberoende varit långsammare än för heroinberoende, och även om lovande läkemedelsstudier finns, krävs det mer forskning för att utveckla behandlingsstrukturer för denna stora grupp av missbrukare och överföra dem dit, exempelvis från kriminalvården. Studien tyder på att amfetaminmissbruk, som är vanligare bland tunga missbrukare i Sverige än i många andra länder, i stor utsträckning är skilt från heroin- och kokainmissbruk i gruppen, med skillnader i demografiska faktorer, men också med en tydligare koppling till alkohol.

Överdos är en vanlig komplikation hos narkomaner i kriminalvård, främst i heroingruppen. Mot bakgrund av att dödligheten i överdos är hög i dessa grupper, är behovet stort av riskbedömning och behandling inför frigivning från kriminalvården. Likaså är självmordsbeteende klart överrepresenterat bland kriminella med missbruk. Det finns också här anledning till riskbedömning i början och under strafftiden, men också inför frigivning. De aktuella studierna tyder på att självmordsförsök har en koppling till ett stort antal riskfaktorer i komplex samverkan, såväl psykiatriska problem, svåra missbrukskomplikationer, samt våldsamt beteende, ärftlighet och traumatiska upplevelser såsom övergrepp och misshandel. Studierna tyder också på att de faktorer som ökar risken för upprepade självmordsförsök skiljer sig från riskfaktorerna för att överhuvudtaget begå självmordsförsök.

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